

**The Growth and Development of Nations**

**Problem Set 4**  
**North-South Trade under Increasing Returns**

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**\*\*PROBLEM SET DUE 19 NOVEMBER\*\***

Our examination of patterns of contemporary growth in Problem Set 2 found that while there is some evidence of divergence in the global economy (i.e., the rich countries get richer), there is also evidence of considerable diversity of experience amongst poorer countries. Together these two observations suggest a more complex process of growth, perhaps one that is consistent with the idea of endogenous growth. Under some models of endogenous growth, national economic policies may have substantial real effects. This problem set asks you to explore trade policy in the context of external increasing returns that can generate endogenous growth.

Problem Set 1 explored the operation of the global economy in a stylized North-South model in which technology exhibited no economies of scale (neither external nor internal). Trade in that model was entirely generated by comparative advantage rooted in factor endowments in the North and the South. Three important findings emerged from that problem set:

1. Commodity Trade (with factors of production geographically fixed to their location of origin) benefited the South by permitting it to reduce the degree to which its economy was constrained by its lack of capital by importing the good that was most capital-intensive.
2. The economies of the North and South converged over time to similar income and economic structures. The more rapid growth in the South resulted from the “diminishing returns” nature of the assumed technology that in effect gave the South a bigger growth bang for each unit of capital invested. The South’s initial pattern of specialization in primary products did not condemn it to eternal specialization in those products—its comparative advantage matured dynamically as it accumulated capital more rapidly than the North.
3. Results (1) and (2) were realized through the operation of decentralized choices, coordinated by markets. In particular, leaving the choice of production specialization to individual firms resulted in the pattern of convergence and period-by-period improvement over the autarchic economy. Government intervention in trade was at best unnecessary and at worst destructive of national welfare.

Similar to the 2x2x2 trade model utilized in Problem Set 1, the model in this problem set assumes that:

1. Households in the economy each own one unit of labor and an equal share of their country's capital stock. Their income is determined by the returns to those factors. In question 2 below, tariff revenue is distributed equally to households, increasing their available budget. Households allocate their income to the purchase of goods in order to maximize their private material well-being, given the prices they face. The rate of savings is taken as an attribute of consumer preferences (just like preferences for computers and bananas) and is fixed at 25% for both North and South.
2. Firms rent capital from its owners and hire workers in order to maximize their profits (defined as the difference between their revenues and their costs of production). The number of firms is large and no firm exercises any market power.
3. Prices simultaneously adjust in all markets such that supply equals demand in all factor and commodity markets.

Unlike the model in Problem Set 1, the studied here assumes that endogenous growth and dynamic external economies are embedded in the high-tech manufacturing sector ("computers"). In particular, it is assumed that when the local computer industry reaches a critical minimum size, resources used in it become more productive as external scale economies kick in, generating endogenous technical progress for the computer sector. Critical minimum size of the industry is defined in terms of the amount of capital stock in the sector.<sup>1</sup> Because these scale economy effects accrue to all firms in the national economy, and because they only take place over time, it is assumed that no individual firm modifies its production decisions to intentionally create more of these external effects by producing more computers than is consistent with its private (short run) profit-maximizing objective.

The production technology in the banana industry is the same as it was in the prior problem set—*i.e.*, there are no economies of scale, nor sources of endogenous growth, in banana production.

To do this problem set, go to the Taylor Hall computer lab follow the instructions for Problem Set 1 (except this time, download the file "Program for P-Set4").

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<sup>1</sup> Numerically, this increased efficiency benefit occurs only after national production of computers becomes large enough to employ 100 units of capital. Note that in the numerical specification of the model, the North begins with 35 units of capital in total, while the South has only 15.

1. *Dynamic Increasing Returns North-South Convergence*

As indicated above, begin this first exercise by entering the GAUSS command:

**run global.prg.gcg**

The program will invite you to explore the impact of external economies of scale on the operation of trade and on long-term patterns of growth and convergence. You will probably find it helpful to print out some of the graphical output. Once you have run the program, please answer the following questions:

- a. Assuming a scenario of unfettered free trade, how does the presence of dynamic external scale economies in the computer industry influence convergence in the global economy (*i.e.*, compare North-South growth and income levels under free trade with and without external scale economies)?

How and why are the two scenarios different in terms of aggregate economic growth, consumer welfare and patterns of production specialization?

- b. In the presence of these dynamic external scale economies, what would happen to the South if it shut itself off from the world economy by withdrawing into autarchy—that is, how is the South’s trajectory of income growth, consumer welfare, production specialization etc. affected by the move to autarchy?

*When* would the costs and benefits of such a move occur? Why?

In what way is the market failing to coordinate individual decisions in a *socially desirable* way in the presence of external scale economies? In what ways is market coordination succeeding? (Please be clear about what your normative standard of “socially desirable” is.)

- c. What would happen to the North if it pursued an autarchic strategy? Why do autarchy and free trade have asymmetric effects in the North and the South?

2. *Trade Policy and Endogenous Growth*

To begin this exercise, please enter the following from within GAUSS:

**run regulate.prg.gcg**

The program will permit you to select and explore the impact of trade policy (tariffs on computers) on the performance and evolution of a “small” southern economy. Note that “small” here means that the imposition of tariffs by the southern economy does not influence world price levels. Prices are assumed to follow the trajectory generated by the free trade scenario in the prior problem set. Note that since a tariff raises the domestic price of a good relative to the international price, the agency collecting the tariff (the southern state) will make money through the collection of the tariff revenues. As mentioned above, the state is assumed to simply redistribute that money to its own citizens. **Note: To correctly answer this question, you will need to run the program for various tariff rates.**

- a. Compared to the free trade case, what does the imposition of a modest tariff (say, 10%) on computers do to the patterns of production and income in the south during the first few time periods (say, 5 years)?

How do these patterns compare to those achieved under autarchy? Why does the tariff create these changes?

What other instruments could be used to achieve the same reallocations?

- b. Over the longer term, what impact does the tariff have compared to both the free trade and autarchy trajectories?
- c. How do these impacts change at both higher and lower tariff levels?

Within the confines of this model, what is your preferred policy regime and why?

Do you think you could do better if you were able to adjust the tariff rate over time rather than leaving it constant?

- d. Does this model help you think about/interpret any of the empirical evidence about contemporary patterns of economic growth? If so, why; if not, why not? (NOTE: You may want to integrate your answer to this question with item (e.) below.)
- e. Finally, what is the most egregious simplification of the model which may lead it to *overstate* the ability of the state to regulate the market and improve economic outcomes?