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**The Growth and Development of Nations**  
*Problem Set 4:*  
*North-South Trade under Increasing Returns*

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*Dynamic Increasing Returns North-South Convergence*

1. 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 (under free trade comparing without and with external scale economies) different in terms of aggregate economic growth, consumer welfare and patterns of production specialization?

- a. In the case without external scale economies free trade led to the equalization of the two countries over time. So the “core-periphery” structure disappeared as the two countries became more and more indistinguishable. We can see this in the: income/capita growth rate and levels, % of capital in the computer sector and utility levels. The reason for this is that without external scale economies, we get convergence both from convergence of capital/worker (Solow) which over time also causes convergence in H-O because as capital/worker converges the basis for comparative advantage shrinks, as seen in the % of capital in the computer sector.

Solow says that the South always grows more quickly than the North because it is poorer and so approaches its steady state more rapidly. Therefore the two country’s growth rates approach one another. In terms of consumer welfare, Northerners begin being better off than Southerners, but by the end that difference is very small. As for specialization, the North starts out with a higher percent of its capital in the computer sector than the South. Over time these shares approach one another, as the pattern of specialization converges.

- b. On the other hand, once we consider external scale economies the story changes. Then trade leads to the continuation and the worsening of the “core-periphery” structure. The South becomes relatively worse off while the North becomes relatively better off. We can see this in the: income/capita growth rate, income/capita levels and utility levels. At first the North’s growth rate is lower than that of the South, but with free trade the North’s growth rate becomes higher than that of the South. Under free trade the difference in welfare and income gets larger and larger. In terms of specialization, the South eventually “deindustrializes” its computer sector while the North’s sector remains fairly level.

The reason for this is that the North starts getting scale economies before the South because of a higher initial capital/labor ratio. Once scale economies kick in, computer production in the North gets more efficient and growth picks up (we can see this in the income/capita growth graph). Once the North reaches this point, it becomes more pointless for Southerners to produce computers. This pushes the South away from computers in two ways: first the North’s comparative advantage in computers increases (H-O) and second relatively slower growth in the South keeps the South from “catching-up” in computer technology, so over time their comparative advantage goes away from computers (we can see this in the % of Capital in computer sector graph). To summarize, the North gets relatively better and better at producing computers and so the South specializes more in bananas which becomes more and more of its comparative advantage. Since the North is becoming more and more productive over

time with their dynamic computer sector, while the South is only investing in the stagnant banana sector, welfare in the two countries and their growth rates must get further apart rather than closer together.

2. 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?

In the presence of these external scale economies the South would actually be better off if they shut themselves off from free trade and just lived in autarchy. The South would have faster income growth, higher utility and income, and would specialize less in bananas.

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

Looking at the Trade Regime and Change in Consumer Welfare graph, the costs of a move to autarky would be experienced in the short run while the benefits of such a move would be experienced in the long run. In the short run the South is better off in free trade because they can take advantage of the comparative advantage of the North in capital-abundant goods, and thus worse off in autarky. The costs of free trade only really start after the North hits the critical minimum computer investment which makes it a computer superstar. If the South stays in autarky it can also become a computer superstar in the long run and experience those benefits in the long run. In free trade the South will depend more and more heavily on the North for computer production, at the expense of its own economy.

In what way is the market failing to coordinate individual decisions in a socially desirable way in the presence of external scale economies?

The South would be much better off in the long run if they could convince computer makers there to keep working on making computers and keep investing in capital to move into the computer sector. This would be socially desirable because then the South would hit the critical threshold needed to have a super-efficient dynamic computer sector. No single capitalist alone in the South would find it rational or profitable to invest a large amount in a computer factory, but if everyone got together and did so the country would be better off.

In what ways is market coordination succeeding? (Please be clear about what your normative standard of “socially desirable” is.)

The market is succeeding in making each person in each country as well off as they could be at a single point in time, but unfortunately it is not forward-looking enough to realize that a bit of “suffering” early on could actually lead to a much better future later. This kind of problem is often referred to as “Dynamic Inefficiency.”

3. What would happen to the North if it pursued an autarchic strategy?

The North is actually worse off in autarky at all points in time, both short run and long run. The difference gets larger and larger over time, so the North gets relatively worse and worse off comparing its autarky and free trade experiences. The North specializes more and more in computers in free trade, but in autarky it continues focusing relatively evenly on bananas and computers. Under free trade, the North can capture economies of scale using both North and South markets faster because of its comparative advantage in computers and so is better off.

## Why do autarchy and free trade have asymmetric effects in the North and the South?

Autarchy and free trade have asymmetric effects in the North and South because of the dynamic returns. Whichever country hits the minimum critical threshold first is going to do much better in free trade because they will grow faster and faster while the other country suffers. On the other hand, in autarchy both countries will reach the critical threshold and so will become more and more similar. Thus, the North does really well with free trade and the South does really poorly with free trade, and they both do similarly in autarchy (although the North has a higher capital/labor ratio and so can take better advantage of economies of scale).

### *Bringing Back the State to Beat the Market*

1. 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 periods (say, 5 years)?

Over the first five years a tariff of 10% causes the country to produce a higher proportion of manufactured products (computers), a lower production of agricultural output (bananas), and causes the country to have a slightly lower level of income per capita than they would have without the tariff.

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

Comparing trade (with a tariff) to autarchy, we observe: income per capita is lower with the tariff than under autarchy and the share of manufacturing in total output is lower although growing faster, and the production of bananas is higher. Also note that welfare is higher.

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

Another policy could be the imposition of a quota which sets a limit on the number of computers imported into the country. Under the tariff, however, the country will collect tariff money, so to be equivalent the country would have to sell its quotas (permission to sell computers in the South) for a fee.

2. Over the longer term, what impact does the tariff have compared to both the free trade and autarchy trajectories?

Over the long run the tariff will make the country better off than either free trade or autarchy. This is because it protects the infant computer sector in the South and leads to a higher investment in computers than it would have with free trade and one that surpasses the investment in computers under autarchy after several years. In such case, the South will accumulate capital in the computer sector and will eventually reach the threshold where scale economies kick in, and thus would enjoy from higher productivity. Without autarchy, the South can then benefit from trade once they reach economies of scale. Hence, utility and income are higher in the long run under the 10% tariff on computer imports, than they would be under autarchy or free trade.

3. How do these effects change at both higher and lower tariff levels?

At a higher tariff level (15%) people are worse off than with autarchy or free trade for a few years. In fact, in the long run welfare (utility and income) is higher under a 15% tariff than under free trade. On the other hand, at the 10% tariff level the people were always better off than autarchy. The share of capital in production of computers looks pretty similar comparing the 15% tariff with the 10% tariff.

At a low tariff level (such as 2%) the country starts off doing better than it did in autarchy, but it soon does quite badly, only slightly better off than the free trade case. This is because the tariff is so low that the South doesn't

produce enough computers to cross the critical minimum threshold before the North does. In this case it produces more computers than it would have in free trade, but less than in autarchy. For the South, the tariff needed to tap into efficient computer production is somewhere around 6%. Below that level the South won't have enough capital in computers to reach the threshold before the North "takes off," whereas above that level it will sustain a booming computer sector.

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

Actually, the tariff of 10% looks like a really good choice. It always does better (higher utility) than autarchy (unlike a tariff of 11) and by 30 years it is doing better than a tariff of lower amounts such as 9 or 8. Free trade is no good, as discussed before, since the South can't make enough computers to hit the threshold before the North does. A small tariff is better than autarchy because the South can hit the threshold earlier than it would in autarchy. A higher tariff rate (closer to 15) can provide higher long term welfare despite initially causing higher domestic prices, but may be a worse policy choice because of the period of years where it is less preferable to autarchy. There can be strong arguments made for different high tariff levels.

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

The best scheme of all would seem to be one in which the tariff was eliminated after the South hit the threshold, because at that point there is no reason to add a distortion into the trade market since the South has already hit the threshold and won't turn back.

4. 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.)

It gives one more reason why countries aren't converging, as the empirical evidence we examined in the first half of this class showed. In the first half of the class we looked at how increasing returns to scale caused countries to diverge rather than converge in autarchy. In this case we are looking at a case in which they would have converged had they been left on their own, but because they enter into free trade they diverge.

5. 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?

In conjunction with the question above, it doesn't seem likely that the reason that countries are diverging hinges on their participation in trade. In the presence of increasing returns to scale countries would diverge whether or not they participated in free trade. Free trade might speed along that divergence, but it might not be entirely the fault of the free trade alone.

The simplifications that make it too easy to beat the market are the fact that we supposedly know in exactly which sector there are increasing returns and at exactly what threshold those increasing returns kick in. There is also the simplification that these increasing returns only kick in after some threshold, not kicking in little by little at every level of computer production.

Simplifications that overstate the desirability of market coordination again are those that state knows how, when, and in which industries increasing returns kick in. This implies that the State can effectively pick winners and promote growth. This might be the case of South Korea, and other Asian countries but it is certainly not the case of most Latin American countries that adopted similar policies (Industrialization by Import Substitution) and had disastrous results. In this case, we also made the simplification that the government behaves as a benevolent social planner while in practice it might be far from this and pursue goals at odds with broad based growth.