

# Capital mobility, international environmental standards and less developed countries

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## **Abstract**

The motivation for this paper is to model the relationship between capital mobility and environmental standards and to understand the opposition of green and trade union activists to capital mobility and their support for minimum environmental standards. This paper presents a two factor model of the impact of capital mobility on environmental standards and welfare of developed and developing countries. The model demonstrates that an environmental “race to the bottom” is not the inevitable result of capital mobility, that imposition of minimum standards will make developing countries worse

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off and that alternative mechanisms exist to raise world environmental standards.

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## 1 Introduction

In December 1999, at the Seattle Round of the World Trade Organization talks, trade officials and trade economists received a rude wake-up call from the outside world. Arrayed outside the WTO meetings were protest groups composed of green activists, trade union members and consumer activists.

Many of the activists were opposed to the movement of developed country firms to developing countries. Firms were accused of destroying the environment and hurting the workers of developing countries. The solutions proposed were to set minimum environmental and labor standards for all countries. Countries that chose not to conform to these minimum standards would be punished by being excluded from the international marketplace.

The activists' principal complaint with trade and international investment was that such trade and investment led to a "race to the bottom." Countries competing for mobile capital would lower envi-

ronmental standards, but as all countries were lowering environmental standards, all countries would end up with worse environments. Setting minimum environmental standards, it was argued, would prevent this competitive lowering of environmental standards.

The response of economists to the Seattle Round protests has been relatively standard. Environmental capacity for absorption of pollution and citizen disutility of pollution differ across countries, so it should not be expected that all countries' optimal environmental standards be identical. Such diversity then represents a further difference between countries that can be welfare-enhancing under trade, much as differences in labor or capital endowments can provide mutually beneficial trading opportunities.<sup>1</sup> Given the presumed comparative advantage of developing countries in pollution, polluting industries would move to developing countries as a result of opening them up to foreign investment, and, economists argued, this will lead to an increase in incomes of both countries. These arguments have not made any progress with the critics of the Seattle Round.

The environmental standards literature and the activists at the Seattle Round of the WTO have focused on the potential for a worsening of standards under trade and investment liberalization in developing countries. However the empirical literature has found no evidence of a lowering of standards under trade in the developing countries.<sup>2</sup>

Two studies (Birdsall and Wheeler (1992) and Lucas, Wheeler and

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<sup>1</sup>See Bhagwati and Srinivasan (1996) for a defence of free trade along these lines.

<sup>2</sup>See Dean (1992) for a summary of much of the empirical work.

Hettige (1992)) find evidence of the opposite result- that pollution emissions grew faster in the developing countries that were less open to the international marketplace. This disconnect between the theoretical literature and the empirical findings, as well as between the empirical evidence and the views of the critics of the Seattle Round, is the basis for this paper.

The paper presents a model to examine the effects of opening up developing countries to capital investment from the developed countries. The explicit treatment of capital mobility is a new feature of this model as is the emphasis on the political economy of the opposition to investment liberalization. The model shows that the disconnect between the two literatures is due to the emphasis in the theoretical literature on only one aspect of capital mobility and that the empirical findings should not be surprising at all. The model is used to examine the consequences of different forms of international environmental agreements.

Section 2 lays out the basic two country two factor model with environmental standards. The model is solved under various conditions of capital mobility and income of countries in Section 3. In Section 4 the model is used to analyze the effects of international environmental agreements in a world composed of rich and poor countries. Section 5 compares the results from this model to several empirical studies of the effects of openness on environmental standards in developing countries. These results are used to draw some conclusions about the

motivations of the Seattle Round activists in Section 6.

## 2 Model

Assume the world is composed of two countries. Country “North” is denoted by the superscript “ $N$ ”, and country “South” is denoted by the superscript “ $S$ ”. There are two factors of production, labor,  $L$ , and capital,  $K$ . Labor is assumed to be immobile internationally, while capital is potentially internationally mobile, subject however to government regulation. Labor and capital endowment in each country are given by  $\bar{L}^i$  and  $\bar{K}^i$  respectively, where  $i$  is either “N” or “S”.

Production within a country will depend on that country’s stock of labor, capital and a third element which represents “environmental standards”,  $S$ . Environmental standards is an index representing the whole set of environmental regulations, standards and community expectations within a country.<sup>3</sup> A higher level of environmental standards within a country is represented by a larger value of  $S$ . The level of  $S^i$  in each country is set by the country’s government as a solution to a government utility maximization problem.

It is assumed that a higher level of environmental standards, holding the levels of capital and labor constant, will lower the level of production in a country. Jaffe *et al.* (1995) did not find strong evi-

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<sup>3</sup>It is not necessary that environmental standards be written into a country’s laws. A sufficiently strong consumer response to a polluting manufacturer can deter polluting activities.

dence that there was a significantly negative impact of environmental standards, but it could be expected that shifting to a higher set of environmental requirements would not increase productivity. Porter (1991) has argued that higher environmental standards might have a dynamic effect on growth by raising the incentives to invent. This Porter hypothesis requires a longer time-scale than is considered in this paper, so this possibility will be ignored.

Pollution is modeled here as a local effect only. That is, the environment in a country depends only on the level of environmental standards in the country. Despite this restriction, it is shown that the mobility of capital alone is sufficient to bring about important strategic interactions between countries and their environmental standards.

Both countries have constant returns to scale in capital and labor production functions,  $f$ , of the form

$$f^i(K^i, L^i, S^i)$$

It is assumed that  $f$  is twice continuously differentiable in all three parameters. The production functions are assumed to be increasing and concave in  $K$  and  $L$  and decreasing and concave in  $S$ . The partial derivatives  $f_L$  and  $f_K$  are assumed to be decreasing in  $S$ .

The markets for capital and labor within each country are assumed to be perfectly competitive. Combined with the assumption of constant returns to scale production functions, these conditions ensure that compensation to each factor is equal to the marginal productivity of that factor within each country. Denoting returns to labor as

wages,  $w$ , and returns to capital as rental,  $r$ , these variables must satisfy

$$w^i = f_L^i(K^i, L^i, S^i)$$

$$r^i = f_K^i(K^i, L^i, S^i)$$

The population of each country is divided into holders of capital inputs, capitalists, and holders of labor inputs, workers. Workers have a utility function which depends on their wages and the level of environmental standards in that country only. Capitalists have a utility function which depends on the rental rate and the level of environmental standards in that country only.<sup>4</sup>

Worker utility:  $U(w^i, S^i)$

Capitalist utility:  $V(r^i, S^i)$

The utility functions are assumed to be twice continuously differentiable, quasi-concave and increasing in factor returns and  $S$ .

It is assumed that capitalists are not politically powerful in either country. It would be sufficient that both countries are democracies and that the median voter in each country is a worker. Under the median voter rule, each country's political processes will be dominated by the

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<sup>4</sup>If the case of capital immobility, capitalists are only concerned with the return to capital in their own country. In the case of capital mobility, returns to capital will be the same in both the North and the South, so capitalist utility is only a function of return to capital in their own country.

interests of the workers. The consequences of alternative assumptions about political processes are examined in Section 3.

In parts of this paper references are made to the worker's utility function in order to make normative statements about the effects of various policies. These statements ignore the effects of policies on the capitalists in each country. To the extent that the environmental debate seems to be driven on the basis of "concern for workers in foreign countries", this assumption to focus on changes in worker utility only is warranted.

Government behavior is modeled through a government utility function. As government behavior is dominated by the interests of the workers, the worker utility function is also the government utility function.

There are assumed to be no frictions in the labor markets in either country and no international mobility of labor. The full endowment of labor  $\bar{L}^i$  is always employed in each country.

Capital has the potential to be mobile internationally. If capital is not mobile, then all of the endowment of a country's capital is employed within that country, and the rental rate is

$$r^i = f_K^i(\bar{K}^i, \bar{L}^i, S^i)$$

However if capital is mobile internationally, then capital is assumed to move to the country that produces the greatest return for that capital. Assuming that low levels of capital are sufficiently productive in each

country,<sup>5</sup> there will be an equilibrium with positive levels of capital in both countries and requiring

$$r^N = r^S.$$

For any given level of  $\bar{K}^i$  and  $\bar{L}^i$  a wage-environmental standards frontier can be defined,<sup>6</sup>  $W^i(S^i; \bar{K}^i, \bar{L}^i)$ , as the maximum level of  $w^i$  that can be reached for a given level of  $S^i$ . Suppressing the fixed factor endowments, this can be expressed as

$$W^i(S^i) = f_L^i(\bar{K}^i, \bar{L}^i, S^i)$$

Given the assumptions on the shape of the production function,  $W^i(S^i)$  will be decreasing and concave in  $S^i$ . The shape of the  $W^i$  frontier suggests that trade unions and environmental activists should be natural enemies, as they are assumed to place quite different relative values on wages and environmental standards. The relationship between trade unions and environmental activists will be returned to in Section 6.

Governments are assumed to maximize their utility by choosing the level of environmental standards subject to the fixed endowment of labor and the equilibrium level of capital in the country.

### 3 Solutions to the basic model

This section lays out solutions to this basic model under conditions of capital immobility and capital mobility.

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<sup>5</sup>A sufficient assumption is that  $f_K^i \rightarrow \infty$  as  $K \rightarrow 0$  for any level of  $\bar{L}^i$  and  $S^i$ .

<sup>6</sup>This phrase will be shortened to “wage-environment frontier” for brevity.

### 3.1 No international mobility of capital

Under this assumption, capital and labor employed in each country is equal to their endowment levels. Each government chooses a solution to the problem

$$\max_{w^i, S^i} U(w^i, S^i)$$

subject to

$$w^i = f_L^i(\bar{K}^i, \bar{L}^i, S^i)$$

There is no strategic interaction between the countries.

Solutions to this model are denoted by the superscript “I”. One solution is represented in  $(w^{Ii}, S^{Ii})$  in Diagram 1. The wage-environment frontier under immobile capital,  $W^{Ii}(S^i)$ , is given by

$$W^{Ii}(S^i) = f_L^i(\bar{K}^i, \bar{L}^i, S^i).$$

The solution is a point on the wage-environment frontier which is on the highest contour line of  $U$ . As the wage-environment frontier is convex to the origin and the contour lines of the utility function are concave to the origin, there will be one or more of these solutions.

This result replicates Result 2 of Nordhaus (1995) which states that for local environmental goods, standards should be set according to the costs and benefits in the local area alone. In these conditions international environmental standards could only reduce the welfare of the workers in these countries. The addition of trade in goods between the North and the South would not change this result.

### 3.2 International mobility of capital

Under this assumption, labor employed in each country will be equal to the endowment levels, however, for capital, combined employment in the two countries will be equal to their combined endowments.

Each government chooses a solution to the problem

$$\max_{w^i, S^i} U(w^i, S^i)$$

subject to

$$w^i = f_L^i(K^i, \bar{L}^i, S^i)$$

$$r^i = f_K^i(K^i, \bar{L}^i, S^i)$$

and there are the additional constraints for equilibrium in the capital market

$$r^N = r^S$$

and

$$K^N + K^S = \bar{K}^N + \bar{K}^S.$$

Under these assumptions one country's choice of its environmental standards will affect the maximization problem of the other country through the level of capital in that country. There is strategic interaction between the countries.

Solutions to this model are denoted by the superscript "M". Each country will have a solution  $(w^{Mi}, S^{Mi})$ . The interaction between the two countries is a two-player game in  $(S^N, S^S)$ . The solution concept used will be the noncooperative Nash equilibrium- each country will

choose its optimal  $S^i$  holding constant the other country's choice of environmental standards. At the equilibrium each country's choice of  $S^{Mi}$  is optimal given the other country's choice of  $S^{Mj}$ .

Given this solution concept, a mobile capital wage-environment frontier can be defined. This frontier,  $W^{Mi}$ , is the maximum level of  $w^i$  that can be reached for a given level of  $S^i$  holding fixed the other country's choice  $S^j$ . The level of capital in each country will depend on both  $S^S$  and  $S^N$ .

$$W^{Mi}(S^i) = f_L^i(K^i, \bar{L}^i, S^i)$$

The wage-environment frontier will have a steeper slope under capital mobility,  $W^{Mi}(S^i)$ , than under no capital mobility,  $W^{Li}(S^i)$ , due to the movement of capital out of a country that raises its environmental standards. The slope of this frontier is

$$\frac{\partial W^{Mi}(S^i)}{\partial S^i} = \frac{\partial^2 f^i}{\partial L^i \partial S^i}(K^i, \bar{L}^i, S^i) + \frac{\partial^2 f^i}{\partial L^i \partial K^i}(K^i, \bar{L}^i, S^i) \frac{\partial K^i}{\partial S^i}$$

Equilibrium in the capital market requires

$$\frac{\partial f^N}{\partial K^N}(K^N, \bar{L}^N, S^N) = \frac{\partial f^S}{\partial K^S}(K^S, \bar{L}^S, S^S)$$

Totally differentiating this constraint and making use of the additional constraint that  $dK^N = -dK^S$ , the resulting condition is derived

$$\frac{dK^i}{dS^i} = -\frac{f_{KS}^N}{[f_{KK}^N + f_{KK}^S]} < 0$$

So the wage-environment frontier is steeper under capital mobility than without capital mobility.

At the solution of the game with capital mobility  $(S^{MN}, S^{MS})$ , there exists a “small” change  $(\Delta S^N, \Delta S^S) \gg 0$  such that

$$(S^{MN} + \Delta S^N, S^{MS} + \Delta S^S)$$

will lead to higher utility for both countries.

This can be achieved by finding a “small”  $(\Delta S^N, \Delta S^S)$  such that

$$f_K^N(K^{MN}, \bar{L}^N, S^{MN} + \Delta S^N) = f_K^S(K^{MS}, \bar{L}^S, S^{MS} + \Delta S^S)$$

This “ $\Delta$ ” is guaranteed to exist since the rental rate is decreasing in each country’s own environmental standards. Rental rates are equalized between the two countries at the equilibrium levels of capital  $(K^{MN}, K^{MS})$ , so the simultaneous rise in environmental standards will not induce a flow of capital. This change is equivalent to moving along the immobile capital wage-environment frontier.

Since the utility contours of each country are parallel to the mobile capital wage-environment frontier at the equilibrium levels of wages and environmental standards, and since the slope of the immobile capital frontier is greater than the slope of the mobile capital frontier, this simultaneous raising of standards would lead to an increase in utility of each country, as shown in Diagram 2.

### 3.2.1 Example for identical countries

In the case of identical countries, with identical endowments of labor and capital, and identical production functions, the solution to

the game of environmental standards is relatively straightforward to illustrate.

Since the game is symmetric in the players and the production functions are concave, the solution must be symmetric as well with

$$K^{MN} = K^{MS}$$

$$S^{MS} = S^{MN}$$

Both countries must have equilibrium capital levels equal to their endowment levels, thus each must be on its immobile capital wage-environment frontier. However as capital can move in response to changes in environmental standards, each country will also be on its mobile capital wage-environment frontier. The mobility of capital has increased the drop in wages due to a rise in environmental standards. In effect, the cost of higher environmental standards is higher under capital mobility than under capital immobility.

This intersection occurs at a point like  $(w^{Mi}, S^{Mi})$  in Diagram 3. At this point the mobile capital wage-environment frontier for a level of capital equal to the endowment level crosses the immobile capital wage-environment frontier. As was shown in the previous section, each country's utility will be lower than the jointly-maximal utility level possible from  $(w^{Ii}, S^{Ii})$ - the utility level under no capital mobility.

The introduction of capital mobility has resulted in no actual shift of capital between countries, however, due to the possibility of capital movement, each country has lowered environmental standards and

raised the return to capital (and wages). This shift along the wage-environment frontier from the point  $(w^{Ii}, S^{Ii})$  to the point  $(w^{Mi}, S^{Mi})$  for a constant level of capital is denoted as the “price effect”, since it results from the greater trade-off required to raise environmental standards when capital is mobile.

Wages, rental rates and incomes are higher in both countries, but environmental standards have been lowered. Both countries could potentially gain from a joint move to a lower wages/higher environmental standards outcome, but neither country can achieve this result unilaterally.

The lowering of environmental standards is the situation that concerns commentators when they talk of a “race to the bottom” in environmental standards. They fear that the mobility of capital will lead to policy competition between countries that will end up reducing the environmental standards in both countries. Such a result can be averted by international environmental standards as discussed in later sections.

Yet it is not in the context of identical countries that current concerns over international environmental standards are being expressed, rather it is between countries that have vastly dissimilar economies as in the case of the developed and developing countries. It is shown in the next section that the analysis for dissimilar countries leads to very different conclusions.

### 3.2.2 Rich-poor country example

Assume that the two countries are a rich country (“the North”) and a poor country (“the South”). Assume that the South possesses a lower endowment of capital than the North, and that the immobile capital rental rate is higher in the South than in the North

$$f_K^N(\bar{K}^N, \bar{L}^N, S^{IN}) < f_K^S(\bar{K}^S, \bar{L}^S, S^{IS})$$

It is assumed that the economy of the North is more efficient than the economy of the South. Unmeasured factors such as poor legal and political structures and lack of physical infrastructure and human capital mean that

$$f^S(K, L, S) < f^N(K, L, S) \text{ for any level of } K, L, S$$

Assume that the utility functions of the two countries are identical. As environmental standards are a normal good, the immobile capital levels of wages and environmental standards are lower in the South than in the North.

If both countries open up their borders to capital flows, there will be a policy competition game between the two countries in  $(S^{MN}, S^{MS})$ . Capital will flow from the North to the South, as both countries adjust to the new equilibrium.

The effects of the new openness can be analyzed in terms of a “price” and an “income” effect. The change in capital in each country will lead to an “income” effect, as countries see their wage-environmental standards frontiers shift in or out. The mobility of capital will lead to a

“price” effect in both countries, as the mobility of capital means that a change in environmental standards will lead to a flow of capital, changing the trade-off between wages and environmental standards. As this flow is against countries which raise environmental standards, this means that the trade-off or “price” of higher environmental standards in terms of lower wages will be greater under capital mobility than under capital immobility.

Capital mobility will lead to a flow of capital from the North to the South and the equalization of rental rates

$$f_K^N(K^{MN}, \bar{L}^N, S^{MN}) = f_K^S(K^{MS}, \bar{L}^S, S^{MS})$$

The effect in the North will be a negative income effect, as capital flows out of the country. This will lower wages and environmental standards in the North. In addition the mobility of capital will have a price effect, raising wages and rental rates and lowering environmental standards in the North, as shown in Diagram 4. The combined effect will be ambiguous in terms of wages and rental rates, and negative in terms of environmental standards in the North.

The effect in the South will be a positive income effect, as capital flows into the country. This will raise wages and environmental standards in the South. The mobility of capital will have a price effect, raising wages and rental rates, and lowering environmental standards in the South. The combined effect will be to raise wages and rental rates, while the effect on environmental standards will be ambiguous in the South. Diagram 4 illustrates the effects of mobility of capital

in the case where environmental standards in the South rise.

Thus, a “race to the bottom” is not necessarily the case if the two countries are dissimilar. International capital mobility will lead to lower environmental standards in the North, but not necessarily in the South. If the income effect of the change dominates the price effect in the South, then the environmental standards in the South may actually rise due to the change. The worldwide environment may actually improve if the increase in the environmental standards in the South leads to environmental changes that outweigh the fall in environmental standards and worsening of the environment of the North.

Much thus depends on the relative sizes of these “income” and “price” effects. The shape of the income path in  $(w, S)$  becomes crucial. Two possibilities are illustrated in the income path in Diagram 5. Absent the price effect, if the South and North are situated as points A in Diagram 5, the South will respond to an increase in its capital stock largely by raising environmental standards, while the North will respond to a decrease in its capital stock by reducing wages. In such a situation world environmental standards have improved. However if the South and the North are situated as points B, capital mobility will serve to worsen world environmental standards, as the South takes its gains mostly in terms of higher wages, while the North will largely reduce environmental standards.

Just as with the previous case of identical countries, there exists the

potential for a jointly beneficial increase in environmental standards. This Pareto improvement would require both the North and the South to increase their environmental standards and could be coordinated so that returns to capital were equal in both countries after the increase. Both countries would have higher environmental standards and higher utility than they would have under the noncooperative outcome. This joint increase in standards would typically be accomplished through an international agreement. This topic is taken up again in Section 5.

### **3.3 Alternative formulations of government utility**

The previous cases in this section were solved assuming that the governments of both countries were dominated by the interests of the workers. Alternative hypotheses could be either that governments are dominated by the interests of the capitalists or that governments seek to maximize some weighted average of worker and capitalist welfare.

If governments are dominated by the interest of capitalists, the problem for the government becomes one of maximizing capitalist utility

$$V(r^i, S^i)$$

subject to some rent-environmental standards frontier. The basic logic of the problem is unchanged.

It is only in the case of capital mobility and dissimilar countries that this alternative formulation will matter. Repeating the analysis

of Section 3.2.2, the opening up of the two countries to capital mobility will induce capital to leave the North and flow into the South. This increase in capital stock in the South will shift inwards the rent-environmental standards frontier, as more abundant capital relative to labor pushes down the return to capital in the South. The mobility of capital will raise the slope of the rent-environmental standards frontier in the South. In the North, the outward flow of capital will shift the rent-environmental standards frontier out, as well as increasing its slope.

In the South the price and income effect both reduce environmental standards but are ambiguous towards rents. While in the North rents will rise but the effect of capital mobility on environmental standards is ambiguous.

This prediction does match the stated fear of developed country activists- that capital mobility will lead to lower developing country environmental standards. However this scenario has one puzzling aspect. Capital mobility will make Southern capitalists unambiguously worse off. If the Southern capitalists control the government and thus direct the government to lower standards after opening up the country to trade, why do they allow capital mobility in the first place? Southern capitalists have higher utility by blocking the inflow of Northern capital.

A further alternative is that the political process in the South seeks to maximize some weighted average of worker and capitalist utilities.

In this case the direction of change of environmental standards in the South under capital mobility is undetermined, as capitalists seek lower standards and workers may desire higher standards. The analysis of this problem is beyond the scope of this paper.

## **4 International environmental agreements**

This section extends the basic model of the previous sections to include international environmental agreements. The analysis in the previous section assumed that there was no coordination between the countries, but it was shown that the potential exists for a cooperative agreement that increases the utilities of workers of both the rich and poor countries.

The current proposals for international environmental agreements do not resemble these Pareto-improving agreements. International environmental agreements can be divided into three types: those that require developing countries alone to change, of which minimum international environmental standards is an example ; those that require developed countries alone to change, of which the Kyoto Accords is an example; and those that require both developed and developing countries to change, of which the Pareto-improving agreements would be a subset. Each of these agreements is analyzed in turn.

## 4.1 Minimum environmental standards

Many of the current proposals require a minimum set of environmental standards in each country. If the two countries are identical, then capital mobility leads to a worsening of utility for the two countries by raising the cost of environmental standards, as shown in Section 3.2. An international agreement that compels both countries to raise their environmental standards can leave both countries better off. An optimal environmental standard would require that each country adopt the same standards as they would have under immobile capital, by requiring minimum environmental standards that were equal to the autarky level.

If the two countries are dissimilar, the analysis is quite different. Assume that capital is mobile and that under capital mobility, wages and environmental standards are lower in the South than in the North. An international environmental agreement sets a minimum environmental standard worldwide  $S^{min}$  at

$$S^{MS} < S^{min} < S^{MN}$$

The effect of such a change would be to lower capital in the South as

$$f_K^N(K^{MN}, \bar{L}^N, S^{MN}) > f_K^S(K^{MS}, \bar{L}^S, S^{min})$$

The new equilibrium after the imposition of minimum environmental standards is denoted by the superscript “E”. The decline in capital has a negative income effect on the South, lowering wages until a new

equilibrium is reached with

$$f_K^N(K^{EN}, \bar{L}^N, S^{EN}) = f_K^S(K^{ES}, \bar{L}^S, S^{min})$$

as illustrated for the South in Diagram 6. The effect of both the rise in environmental standards and the decline in capital is to push wages in the South lower.

In the North, the increase in capital has a positive income effect, raising wages and environmental standards as illustrated in Diagram 6. The overall effect is unambiguously to raise world environmental standards. However it would also increase the gap between rich country and poor country incomes. Workers in the South are unambiguously worse off because of the minimum standards, while workers in the North are made unambiguously better off.

## 4.2 Kyoto Accords

Does there exist a way to raise environmental standards in both countries without increasing the gap between rich and poor countries? One possibility would be an agreement that requires raising developed country environmental standards instead of developing countries standards. The Kyoto Accords is an example of an agreement that only requires the increase of environmental standards of the more developed economies.<sup>7</sup> Analyzing the effects of a policy of increased

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<sup>7</sup>Developed countries may subsidize developing countries to undertake pollution reductions for them, but the cost of pollution reduction is wholly imposed on the developed countries.

developed country environmental standards is as easy as reversing the superscripts of the variables in the previous example. A rise in the standards in the North leads to an increased flow of capital to the South. This increases both the wages, environmental standards and worker utility in the South. The rise in environmental standards leads to lower wages and lower worker utility in the North.

In this case, environmental standards have been increased in both countries, but now at the expense of rich country incomes. The gap between poor and rich countries is lower than before the imposition of the agreement.

### 4.3 Pareto-improving agreements

Under mobile capital, it was shown in Section 3.2 that it was possible to increase the utilities of two identical countries by raising the environmental standards of both countries. A similar argument can show that this is also possible for two dissimilar countries. If both countries simultaneously raise environmental standards at a rate which does not induce capital flow out of either country, then “small” increases can lead to higher utilities for both countries.

Thus, it is possible to construct international environmental agreements that would lead to higher worker utilities and environmental standards in both the developed and developing countries. These Pareto-improving agreements would lead to lower wages and returns to capital in both rich and poor countries, but these declines in wages

would be more than offset by increases in environmental standards.

## 5 Empirical evidence

No empirical studies have found a strong relationship between environmental standards and the location of “dirty” industries. As summarized in Dean (1992), the main conclusions from this literature are that pollution control costs are small, reductions in output due to pollution control costs are small, and the costs have not been found to have had a significant impact on the location of industries.

This evidence suggests that the slope of the wage-environmental standards frontier is relatively flat and is not greatly increased after opening up to international investment. Firms locate in developing countries for many reasons, only one of which is lower environmental standards. The “price” effect of opening up a country to international investment will be small and likely is dominated by the “income” effect of new investment. If the “income” effect is dominant, then we would expect that developing countries will raise environmental standards after opening up, if the country is successful in attracting sizeable foreign investment. This conclusion is the exact opposite of the green activists at Seattle.

Opening up a developing country to international trade and investment has further effects than simply the increase in country capital. Openness to the international marketplace has proven a strong predic-

tor of growth rates for developing economies in multiple cross-country growth regressions, such as Sachs and Warner(1995). This dynamic effect will follow through into environmental standards, given that standards are a normal good. One would expect more open economies to have higher incomes and thus higher standards than closed economies over long-range time horizons.

A further benefit of openness has been indicated by Lucas, Wheeler and Hettige (1992) and Birdsall and Wheeler (1992). Both papers found that closed economies had higher level of pollution or polluting industries, after accounting for differences in incomes. Whether this is due to better technology available from foreign investment or due to better policies forced on developing countries due to openness is uncertain.

The advantages of openness in terms of higher income growth and higher environmental standards raises a problem with minimum international environmental standards. One alternative open to developing countries under a WTO-mandated environmental standard would be to drop out of the international marketplace altogether. Standards that are sufficiently high may so reduce developing country utility that they prefer not to trade at all, or may be impossible for countries to reach. The countries for which this is most likely to be true are those with the lowest environmental standards- the poorest of developing countries. Locking the poorest developing countries out of the international marketplace means that they may never gain the

dynamic benefits of trade and international investment. This may be yet another poverty trap.

## 6 Conclusions

There is a link between international capital mobility and the environment of trading countries. The true relationship is not, however, the simple story told by the “race to the bottom” if one is considering the movement of capital from developed to developing economies.

Capital mobility between developed and developing countries will raise wages in developing countries and lower wages and environmental standards in the developed countries. The effect on the environment in developing countries is not certain. Higher incomes in developing countries may lead to an improvement in the environmental standards in those countries as a result of the inflow of capital.

Existing empirical studies find a weak link between environmental standards and plant location. These results suggest that the income effect of a capital inflow will outweigh the “policy competition” effect of opening up developing countries. It thus seems likely that capital flows to developing countries will lead to higher environmental standards in those countries.

International environmental agreements jointly raising environmental standards in all countries could lead to a raise in welfare in both developed and developing countries. But the forms of international

agreements that are currently being discussed are not of this form. Current agreements either place the entire burden of improving environmental standards on developing countries- “minimum international environmental standards”- or place the entire burden on developed countries- “Kyoto Accords”.

The effect of both types of agreement would be to raise environmental standards in both developed and developing countries. But the effect on welfare for rich and poor countries differs between these two types of agreement. Agreements that place the burden of raising standards on developing countries lead to lower wages and worker utility in developing countries, while wages and worker utility rises in developed countries. Agreements that place the burden of raising standards on developed countries raise wages and worker utility in developing countries, while lowering wages and worker utility in developed countries. On equity grounds a preference might be expressed for agreements that place the burden of raising standards on developed countries, as these agreements raise standards worldwide and serve to reduce the disparity between developed and developing country wages.

Based on this model of the effect of capital mobility and international environmental standards, what can be gleaned about the preferences of developed country activists from the positions they take on these issues? Strong opposition to capital mobility is observed from trade union and environmental activists in developed countries. Strong support for minimum international environmental standards

from these same groups is evident. There was however only a tepid response from trade union and environmental activists to the collapse of the Kyoto Accord discussions at The Hague.

The opposition of trade union activists to the Seattle Round and their strong support of minimum environmental standards, such as the pressure from U.S. unions for minimum environmental and labor standards under NAFTA, are not a puzzle. The opening up of developing countries to developed country capital can only lower developed country union members' wages and environmental standards. Likewise minimum environmental standards imposed on developing countries raise their members' wages and improve their environment. Imposing higher environmental standards on developed countries would lower wages in developed countries, but improve wages and environmental standards in developing countries.

The positions of the trade union activists on these policies can be inferred from a consideration of the effects of the policies on developed country labor. The costs or benefits of these policies to developing countries do not appear to be a concern to developed country labor activists. Any solidarity of developed country trade unions with developing country workers evidently does not extend to policies that might lower developed country wages or worsen developed country environments.

It is puzzling however why developed country green activists are so strongly opposed to capital mobility and in favor of minimum envi-

ronmental standards. If green activists are concerned with the welfare of workers in developing countries, it seems strange that they would support policies that are so costly to developing countries, lower developed country worker wages and run the risk of locking the poorest countries out of the only development path we know that works- openness to the international marketplace. If green activists are concerned with the environment in developing countries, it seems strange that they support policies that may lock the poorest countries out of the international marketplace and lead to worse environments in the poorest countries in the long term.

One hypothesis about developed country green activists that does fit their observed preferences is that these green activists are concerned with the effect of these policies on developed country wages and environments. Professed concern for developing country workers is the means by which to promote policies that enhance the environment of developed countries- no matter the cost to developing countries.

This hypothesis is further supported by consideration of the constituency of developed country green groups- developed country citizens. Concern in developed countries for the welfare of citizens of developing countries is illustrated by the low level of foreign aid granted by developed countries. It should then be no surprise that representatives of these same citizens oppose policies that lower developed country wages and environmental standards but may benefit people in developed countries.

This hypothesis also explains why economists have so far failed to develop any arguments to influence developed country activists. The environmental standards literature has focussed on the effect of capital mobility on the environmental standards of developing countries. Empirical work has concentrated on the link between environmental control costs and plant and industry location. But this is not the concern which is driving the activism in Seattle- that of capital mobility lowering environmental standards in the developed countries. Unless economists begin to address this fear, economists will never make progress with these activists.

## References

- [1] Bhagwati, J. and T. N. Srinivasan (1996) "Trade and the environment: Does environmental diversity detract from the case for free trade?" in J. Bhagwati and R. E. Hudec, eds., *Fair Trade and Harmonization: Prerequisites for Free Trade?*, MIT Press, pp. 159-223.
- [2] Birdsall, N. and D. Wheeler (1992) "Trade policy and industrial pollution in Latin America: Where are the pollution havens?" in P. Low, ed., *International Trade and the Environment*, World Bank Discussions Papers No. 159, pp. 15-28.
- [3] Dean, J. M. (1992) "Trade and the environment: A survey of the literature" in P. Low, ed., *ibid*, pp. 159-167.
- [4] Jaffe, A. B. et al (1995) "Environmental regulation and the competitiveness of U.S. manufacturing: What does the evidence tell us?", *Journal of Economic Literature*, 33(1):132-163.
- [5] Lucas, R. E. B., D. Wheeler and H. Hettige (1992) "Economic development, environmental regulation and the international migration of toxic industrial pollution: 1960-1988" in P. Low, ed., *ibid*, pp. 67-86.
- [6] Nordhaus, W. D. (1995) "Locational competition and the environment: Should countries harmonize their environmental policies?" in H. Siebert, ed., *Locational competition in the world economy*, Tubingen, pp. 261-287.

- [7] Porter, M. E. (1991) "America's green strategy", *Scientific American*, April 1991, p. 168.
- [8] Sachs, J. D. and A. M. Warner (1995) "Economic reform and the process of global integration", *Brooking Papers on Economic Activity*, 1995:1, pp. 1-118.

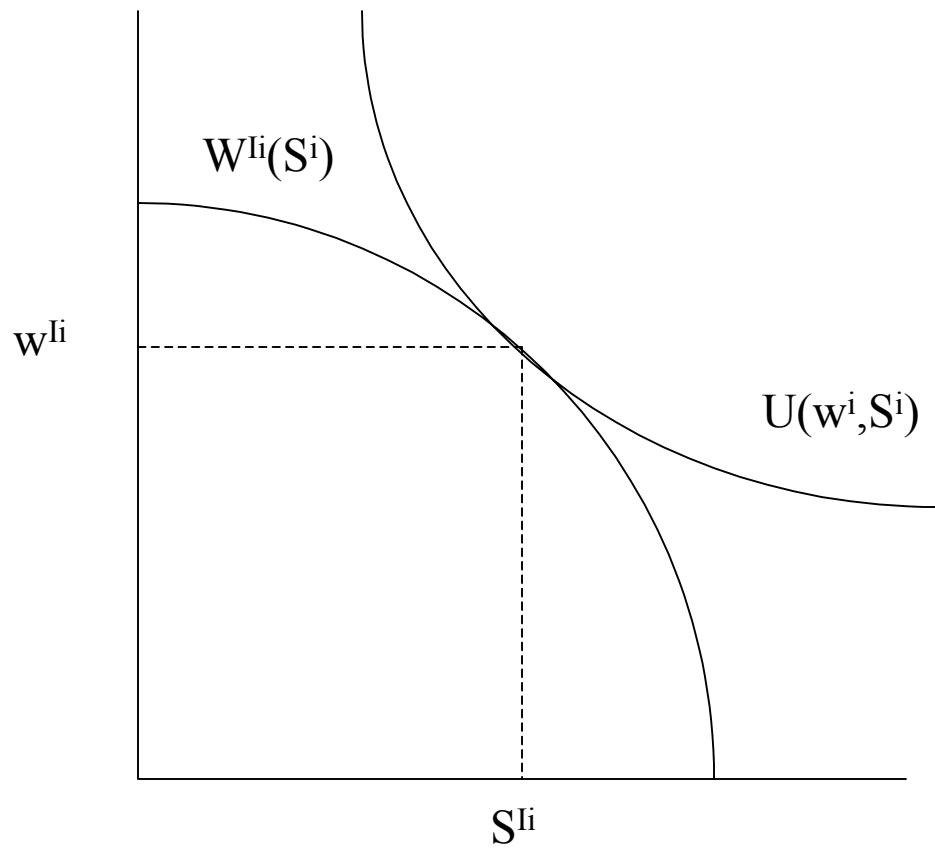


Diagram 1

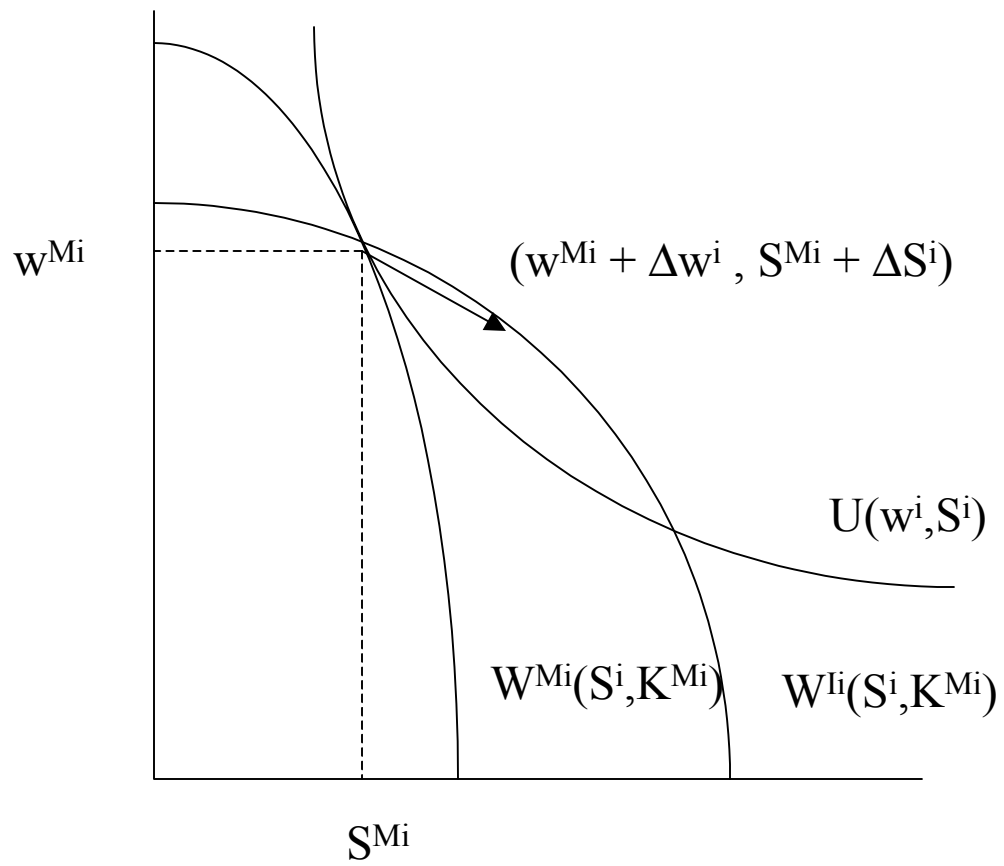


Diagram 2

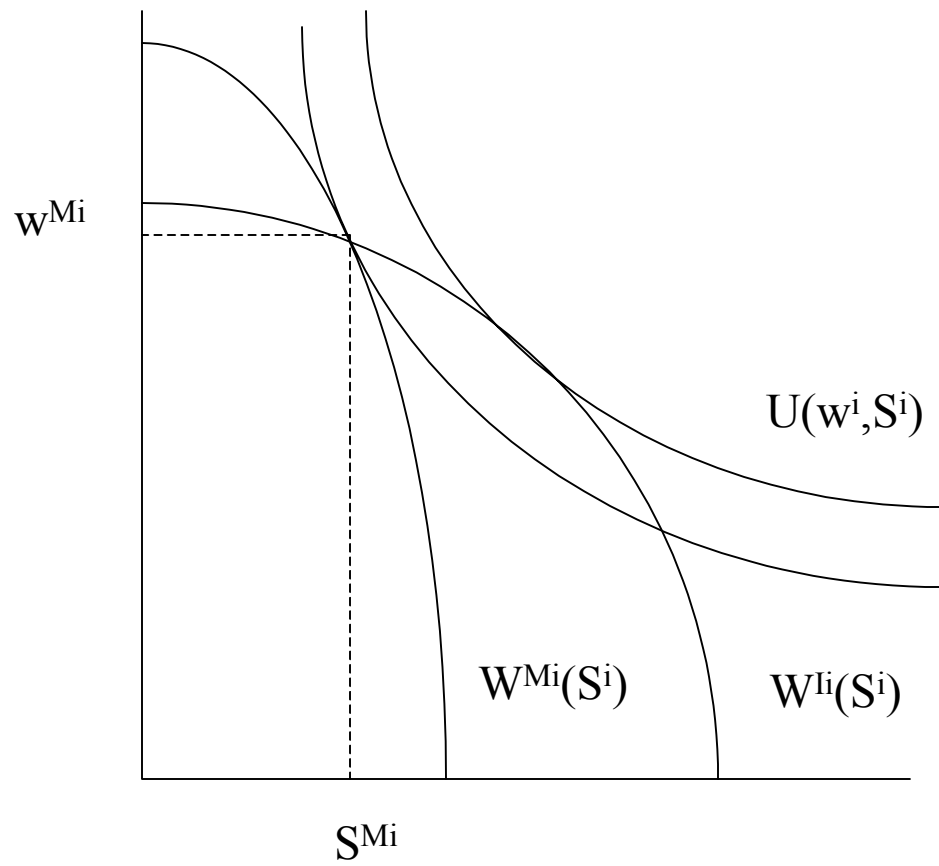
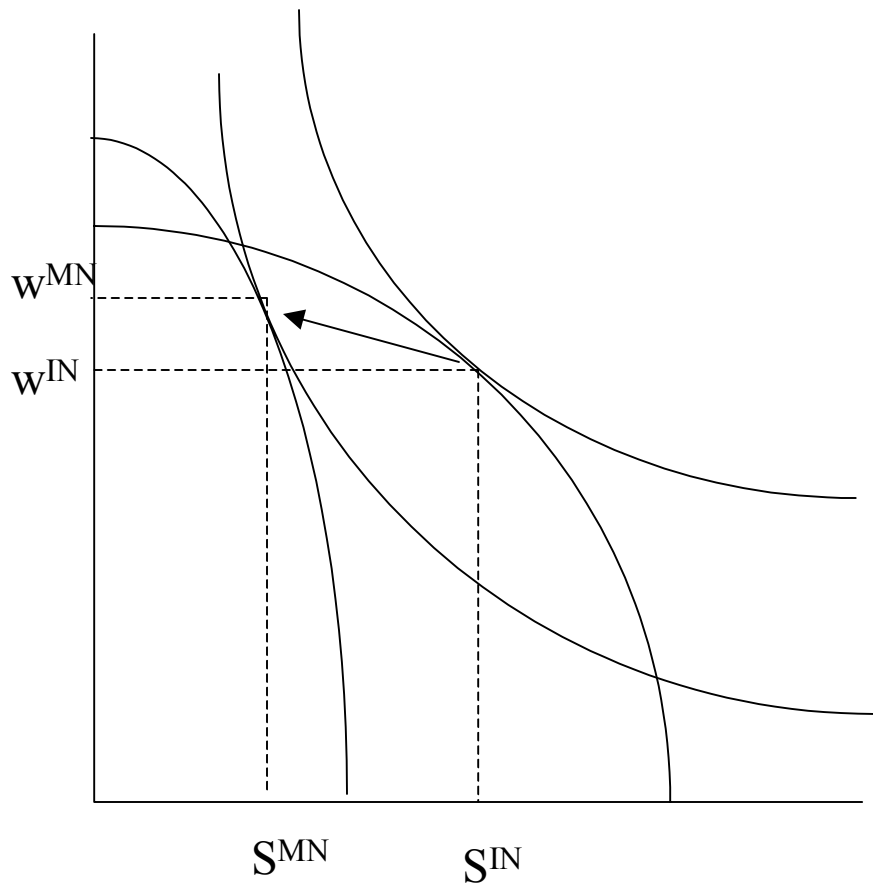
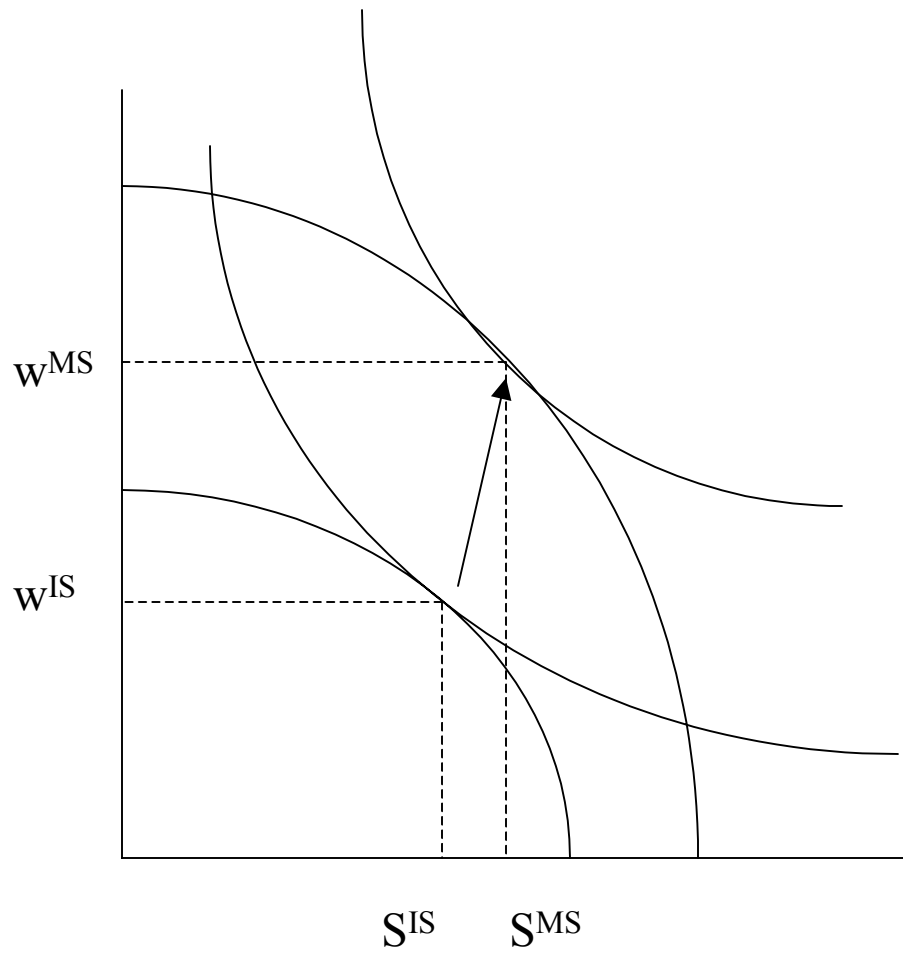


Diagram 3



North



South

Diagram 4

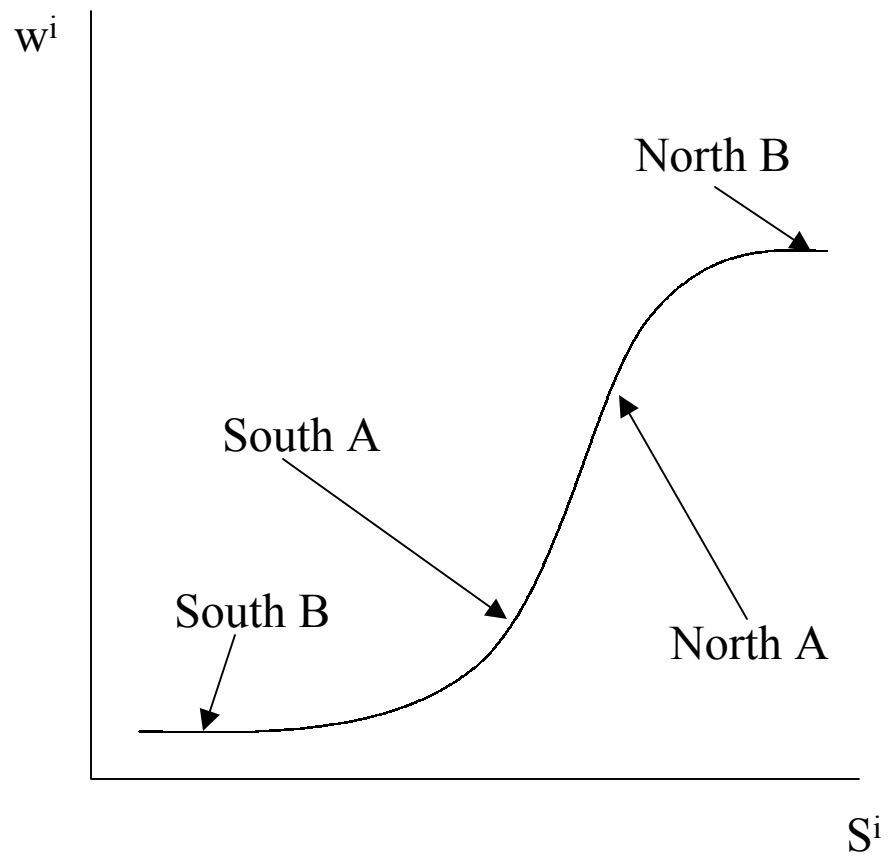
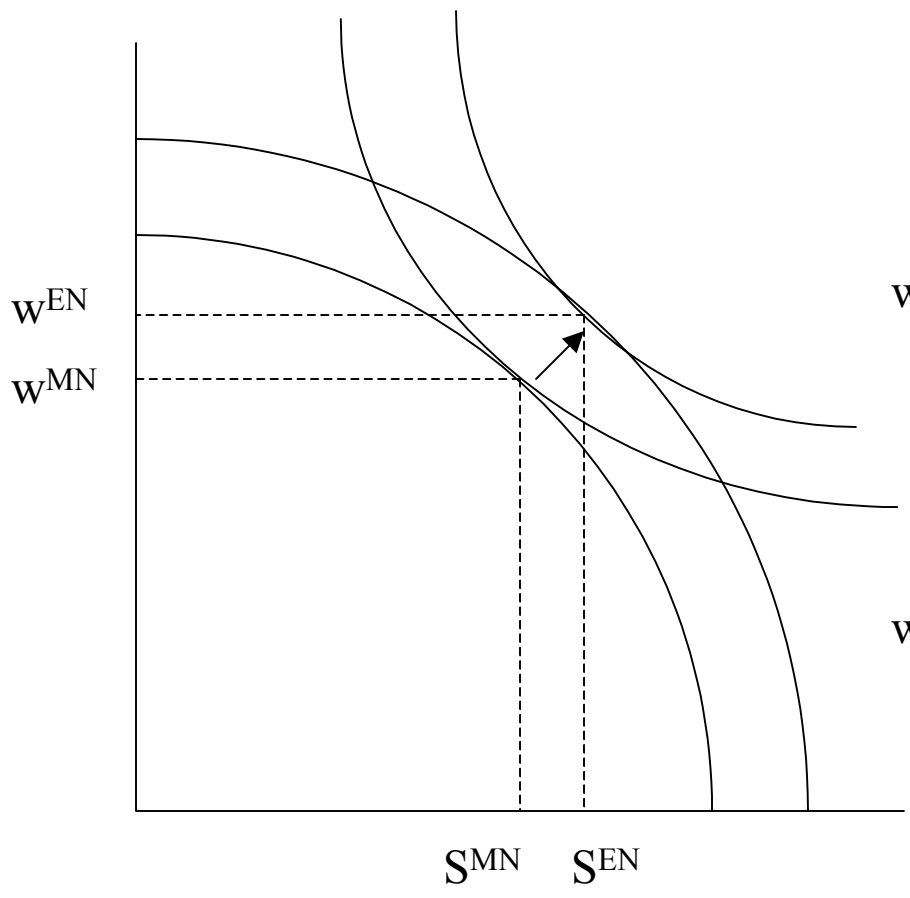
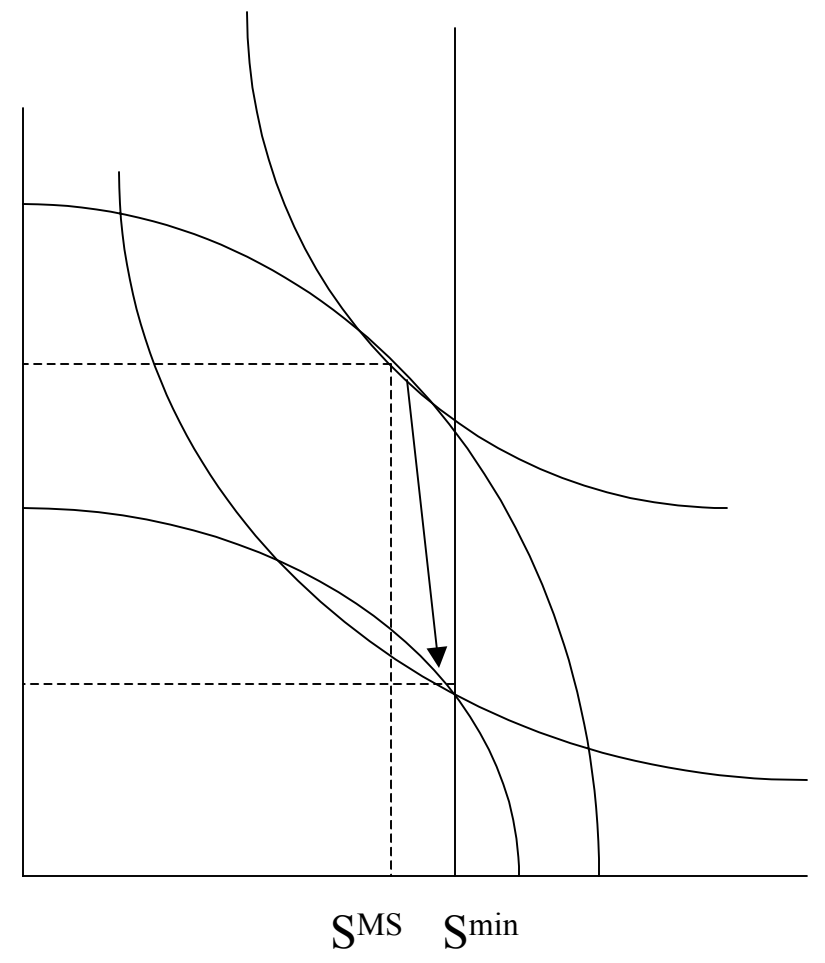


Diagram 5



North



South

Diagram 6