International Studies & AAE 374

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The Growth and Development of Nations in the Global Economy

Problem Set 1:
Trade in a North-South Model

Due 24 September

This problem set puts forward a "North-South" trade and growth model that allows interactive exploration of the conventional comparative advantage-based theory of trade. It highlights three specific implications of this model:

1. Both North and South can benefit from free trade.

2. Growth in the world economy is characterized by a pattern of convergence in which the South grows faster than the North such that Southern income levels eventually catch-up with those of the North.

3. Decentralized market regulation of the economy not only sees to it that trade is mutually beneficial, and that growth is convergent, but that it also generates an economic outcome which cannot be improved upon (in a well defined way) given the real structural constraints of technology and resources. Put differently, this third implication is that any non-market regulation of the economy is at best superfluous, and at worst destructive.

With the exception of question 1, you will need to go to the computer lab in Taylor Hall to do this problem set (or any other campus computer lab that has the Gauss software). Please follow these instructions for the problem set:

1. *Go to the Taylor Hall computer lab (open M-F, 8 a.m.-5p.m.—you may stay later than 5 p.m., but you must get in the door before 5 p.m.).* Logon to a computer using the following:
   username: heccuser
   password: Ag&AppEc

Using Firefox or Internet Explorer, go to the course web page (http://www.aae.wisc.edu/aae374/) and download the file called "Program for PSet-1." Remember, to download, right click on the link and select "save target as." Save the file in the C:\gauss7.0 directory.

You next need to unzip the file and put its contents into the C:\gauss7.0 directory. To do this, go to windows explorer, find your way to the C:\gauss7.0 directory. Double click on pset5.zip file. The winzip program should open. Use the "classic interface" of the program to extract the files. Extract all the files into the C:\gauss7.0 directory.

Now, open up the Gauss 7 program by clicking on Start-Programs-Statistics-Gauss 7.0. You are now inside Gauss. When instructed below to run a program, simply enter the following in Gauss' "Command Input" window:

run <<filename>>

where **<<filename>>** is the name of the file you are asked to run. You are now ready to run the program files as directed in the problems below.

2. *General Gauss Tips and Advice*
Please take note of the following.

   a. In this exercise, we use Gauss to "run" programs. When you're inside the Gauss program, to run a program, we type **run <<filename>>** and then hit return. For example, in question 1 below, you will type **run autarchy.prg.gcg** and hit return. In this case, it's important to include the file suffix .gcg.

   b. GRAPHS. Each time you run the program, a new pair of graphs is produced. These graphs accumulate as you repeatedly run the program and will each have a numbered button on the bottom toolbar of your screen for referencing. Make sure that you do not miss any graphs that might have been put there for you. And if the program generates a graph for you, but you can't see it, look down at the toolbar and you'll find it waiting for you.

   c. PRINTING. Each graph is generated in a "TKF Viewer" window. In this viewer, click on "FILE" on the button bar. Select the print option to print the graph on the lab printer. You will need a standard campus venda-card to print on the lab printer (see instructions in lab). You may also go to the "CONVERT" menu on the TKF viewer and convert the file to a format that you can insert into a wordprocessor document. I would suggest that you convert your graphs into "Enhanced Metafile" format. Save the file for later use if you wish.

1. The simulation model you will analyze below assumes a world of two countries—the North which is assumed to have a relatively abundant supply of physical capital; and the South which has a relatively abundant supply of labor. Both economies can produce a manufactured good (computers, whose production is relatively capital-intensive) and an agricultural good, (bananas, whose production is relatively labor-intensive). Both countries have access to the same technologies which are define as follows:

$$X_a = L_a^{(1-\alpha)} K_a^{\alpha} \text{; and,}$$

$$X_m = L_m^{(1-\beta)} K_m^{\beta}.$$

where X_a is the quantity produced of the agricultural good which can be physically produced from inputs of labor (L_a) and capital (K_a). Symmetric definitions apply to the manufacturing sector where X_m is the quantity of computer output, and L_m, and K_m are the production inputs. The symbols α and β simply represent the parameters of the technology and it is assumed that $\beta > \alpha$ (*i.e.,* the manufactured good is more capital-intensive then the agricultural good). The simulation assumes that $\beta=0.8$ and that $\alpha=0.2$. Please use these same assumptions in answering this question.

a. Consistent with the simulation model assume that North and South have the following initial endowments of productive factors:

	North	*South*
Initial Labor Endowment	25	30
Initial Capital Endowment	40	10
Capital-Labor ratio	40/25=1.60	10/30=0.33

Suppose that the North devoted all of its labor and capital to the production of computers. How many computers could it produce in total? How many bananas could it produce if it only produced bananas? What is the ratio of maximal computer to maximal banana production in the North?

b. What is the ratio of maximal computer to maximal banana production in the South?

c. Why are the two ratios that you calculated in parts (a) and (b) different? Explain why the North have a comparative advantage in computers, and why the South has a comparative advantage in bananas.

d. Now let's approximate the marginal productivity of capital in both economies when they engage in maximal computer production. To do this, calculate how many *additional* computers the north can maximally produce if we give them one more until of capital (so that they are producing computers with 25 units of labor and *41* units of capital). Calculate the same thing for the South (when they are

given one extra unit of capital for a total of *11* units).

e. What do you think this difference in the marginal productivity of additional capital means for the ability of South to converge with North?

2. Autarchy and Differential Scarcity in North and South

To begin the problem, start the Gauss program and then enter **the following command into the Gauss command window:**

run autarchy.prg.gcg <<enter>>

a. As you run the **autarchy.prg.gcg** program, you will be asked a few simple questions and be given the opportunity to record output from the computer program. You will need to take down information from the graphs that are shown, as well as record information from the autarchy equilibrium tables that are produced. You should fill in the following three tables prior to exiting the program. There are some additional questions for you to answer concerning the output you get from following the tables.

Table 1a: Economic Scarcity in the South

Initial Level of Computer Production which you choose	Number of Units of Bananas given up when four more computers are produced	Relative Price of Computers (Number of bananas given up per computer at this margin of computer production) < You have to calculate this yourself!>

Table 1b: Economic Scarcity in the North

Initial Level of Computer Production which you choose	Number of Units of Bananas given up when four more computers are produced	Relative Price of Computers (Number of bananas given up per computer at this margin of computer production) < You have to calculate this yourself!>

b.

Table 2: Autarchy Equilibrium

	Production		**Consumption**		**Equilibrium Prices**				**Income**		**Consumer Utility**
	Ban.	*Comp.*	*Ban.*	*Comp.*	*Ban.*	*Comp.*	*Lab.*	*Cap.*	*Total*	*Per-Capita*	
South					1						
North					1						

c. Prices:

1. In what sense are the numbers you calculated for the third column of Tables 1a and 1b real economic or scarcity prices?
2. Focusing on the numbers for the south, what happens to the relative price of computers as the level of computer production increases?
3. Intuitively, explain why this happens?

d. Comparing Prices:

1. How do relative prices for computers compare between North and South?
2. Why are these prices different at the same level of production?
3. Assuming identical consumer preferences between North and South (as in this model), what would you expect production patterns between the two countries to look like in autarchy in terms of the relative and absolute numbers of computers produced and consumed (given that the North is relatively well endowed with capital as assumed here)?

e. Production and Prices:
   1. Do the autarchy equilibrium production patterns bear out your expectations?
   2. How do the equilibrium prices for computers compare to the relative prices you calculated earlier for the two economies?
   3. Why aren't more computers produced and consumed in the south given that southern consumers have the same love of computers as northerners?

f. Consumers:
   1. If you were a southern consumer, would you be interested in access to the international market?
   2. Why or why not?
   3. If you were a southern worker, would trade liberalization appear promising?
   4. What if you were a southern capitalist (the owner of capital)?

3. Static Gains from Trade

In simplest terms, trade between economies allows two things to happen. First, it loosens the linkage between domestic consumption patterns and domestic production patterns—*i.e.*, consumers do not have to consume exactly what domestic producers turn out. In more lyrical language, it permits consumers to shop for bargains.

The second impact of trade is that it also loosens the linkage between producers and the domestic market—*i.e.*, it also permits producers to search for markets where prices are better.

Trade does not completely eliminate those linkages however, since consumer income is linked to production outcomes and balanced trade requirements (simply imposed in this model as there is no external finance to cover trade deficits) link production and consumption choices. This problem analyzes what happens as the two autarchic economies studied in the previous section open up to international trade.

a. Trading from the autarchic production pattern

This first part of the problem studies what happens when Southern producers do not adjust their production patterns to international trading opportunities, but Southern consumers are allowed to buy foreign goods at a set of given world prices (those in the North). You get to do the shopping for Southern Consumers (!) by deciding how many computers you would like to buy. The computer will automatically adjust to your choices by making sure that enough Southern Products are exported so that you have the income (and foreign exchange) needed to pay for your computer shopping.

To begin the problem (assuming you are already in Gauss, as explained in question 1)

simply enter:

run shop.prg.gcg <enter>

Fill in the following blanks:

Table 3: Autarchic Production Patterns for the South:

Computers:_____ <fill this in from problem 1 above>
Bananas:_____

World Prices:
Bananas: 1
Computers: _____

Computer Consumption <Your choice>	Exports < Implied by production patterns and trade balance >	Imports < Implied by production patterns and trade balance >	Banana Consumption	Consumer Utility

b. Free Trade Equilibrium

Now suppose that producers also adjust their production patterns to the new international prices. A general equilibrium concept is used to determine the production and consumption patterns for the world economy, except this time there is a only a single set of product prices (common to both countries) which simultaneously clears all markets in all countries (general equilibrium means that all prices adjust to the point where neither producers nor consumers desire to change their production and consumption decisions given those prices). To explore the impact of this complete liberalization, run the following program and fill in the blanks:

run free.prg.gcg <enter>

Table 4: Free Trade Equilibrium

	South	*North*
Equilibrium Prices		
Bananas		
Computers		
Labor		
Capital		
Bananas		
Production		
Exports		
Imports		
Consumption		
Computers		
Production		
Exports		
Imports		
Consumption		
Consumer Utility		

c. Analysis:

1. What are the most striking changes in the free trade versus the autarchy equilibria you examined in question 1 above?
2. What results most surprised you?
3. Are the gains from free trading "large"?

d. Pareto Optimality of Free Trade Equilibrium

Perhaps one of the least transparent, but most intellectually powerful claims of neoclassical liberalism is that the economic coordination that is realized by decentralized

markets is Pareto optimal—that is, given technology, resources and the distribution of endowments, no one individual can be made better off without making someone else worse off. The final part of this question asks you to explore this idea a bit by giving you the role of a central planner given the unenviable task of "beating the market." Run the following program and fill in the blanks:

run pareto.prg.gcg <enter>

Table 5: Plan versus Market in the South

Southern Consumer Utility under Autarchy: _____ <from above>
Southern Consumer Utility under Free Trade: _____ <from above>

Computer Production <Your choice>	Implied Banana Production	Computer Consumption <Your choice>	Implied Banana Consumption	Consumer Utility

e. Results:

1. Were you as central planner able to beat the market?
2. Are you a free trader now (explain your answer)?