Department of Economics
Queen's University

ECON239: Development Economics
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Assignment #4 — Answer Key
Monday December 6, 2010

Section A (40 percent)**:** Briefly discuss the validity of each of the following statements. In your answer define or explain as precisely as possible any terms or concepts which are underlined, with particular reference to the context in which they are being used. The text for each answer should be no longer than a page, but you also should also include diagrams or examples where appropriate. They have equal value.

A1. When rural labour markets function according to the nutritional efficiency wage model, increased demand for agricultural labour may have little impact on the earnings of individual workers.

Figure 1 depicts the basic mechanisms of the nutritional efficiency wage model. The capacity curve (the darker line) shows the maximum feasible output of the worker at each income level. At low income levels, work capacity rises slowly with income until a critical point where the worker's nutrition is sufficient to go beyond that necessary to maintain his resting metabolism. At this point work capacity rises quickly with income. Eventually, diminishing returns set in and work capacity rises at a decreasing rate with income. The piece rate line shows the relationship between the worker's productivity and his income, for a give piece rate. Figure 1 illustrates several alternative piece rate lines (the lighter lines). As the piece rate falls the piece rate line becomes steeper. At the highest piece rate, the highest feasible income of the worker would be given at point A, so this would be the output level chosen. As the piece rate falls, the worker is capable of supplying gradually less and less maximum effort. However, once the piece rate falls beyond the level at which the piece rate line and capacity curve are tangent at C, the supply of labour output drops precipitously to a point like D. This is because such a piece rate is too low for the worker to be able to earn enough to pay for the food necessary to sustain higher activity levels.

The consequence of this for labour supply is illustrated in figure 2. When demand is high and given by D_1 the equilibrium piece rate is set at v_1 where the supply of labour effort is just equal to the demand. When demand falls to D_2, any piece rate above v^* would induce excess supply of labour effort. Employers could do better by lowering the piece rate and contracting employment. However, once the piece rate falls below v^* there is excess demand and employers would compete for labour supply by raising the piece rate. At v^*, there is an excess supply of labour and hence

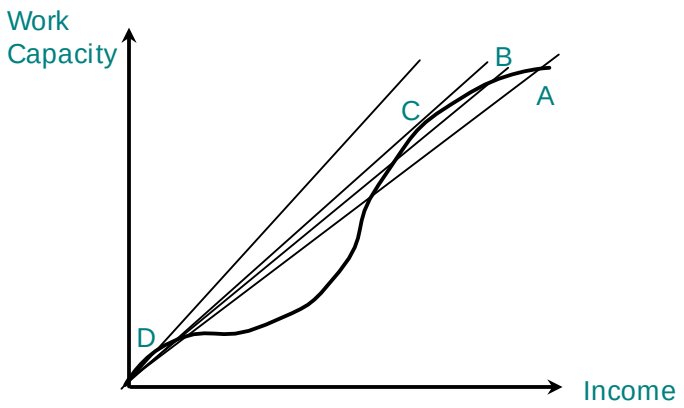


Figure 1: Nutritional Efficieny Wage Model

involuntary unemployment. However, employers do not want to lower the wage because of the effect on work capacity. It follows that under low demand conditions, the piece rate at which there is a point of tangency in Figure 1 is an equilibrium. Note that, according to this theory, when the aggregate demand curve intersects this flat part of the supply curve, fluctuations in it will have no impact on the earnings of individual workers.

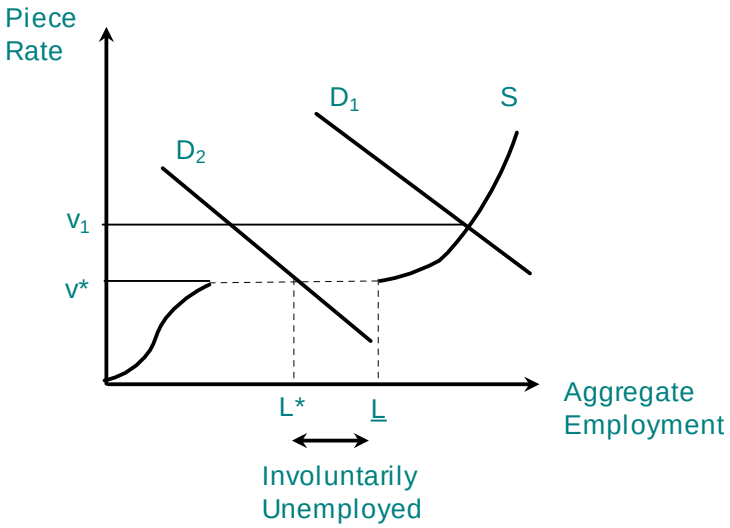


Figure 2: Equilibrium in the Nutritional Efficiency Wage Model

A2. In a casual labour market, where worker productivity depends on past income due to their nutritional status, the introduction of a minimum wage may increase the profits of employers.

Casual labour markets are those where hiring is undertaken on a short–term basis (perhaps even daily). In the standard neoclassical analysis of labour markets, a minimum wage will always tend to reduce profits and induce employers to cut back on their hiring. However, one consequence of a casual labour market is that a worker does not work for the same employer on each occasion — there is no permanent relationship between them. This can create a negative externality between employers if worker productivity depends on income. Specifically, since there is a low probability that an employer will hire the same worker again, she will not fully take into account the impact on future productivity of the wage she pays today. If other employers pay a relatively high wage, a given employer has an incentive to "free ride" and pay a low wage, since there is some chance she will hire workers who previously worked for others. Since all employers face this incentive, they may all be tempted to pay low wages, so that the Nash equilibrium of this "game" between employers results in a situation of low wages, low productivity and low profits. It may be that a superior outcome, in terms of profits, would be for all employers to pay a high wage, so that productivity remains high. However, if the employers do not coordinate, they will always tend to deviate, thereby returning to the inferior Nash equilibrium. If, however, employers are required by law to pay a wage high enough to sustain worker productivity (but no higher), free-riding is no longer an option and the superior outcome may be sustained.

A3. Rapid urban development and/or increased trade with the rest of the world may cause a deterioration in the economic institutions governing trade in rural areas.
Informal institutions that determine people's incentives in economic transactions in rural areas often rely heavily on local information, trust and reciprocity. For example, the costs of making uncollateralized loans are minimized be the fact that lenders often know something about borrowers though family ties or other forms of trade. Repayment in ROSCAs are often enforced by strong social sanctions within communities where individuals know each other. Permanent labour contracts rely on the fact that labourers do not break the contract during peak periods when the spot market wage exceeds their contracted wage. Land use relies on informal land rights (e.g. whoever cleared the land has the right to farm it) that may only work within communities where people know each other and reputations matter. As economies develop, alternative non–agricultural occupations start to become available and people start to become more mobile. These outside opportunities allow people to break informal contracts without suffering any consequences since they effectively leave the community. People are more likely to be strangers, so that the informational advantages of informal lenders start to break down. If the value of land starts to rise due to increased commercialization, informal land rights may no longer be strong enough to mitigate conflicts, etc. Until the economy becomes sufficiently wealthy to afford more formal institutions (e.g. formal land titling, information networks, legal enforcement of explicit contracts through the court system, etc.), they often tend to become "intermediate societies" in which more traditional sectors suffer despite growth in modern sectors.

A4. The Prebisch–Singer hypothesis is a sensible motivation for a policy of import substitution.
The Prebisch–Singer hypothesis is that as the world economy gets richer, it will tend to spend a declining fraction of its income on primary products and more on manufactured goods. This will tend to cause the relative price of primary products to fall relative to manufactured goods and, for countries whose net exports are mostly primary goods and net imports are manufactured goods, there will be a deterioration in their terms of trade (the relative price of exports to imports). If a country wants to import manufactured capital goods in order to grow, it now faces the problem that the prices for what it sells has fallen and the prices of what it buys has risen. To avoid such a situation, Prebisch, Singer and others advocated a strategy of import substitution — impose tariffs and other trade barriers on foreign imports, allowing domestic producers to supply more of the domestic market for a time, then remove the protection once those producers have become sufficiently competitive. Although there are static welfare costs to distorting trade in this way, it was argued that it may be worth if it allows domestic "infant" industries to lower their costs via learning by doing, cross-industry spillovers and by taking advantage of increasing returns to scale

This motivation seems reasonably sensible in principle, especially if large efficiency gains are potentially there for the taking and if private capital markets are functioning ineffectively.[1] Unfortunately, the argument ignores a potential credibility problem: once trade barriers are in place and factors of production have been allocated accordingly, it is often socially, politically and economically costly to remove them, especially if no efficiency gains have been realized. Anticipating this, producers may have little incentive to incur the costs needed to improve their competitiveness, so that the strategy may, in fact, end up fostering greater productive *in*efficiency. Consequently, governments often find themselves unable to remove tariff barriers once installed, which undermines the credibility of the IS strategy in the first place. A second major problem with such policies arises if they become sufficiently widespread to affect exchange rates. By reducing the demand for foreign currency, tariffs cause the domestic currency to become over-valued. This can hurt domestic exporters because their price in foreign units of exchange will increase, thereby reducing demand for them.

[1] Otherwise investment should flow into the manufacturing sector without any government intervention.

Section B (60 percent)**:** Answer the following long questions**.** They both have equal value.

B1. Consider a simple economy with only two sectors — urban and rural. Workers in the urban sector who do not obtain formal sector jobs are assumed to be able to obtain informal sector jobs. The wage in the informal sector is fixed at $w_I = 10$. There are 10 million workers in the economy and they are all identical and risk–neutral. The following table represents the marginal product of labour (MPL) in the two sectors for various levels of employment:

Workers (millions)	Urban MPL Formal	Rural MPL
0	**50**	**40**
1	**45**	**36**
2	**40**	**32**
3	**35**	**28**
4	**30**	**24**
5	**25**	**20**
6	**20**	**16**
7	**15**	**12**
8	**10**	**8**
9	**5**	**4**
10	**0**	**0**

(a) On a diagram with the number of workers in the urban sector on the horizontal axis, plot the marginal product labour in each sector. Based on this diagram, estimate what would be the number of workers and the marginal product in each sector in a competitive migration equilibrium?

The number of workers in the urban sector is approximately 5.5 million, leaving 4.5 million in the rural sector. The wage in this competitive migration equilibrium is approximately 22.

(b) Now suppose the formal sector wage is raised to $w_F = 30$. What would be the demand for workers in the formal sector? Starting from the situation in part (a), what would be an estimate of the probability of obtaining a formal sector job? Would workers start to migrate? Explain

From the table the demand for formal sector workers is 4 million. If there are initially 5.5 million workers in the urban sector, the probability of finding an urban sector wage is $p = 4/5.5 = 0.73$. The expected wage in the urban sector is now

$$\begin{aligned} w^e &= p\bar{w} + (1-p)w_I \\ &= (.73 * 30) + (.27 \times 10) \\ &= 24.6 \end{aligned}$$

Since this exceeds the wage in the agricultural sector of $w_a = 22$, workers should start to migrate.

(c) Compute the probability of obtaining a formal sector job, when the number of workers who have migrated to the urban sector is equal to 2, 3, 4, 5, 6, 7, 8 and 9 million respectively. Note that a probability cannot exceed 1.

The probabilities are given by

$$p = \frac{\text{\# of formal jobs (4)}}{\text{\# urban population}}$$

Thus we have

Urban Population	4	5	6	7	8	9
p	1	0.8	0.67	0.57	0.5	0.44
w^e	30	26	23.4	21.4	20	18.8

(d) Use the values from part (c) to compute the expected wage in the urban sector at each of these migration levels. On a new diagram like that in (a), plot the expected urban wage from and the marginal product of labour in the rural sector from the table above.

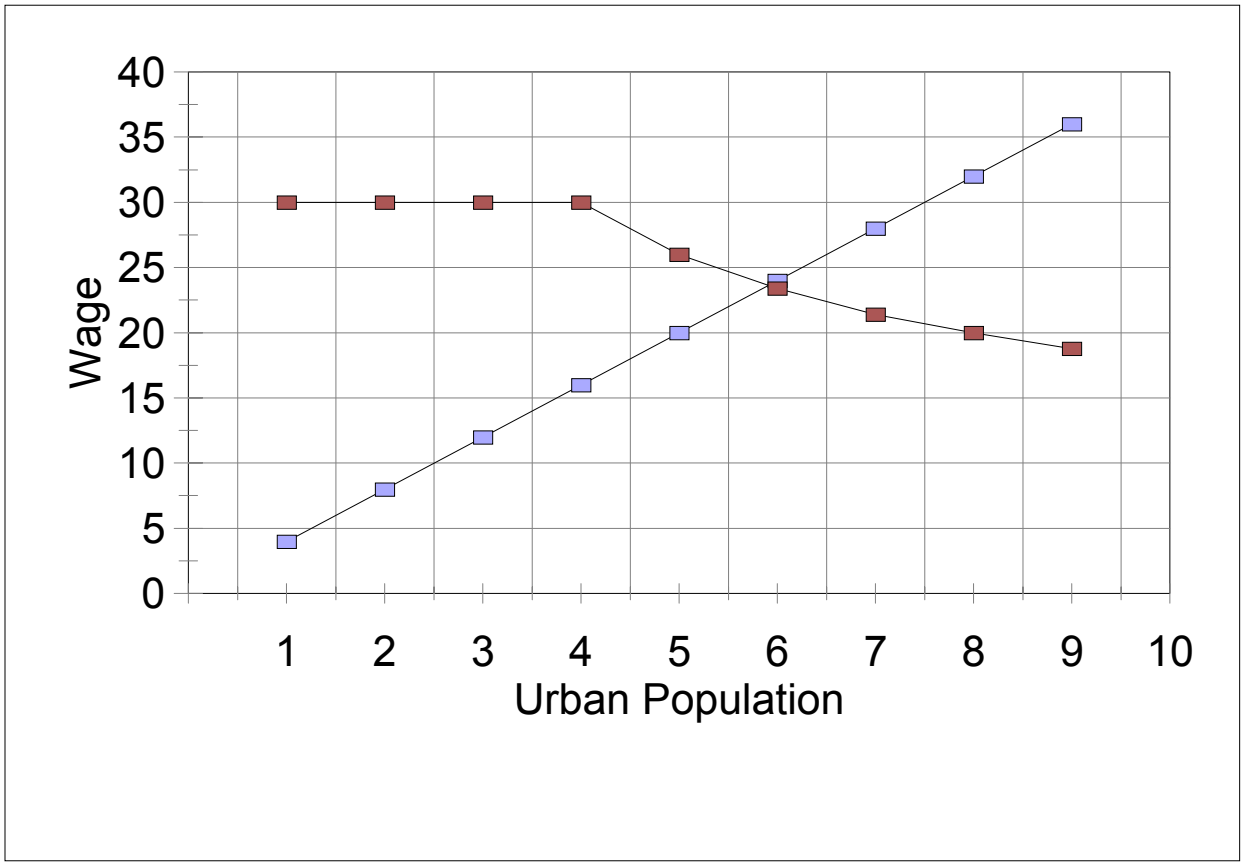
The expected wage is given by

$$\begin{aligned} w^e &= 30p + 10(1-p) \\ &= 20p + 10 \end{aligned}$$

The values are given in the table above and illustrated in the diagram (over).

(e) Based on the diagram in part (d), estimate the numbers of workers in the informal urban sector and the rural sector in a Harris–Todaro migration equilibrium. What is the equilibrium wage in the rural sector? How many more workers migrate relative to the competitive equilibrium?

From the diagram, the number of workers in the urban sector is now about 5.9 million. Since 4 million are in formal sector jobs, 1.9 million must be in the informal sector and 4.1 million are in the rural sector. The equilibrium wage in the agricultural sector is approximately 23.5. Approximately 400,000 more people migrate relative to the competitive equilibrium.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Urban Population

B2. Imagine there are only two countries that make up the world economy: North (N) and South (S). In this simple world, only two commodities are produced: computers and rice. Both N and S are capable of producing both commodities and, to begin with, assume that the only factor of production is labour. Each country has 400 units of labour. Assume that producers are competitive and that labour is perfectly mobile between production sectors. The following table describes how many units of labor are required to make one computer and one sack of rice:

Labour Required	One Computer	One sack of rice
in N	**10**	**5**
in S	**20**	**5**

(a) If country N were in autarky and both goods were produced and consumed, what would the price of computers be relative to rice have to be ? Explain.
Let the price of computers and rice in the North be P_C^N and P_R^N, respectively. Perfect competition amongst producers and perfect labour mobility implies that

$$\begin{aligned} \frac{P_C^N}{10} &= \frac{P_R^N}{5} = w^N \\ \frac{P_C^N}{P_R^N} &= 2 \end{aligned}$$

If the ratio were greater than 2 the wage would be higher in computers than rice and all labour would flow into computers. Similarly, if the ratio were less that 2 all labour would flow into rice production.

(b) If country S were in autarky and both goods were produced an consumed, what would the price of computers be relative to rice have to be ? Explain.
Let the price of computers and rice in the South be P_C^S and P_R^S, respectively. Perfect competition amongst producers and perfect labour mobility implies that

$$\begin{aligned} \frac{P_C^S}{20} &= \frac{P_R^S}{5} = w^S \\ \frac{P_C^S}{P_R^S} &= 4 \end{aligned}$$

If the ratio were greater than 4 the wage would be higher in computers than rice and all labour would flow into computers. Similarly, if the ratio were less that 4 all labour would flow into rice production.

(c) If both goods are consumed once the economies are opened to trade, within what range must the international relative price of computers to rice lie ? Why are both countries better off in this example? What happens to the wages in each country?

With trade, the international relative price of computers to rice must satisfy

$$2 < \frac{P_C}{P_R} < 4.$$

Otherwise one of the goods would not be produced. In this case, the North specializes in the production of computers and the South in the production of rice. Both countries are better off because they are both able to consume a combination of rice and computers that is outside their production possibilities frontier. This reflects the fact that production of each good is concentrated in the country which has a comparative advantage in producing it.

This is illustrated in Figure 3 which depicts the production possibilities frontier (PPF) for each of the two countries. The slope of the PPF for the North is 2, reflecting the fact that the production of one more computer implies that 2 fewer sacks of rice can be produced. The fact that the North specializes in computers implies that its production point is at the lower end of its PPF. Each computer can be traded for $p_C/p_R > 2$ in the international market, so North can achieve a consumption point like the one illustrated. By similar arguments, the South can trade some of the rice it produces for computers to achieve a consumption point outside its PPF.

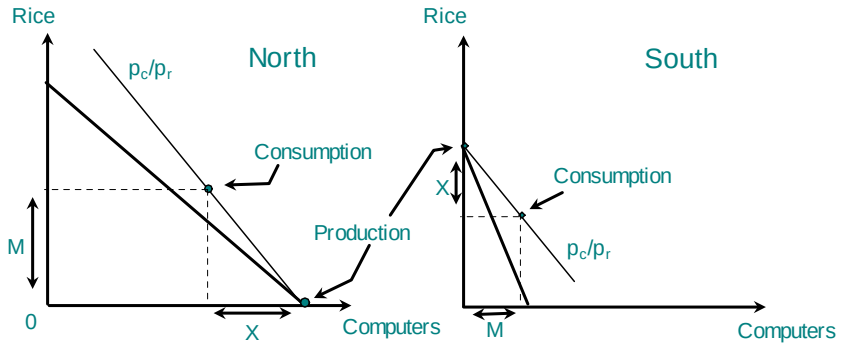

Figure 3: Gains From Trade

Wages in each country rise. This is because the price of computers rises in the North and all labour is used in the computer sector, while the price of rice rises in the South and all labour is used in rice production.

Now suppose we replace the assumptions above with those of the Heckscher–Ohlin neoclassical trade model. Both goods are produced using skilled and unskilled labour, but computer production is more skill–intensive than rice production. Assume now that the two countries are identical except for the fact that North has more skilled labour than South.

(d) Explain, with the aid of diagrams, why this model predicts that the autarky relative price of computers is higher in the South than in the North?

In both countries the PPF is now bowed out. To see this note that as production shifts from unskilled labour-intensive rice to skilled labour-intensive computers, the demand for skilled labour

relative to unskilled labour increases causing the relative cost of skilled labour to rise. As a result, the optimal skilled to unskilled labour ratio used within each sector declines and, since computer production uses skills more intensively, the productivity of the computer sector declines relative to rice. Consequently, for every reduction in terms of sacks of rice the gain in terms of computers declines.

Figure 4 depicts the autarky equilibrium for the two countries. Because the North is endowed with relatively more skilled labour, it can produce more (skilled labour intensive) computers relative to rice when compared with the South. Conversely, because the South is relatively well-endowed with unskilled labour, it can produce more (unskilled labour intensive) rice relative to computers. Consequently, the PPF for the North is wider and shorter than the PPF in the South (when drawn with Rice on the vertical axis and computers on the horizontal axis). Given that the two countries are assumed to have the same preferences, represented by a set of indifference curves, in autarky equilibrium the relative price of computers will tend to be higher in the South than the North, reflecting the slopes of the PPFs:

$$\frac{p_c^N}{p_r^N} < \frac{p_c^S}{p_r^S}$$

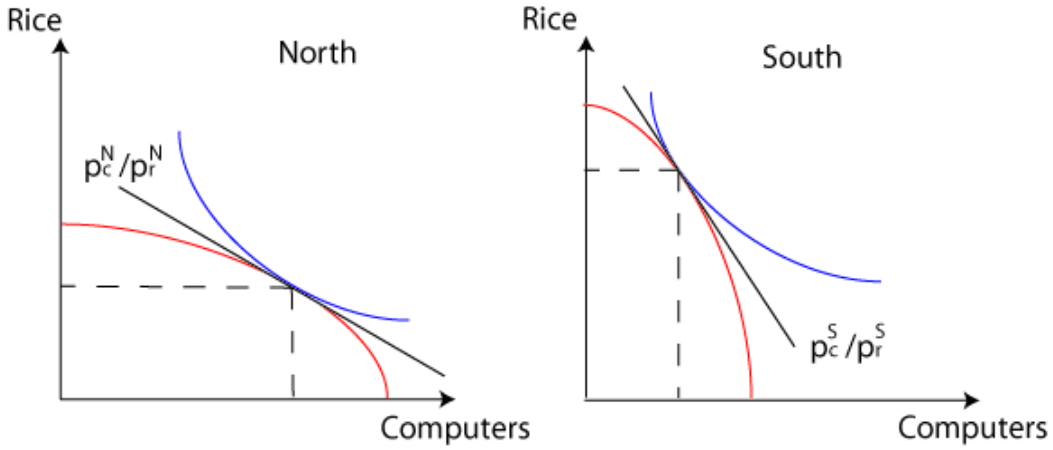

Figure 4: Autarky equilibrium

(e) When, under these assumptions, the countries open up to international trade, which factor would be predicted to gain and which factor to lose in the South? Carefully explain your reasoning.

When the countries open up to international trade, the prices of the two goods must be the same in both. The relative price of computers will adjust so that it is between the autarky price ratios in the two countries. The free trade equilibrium is illustrated in Figure 5. As the price of computers rises relative to rise in the North, producers there shift more into computer production and away

from rice production. Conversely, as the relative price of computers rises, households in the North shift their consumption more into rice and away from computers. The opposite happens in the South. This process continues until the relative price is such that the total world demand for both goods equals the total world supply. In this situation, the North exports computers which are imported by the South ($X^N = M^S$) and the South exports rice that is imported by the North ($X^S = M^N$).

Since the production of computers is skill-intensive and the production of computers falls in the South, the demand for skilled labour falls and their wages fall. Conversely, since rice is unskilled labour-intensive and the production of rice rises, unskilled labour will gain from the shift to free trade. The opposite is true in the North.

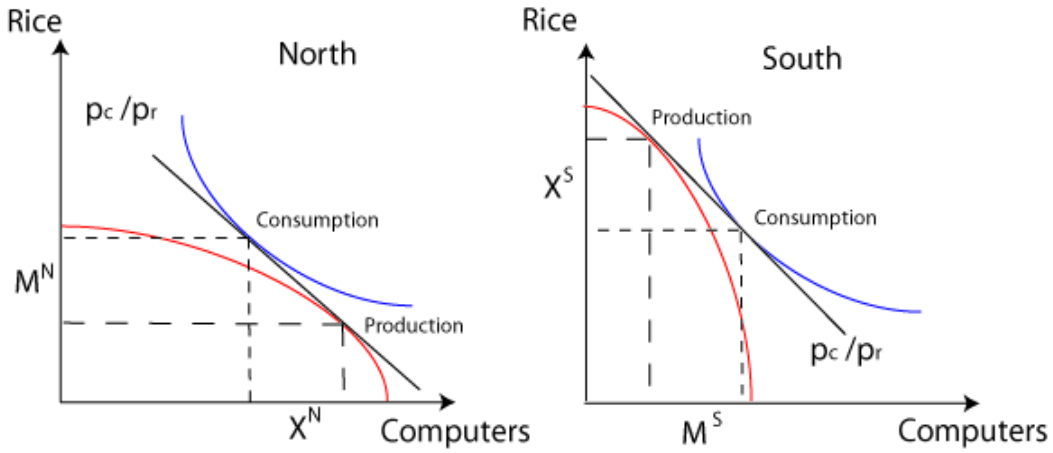

Figure 5: Free Trade Equilibrium