

# On Trade and Poverty-Induced Comparative Advantage\*

Robbert Maseland & Albert de Vaal<sup>†</sup>  
Radboud University Nijmegen

August 2005

## Abstract

This paper deals with the relation between trade and transformation in developing countries. Trade economists typically argue that countries should open up to trade in order to benefit from comparative advantage. Opponents of free trade, by contrast, stress the importance of the level of industrial development of a country before doing so. In their view, countries should first transform into industrial societies to be able to reap the full advantages of trade. Our paper integrates the two views. We develop a two-sector model that links production and schooling decisions under poverty with standard neo-classical trade analyses. The decision to either work in agriculture or to acquire skills needed for manufacturing is modelled to depend on households having reached a certain minimum, subsistence level of income. Apart from the influence of natural comparative advantages, also the income level of a country then becomes important in establishing actual comparative advantages. This implies that over time reductions in poverty might shift trade patterns and that the verdict on the desirability of trade depends highly on the timing of trade liberalization and the evaluative perspective taken. Even though trade

---

\*We would like to thank participants of the DEGIT X conference on June 3-4, 2005, in Mexico City for their useful comments and suggestions.

<sup>†</sup>Corresponding author. Please address all correspondence to: A. de Vaal, Nijmegen School of Management, Department of Economics, Radboud University Nijmegen, P.O. Box 9108, 6500 HK Nijmegen, the Netherlands or by email to a.devaal@fm.ru.nl.

is always allocation efficient, the timing of trade liberalisation is important for the speed by which countries industrialise. The verdict on whether or not to open up to trade is therefore more complex than what either standard trade theory or the opponents of free trade want us to believe.

## 1 Introduction

Ever since Adam Smith wrote his groundbreaking *The Wealth of Nations*, economists have debated the desirability of international trade. In this discussion, opponents have continuously brought in numerous specific cases in which free trade might not be desirable. Many of these convincing cases notwithstanding, this focus on exceptions has in a way only served to confirm the general rule that free trade is beneficial under 'normal' circumstances. With "the case for free trade (thus being) settled" in principle (Bhagwati et al., 1998), the economic debate has shifted towards specification of what circumstances could still count as normal.

Outside the habitat of trade economists, however, the case for free trade is far from being settled. On the contrary, the public debate about the desirability of global trade liberalisation has grown increasingly vocal in recent years. Public opposition against the WTO-agenda of trade liberalisation could be observed during the many protests staged by anti-globalists (Seattle, Geneva, Cancun). Theoretically, these dissent voices have been propped up by economic historians and development economists claiming that late-comer development requires industrialization under government protection and support, before subjecting economic sectors to the discipline of the market (e.g. Amsden 1989; Wade 1990). In addition, during the latest round of trade talks in Cancun, poor countries united to block what according to them were anti-poor trade talks, dealing a major blow to the WTO. Although one could argue that the torpedoing of trade talks in Cancun by developing nations was inspired more by a commitment to equal free trade rather than an opposition to it, in general, it fits within a forceful critique that the current wisdom about trade liberalisation does not adequately take into account the needs and problems of the poor. This critique stands in dire contrast with the (admittedly still fragile) consensus within economics that free trade is the best way to alleviate poverty.

The question, therefore, is how these different positions could come about.

One explanation might be that trade economists have just failed to communicate their message effectively to the public. Alternatively, one could recognise the possibility that the critics have a point in the argument that the economist's analysis of trade does not satisfactorily take into account the circumstances of the poor. In both cases, whether it is merely to bring across the message more effectively or to provide an analysis more relevant to developing nations, it is necessary for economics to specifically address the impact of poverty upon trade patterns. This is what we aim to do in this paper. We set-up a model in which poverty is explicitly related to comparative advantage. In particular, we develop a two-sector model that links production and schooling decisions under poverty with standard neo-classical trade analysis. The decision to either work in agriculture or to acquire skills needed for manufacturing is modelled to depend on households having reached a certain minimum, subsistence level of income. Apart from the influence of natural comparative advantages, also the income level of a country then becomes important in establishing actual comparative advantages. This implies that over time, reductions in poverty might shift trade patterns and that the verdict on the desirability of trade may become dependent on the timing of trade liberalisation and the perspective taken. We suggest that whereas trade is always beneficial if one focuses on short-term allocative efficiency, temporary protection might be preferred because of dynamic effects on industrialization and development of comparative advantage.

The structure of this paper is as follows. Section 2 analyses the impact of poverty upon labour supply and production decisions on a micro-level. Section 3 subsequently constructs a formal model which takes the insights from the micro-level into account. Section 4 discusses the implications of this model for comparative advantage. Section 5 concludes and gives our agenda for further research.

## **2 The Impact of Poverty**

Although standard, neo-classical, models of international trade generally show positive effects of trade liberalisation, they do not address one main point of critique that opponents of free trade bring in, namely that free trade might be less than optimal because of the disadvantaged starting position of poor countries. This point demands some clarification. Trade theory, and specifically comparative advantage models, in fact do address the con-

sequences of differences between countries engaging in international trade. Indeed, such differences are the prime source of trade and welfare gains in these models. However, differences between countries considered only apply to endowments or technology, and are treated as 'givens' rather than as consequences of the level of development at a given time. The underlying assumption is that economic mechanisms apply universally, regardless of development level or context. In other words, comparative advantage models are not based upon micro-level analysis of specific consequences of making economic decision under conditions of poverty.

In the sub-discipline of development economics, on the other hand, arguments have been brought to the fore why economies might operate differently under poverty than under relative affluence. The literature about efficiency wages provides a good example (e.g. Dasgupta 1997). The implications of such work for trade theory are serious. If decision making under poverty differs from decision making under affluence, economic actions will be dependent upon outcomes of previous actions, and thus to some extent endogenous<sup>1</sup>. Hence, the behavioural assumptions on which standard trade models are founded in that case are too static and too simplistic to be instrumental in analysing the welfare effects of trade.

In order to come up with an alternative, a micro-analysis of the circumstances under which the poor produce is in order. A main characteristic of situations of poverty is that individuals are directly confronted not with one, as in usual neoclassical theory, but with two budget constraints. On the one hand, it is impossible to consume more than one earns. On the other hand, it is impossible to consume less than a certain minimum needed for survival. This simple fact has important consequences for the labour supply decision of the individual, which are depicted in Figure 1.

*[insert Figure 1 about here]*

The figure depicts the decision of an individual confronted with the choice between work, resulting in income in the present, and training, resulting in

---

<sup>1</sup>See for example efficiency wage theory (Dasgupta, 1997), which shows that self-reinforcing income differences may occur between initially identical individuals. A similar idea is endorsed by Sen who regards development as an increase in freedoms or entitlements (Sen, 1999). The corollary of this idea is that lack of development means a lack of freedoms and capabilities, which will make decision making qualitatively different.

higher wages in the future. The U-curves represent iso-utility curves depicting all possible combinations of training and current income that yield the labourer the same level of utility. The slope of the curve in each point gives the marginal rate of substitution of current income and training in utility: the steeper the slope, the more the labourer values an additional unit of training. She weighs this against the opportunity cost of training, which is here the wage to be earned on the labour market. In the figure, this is represented by the slope of the budget lines  $w_z L_{max}$ , for  $z = A, B, C$ . These budget lines give, for each level of training that is physically possible ( $L \leq L_{max}$ ), the income level attainable at the prevailing wage rate. Normally, the optimising labourer will choose a 'consumption' basket of training and income such that the marginal costs of training equal the marginal benefits, that is: where the budget line is tangent to the highest indifference curve possible. Point B and C indicate such points. Below the wage associated with point B, however, optimisation means to work until income reaches the level of consumption minimally required to sustain the household (the horizontal line  $E_{min}$ ), while spending the rest of the time on training. The low wage prevents the labourer from choosing the desired combination of training and work, resulting in a lower than desired rate of training. For instance, for wage  $w_A$ , the optimum choice would be  $A'$ , yet the labourer must choose A to stay at a subsistence level of income. In the presence of poverty, therefore, the training expansion path is depicted by the bold solid line in the figure. Up until point B, any rise in the wage rate will increase the possibilities for training, and, thereby the level of it. It is the room for training the labourer has that determines the training it takes, not his or her preferences. At wages above  $w_B$ , however, she is not longer constrained by the need to survive and the level of training is determined by the normal marginal cost-benefit analysis. Under such conditions, the optimal level of training will be lower than upon subsistence, though at wage levels high enough training may increase again. This leads to the 'bend' in the training expansion path.<sup>2</sup>

The relevance of this analysis is that for an individual constrained by poverty, it will be rational to limit labour supply once earnings go up, since

---

<sup>2</sup>That is, we implicitly assume that the wages just above subsistence are not high enough to lead to a situation in which higher wages lead to a lowering of the number of hours worked. The latter phenomenon is a well-known possibility in the literature on labour markets, where it leads to the backward bending part of the individual labour supply curve. It seems a reasonable assumption in the light of the fact that backward bending supply curves are usually considered to occur in situations of relative affluence.

more room is created to invest in training. This implies that, ironically enough, the individuals earning the highest wages when supplying untrained labour will be the ones deciding to work least. In other words, if training is assumed to lead to same higher incomes for every individual, those with the least incentive to train will devote the most time to training. This only changes when wages rise to above subsistence level, after which the trade-off decisions common in neoclassical analysis apply and a negative relation between wages and time devoted to training arises. On a macro-level, this has important implications for the development of societies.

If we take the development of a society as a process of industrialisation coupled with increasing labour productivity, the level of training becomes central to the pace of economic growth. Training is required for untrained labour to engage in manufacturing and to become more productive. Therefore, a society in which more people devote more of their time to training instead of earning direct income will develop faster. If the amount of time devoted to training is positively dependent on current income, it follows that relatively affluent societies will develop a vaster stock of trained labour, fostering industrialisation. If such a country subsequently engages in trade with a poorer country in which less time has been assigned to training, it will have developed a comparative advantage in manufacturing goods and export these goods accordingly.

The interesting aspect of this comparative advantage in manufactured goods is that it arises precisely because the richer country was more productive in the goods for which untrained labour was required. Although this may seem a rather odd result, this pattern is actually quite common in history; industrial and commercial centres typically emerged at locations where the soil was fertile enough to boost large populations not directly engaged in food production (Cipolla 1980, 75-6).<sup>3</sup> Thus, because development and industrialisation are constrained by low productivity in the agricultural sector, more fertile regions developed comparative advantages in manufacturing production while less fertile regions continued to produce agricultural goods. Upon trade, the resulting specialisation pattern is based on a reversal of natural comparative advantages, according to which the most fertile region would specialise in agricultural production. In this sense, it might be less

---

<sup>3</sup>Or where particularly favorable water routes made it possible to import food from other regions, such as the cases of Venice, the Black Sea and Holland (Cipolla 1980, 75-6). In other words, trade allows for further development.

than optimal from the point of view of global efficiency.

### 3 A Formal Model of Poverty and Training

To verify the consequences of poverty-based training decisions at the household level on aggregate variables in a more formal manner, we model the economy of a potentially poor country as producing two goods by means of the production factors land and labour. The quantity and quality of land is fixed throughout the analysis. Labour, in contrast, is not homogenous but consists of two qualities: trained and untrained labour. Initially, all labour is of the untrained quality but this can change over time as individuals might become trained. Untrained labour is an input to the production of a homogenous, agricultural product  $F$  (from Food), which also takes land as an input. Trained labour is the sole production factor for the production of a variety of manufactured goods  $M$ . Food is characterised by decreasing returns to scale (as the quantity of land is fixed over time, whereas the quantity of untrained labour is not). For the production of manufactured goods we assume increasing returns to scale at the firm level.

The decision to become trained labour is based upon the wage differential between trained and untrained labour. Such a wage differential emerges as trained and untrained labour are employed in different sectors of the economy. By choice of units, we set the total amount of labour equal to one. Denoting untrained labour with  $L$  and trained labour with  $H$ , this implies that at any point of time:

$$H + L = 1. \tag{1}$$

The training decision is given by the following "transformation equation":

$$T = \frac{r - w}{\rho(C + 1)w} \tag{2}$$

where  $T$  denotes the amount of training an individual engages in as a function of the wage rate of trained labour,  $r$ , and that of untrained labour,  $w$ .<sup>4</sup>  $C > 1$  is a constant which denotes the costs of transformation per transformed unit of labour (in terms of the numeraire good), while  $0 < \rho \leq 1$  denotes the individual's time preference. Essentially, (2) is the outcome of a cost-benefit

---

<sup>4</sup>The expression features nominal wage rates, where real wage rates would be due. However, in (2), the price index drops out.

calculation made by the untrained labourer, where she weighs the net present value of a persistent difference in wages  $(r - w)/\rho$  against the costs of current wage income foregone due to (also) being engaged in training  $wT$  (which therefore cannot be used to work) and the monetary costs of transformation  $CT$ .<sup>5</sup> Note therefore that the individual is assumed to be myopic in the sense that she perceives the current wage differential to persist forever.<sup>6</sup> This is less restrictive than it seems, however, as it can be shown that the result is also consistent with static forward-looking expectations (see Baldwin et al., 2003).<sup>7</sup> The transformation equation is therefore also less ad hoc than it seems. Moreover, the equation seems intuitively plausible as untrained labour bases its decision to become trained or not on the profitability of such a move.

The transformation equation is relevant when individuals have a choice to optimally determine their training-work decision. That is, it applies when an individual's wage income, after deduction of the costs for training as determined by (2) at least equals a minimum subsistence level of expenditures  $E_{\min}$ . In terms of Figure 1 of the previous section: when the curved part of the training expansion path applies. Agents need to have a certain minimum level of income available for consumption, below which survival becomes impossible. Therefore, if the remaining income falls short of  $E_{\min}$ , it is the room for training that determines how much an individual trains (the flat part of the training expansion curve in Figure 1). Then, the training decision is governed by,

---

<sup>5</sup> $T$  is therefore actually the share of the individual's total working time during a certain period. We normalise the total working time of an individual per period to one, implying that  $T < 1$  always.

<sup>6</sup>The specification thus takes workers as price-takers, conform to conventional neo-classical modelling. It should be noted that, by making this assumption, the specification actually reflects the socially optimal training decision (for a closed economy). An untrained worker does take into account neither the fact that, as a consequence of the training decision, relative wages  $r$  and  $w$  are altered for him- or herself, or the fact that these wages change for fellow workers. The myopia assumption can be seen as a way to internalize this latter effect. A non-myopic (i.e non price-taking) individual worker would base its decision on the actual own discounted future wages, not on present wages. However, for society as a whole, the worker's outflow from the agricultural sector means that total agricultural production falls with  $w$ , and the inflow into the industrial sector means that total industrial production rises with  $r$ . Socially speaking, then, the decision we attribute to workers is exactly the one that should be made.

<sup>7</sup>In particular Section 2.B.4 in Baldwin et al. (2003).

$$T^S = (w - E_{\min})/C \quad (3)$$

where the superscript 'S' indicates that this is the rule that applies when individuals are at or below subsistence. Note that as the decision is now related to current income and expenditures, the time preference  $\rho$  is excluded from (3). Moreover, the division by  $w$  has disappeared, as it is not longer relevant. It is the room for training which determines how much is trained, not a cost-benefit analysis based on, inter alia, income foregone.

Which of the two decision rules applies is determined by the model, of course, as it will depend on the wage income untrained labour earns. Since food is a homogenous product, we choose it as numeraire and set its price to one throughout the analysis ( $p_F = 1$ ). This implies that the wage income of untrained individuals is equal to the marginal productivity of labour in the food sector. As food is produced by land and untrained labour, while the pile of arable land is given and fixed, the production of food entails decreasing returns. Specifically, agricultural production is given by:

$$F = AL^\beta \quad (4)$$

with  $0 < \beta < 1$  to have decreasing returns to scale and where  $A$  is a positive constant to denote the fertility of land. Consequently, the wage rate is given by:

$$w = \beta AL^{\beta-1}. \quad (5)$$

The wage rate for trained labour is determined by specifying equilibrium for the economy. We assume that consumption is divided over the agricultural good and the composite of manufactured goods in a Cobb-Douglas way, while the demand for varieties entails a standard Dixit-Stiglitz love of variety.<sup>8</sup> Denoting the total number of varieties available by  $N$ , we get:

$$U = C_M^\mu C_F^{1-\mu} \quad (6)$$

$$C_M \equiv \left( \int_{i=0}^N c_i^{1-1/\sigma} di \right)^{1/(1-1/\sigma)} \quad (7)$$

---

<sup>8</sup>In modelling the manufacturing sector and the demand side of the economy, we follow the standard practice in international trade modelling and modelling in the new economic geography literature. See e.g. Brakman et al. (2001) and Baldwin et al. (2003).

where  $0 < \mu < 1$  denotes the expenditure share on manufactured goods and where  $\sigma > 1$  is the constant elasticity of substitution between varieties as well as the price elasticity of demand.  $C_M$  and  $C_F$  denote, respectively, the consumption of the manufacturing composite and food. Utility maximisation then implies that a share  $\mu$  of total income is spent on manufactured goods and a share  $1 - \mu$  on food. Hence,

$$C_F = (1 - \mu)I \text{ and } C_M = \mu I \quad (8)$$

where  $I$  denotes total income of the economy.<sup>9</sup>

On the supply side, we assume that the manufacturing sector is monopolistically competitive and faces increasing returns to scale, using only trained labour. Specifically, the production of a variety of the manufactured good requires  $f$  units of trained labour to organise production —this is the fixed cost— and  $a_m$  units of trained labour for each unit of output produced —the marginal cost of production. Hence, the labour requirements of any manufacturing variety is:  $H_x = f + a_mx$ .<sup>10</sup> The costs of producing  $x$  units of a variety thus equals  $r(f + a_mx)$ . Profit maximisation by manufacturing producers then implies that the price each producer charges is a fixed mark-up over marginal cost:

$$p = \frac{a_mr}{1 - 1/\sigma} \quad (9)$$

Assuming free entry and exit in the manufacturing sector implies that profits will be driven to zero, so that, in equilibrium  $x = f(\sigma - 1)/a_m$  and  $H_x = \sigma f$ . Since trained labour is only used in manufacturing, this implies that the total number of varieties in the economy is implicit in the full employment condition for trained labour:

$$H = NH_x = N\sigma f \quad (10)$$

---

<sup>9</sup>As we assume that individuals have to pay for their training, the income they can spend on goods is actually  $I - C\dot{H}$ . For the relative expenditure on goods this does not matter. We also assume that tuition fees are paid to the government, which has as only task to provide for tuition. To make government neutral in the analysis we also assume that it provides tuition at a cost level that exactly matches the amount of tuition fees collected at any point in time.

<sup>10</sup>We ignore subscripts to distinguish between varieties as each variety enter consumer demand symmetrically. Hence, the equilibrium output, price and labour requirements will be the same across varieties.

In autarky, the ratio of total earnings in manufacturing and agricultural must equal the ratio of expenditure shares. Hence, equilibrium requires that:

$$\frac{r(f + a_mx)N}{AL^\beta} = \frac{\mu}{1 - \mu} \quad (11)$$

where we have used (8) to determine  $C_M/C_F$ . Substituting the equilibrium firm size in this equation, rearranging, and using  $H = 1 - L$  gives the wage rate for trained labour as a function of  $H$ :

$$r = \frac{\mu}{(1 - \mu)} \frac{A(1 - H)^\beta}{H} \quad (12)$$

We are now in the position to determine the amount of training when the income of untrained labour is above subsistence. Substituting (5) and (12) in (2) yields,

$$T = \left[ \frac{\mu}{(1 - \mu)} \frac{(1 - H)}{\beta H} - 1 \right] / \rho(C + 1) \quad (13)$$

In other words, above subsistence training is a declining function of the amount of labour that has already been trained ( $\partial T / \partial H < 0$ ). A rise in the share of trained labour<sup>11</sup> will cause a fall in the relative reward of trained labour, both because the wages of untrained labour will rise due to decreasing returns to scale in agriculture if untrained labour is removed, and because a higher share of trained labour means a higher number of manufacturing varieties, which increases competition and therefore entails a lower wage rate for trained labour. If the relative reward for trained labour falls, so does the desirability of undergoing training, and therefore transformation slows down ( $\partial^2 T / \partial H^2 > 0$ ). The amount of  $H$  beyond which training is zero is given by  $\bar{H} \equiv \frac{\mu}{[(1 - \mu)\beta + \mu]}$ . For any  $\bar{H} < H < 1$  the wage premium of getting trained does not compensate for the loss of the wage income foregone. We note that  $\bar{H}$  is independent of  $A$ . The reason is that a higher fertility of land constitutes an exogenous boost of total incomes and hence expenditures in the economy, which are distributed over the economy following the relative expenditure shares of various goods. Although agricultural incomes thus are higher because of land of a higher quality, manufacturing wages are also higher, so that the difference between the two is the same.

Below subsistence, it is the room for training that determines how much an individual trains, as given by (3). Applying the equilibrium wage rate for

---

<sup>11</sup>By (1),  $H$  is also the share of trained labour in society.

untrained labour, the amount of training is:

$$T^S = [\beta A(1 - H)^{\beta-1} - E_{\min}] / C \quad (14)$$

Below subsistence, therefore, the amount an individual trains increases with the share of trained labour in society, at an increasing rate ( $\partial T^S / \partial H > 0$ ,  $\partial^2 T^S / \partial H^2 > 0$ ). As transformation is based on the possibilities for training, training increases when the income of untrained labour rises, which is the case as more labour becomes trained. When the wage rate is equal to the subsistence level of expenditures, the room for training is zero and individuals devote all their time to earn wage income. This is the case for any value of  $H \leq \underline{H} \equiv 1 - (E_{\min} / \beta A)^{1/(\beta-1)}$ . To have a positive level of training in the initial situation, when all labour is untrained and  $H = 0$ , therefore requires  $\underline{H} < 0$  and hence  $(E_{\min} / \beta A)^{1/(\beta-1)} > 1$ . For the remainder of the analysis we assume that this is the case, so that also at  $H = 0$  we have nonnegative training levels.<sup>12</sup>

Figure 2 shows for either function the evolution of  $T$  as a function of  $H$  (the dashed curves). The exact position of both curves of course depends on the particular parameter values. For instance, the below subsistence curve cuts the vertical axis at  $[\beta A - E_{\min}] / C$ , which is nonnegative by assumption. The above subsistence curve always cuts the horizontal axis for  $H < 1$ , as drawn.<sup>13</sup> The true function of  $T$  of course depends on which decision rule applies. This is most easily determined by comparing the outcomes of the training decisions under either regime. If  $T_t^S \geq (<) T_t$ , then untrained labour is apparently above (below) subsistence as the room for training is equal or higher (lower) than the desired levels of training. If we denote the value of  $H$  for which this is the case by  $\tilde{H}$ , we note that its value is implicit in:

$$\frac{\mu(1 - \tilde{H})}{\beta(1 - \mu)} = \tilde{H} \left[ \frac{\rho(C + 1)}{C} \left( \beta A(1 - \tilde{H})^{\beta-1} - E_{\min} \right) + 1 \right] \quad (15)$$

It can be shown that  $\tilde{H}$  is unique and that it always lies between zero and one.<sup>14</sup> By applying the implicit function theorem it is easy to see that

---

<sup>12</sup>Though technically feasible, it makes no sense to allow for  $w = E_{\min}$  at positive levels of  $H$  as then positive  $H$  could never have been reached.

<sup>13</sup>The above subsistence curve also cuts the horizontal axis at  $H = 1$ , which has not been drawn as it is due to  $w$  going to infinity when  $H \rightarrow 1$ .

<sup>14</sup>The right-hand-side of (15) is linear, negative function of  $H$  and positive at  $H = 0$ . The left-hand-side of (15) is a positive hyperbolic function of  $H$  with an asymptote at  $H = 1$ . Hence, both functions intersect at  $\tilde{H} < 1$ .

$d\tilde{H}/dA < 0$  and  $d\tilde{H}/dE_{\min} > 0$ . If land is more fertile, there is more room for training and the economy reaches its above subsistence state faster. Likewise, as the room for training reduces when the subsistence level of expenditures is higher, it takes longer for the economy to get above subsistence.

*[insert Figure 2 about here]*

The accumulation of  $H$  is based on an aggregation of individual training levels. Supposing that all individuals behave according to the decision rules (2) and (3), and assuming that the amount an untrained labourer trains translates into trained labour on a one-to-one basis, the change in  $H$  at time  $t$  is determined by:<sup>15</sup>

$$\dot{H}_t = \begin{cases} L_t \cdot T_t & = \frac{(1-H_t)}{\rho(C+1)} \left[ \frac{\mu}{(1-\mu)} \frac{(1-H_t)}{\beta H_t} - 1 \right] & \text{(if above subsistence)} \\ L_t \cdot T_t^S & = [\beta A(1-H_t)^\beta - (1-H_t)E_{\min}] / C & \text{(if below subsistence)} \end{cases} \quad (16)$$

where a dot denotes a time derivative. The subscript  $t$  is also added to the endogenous variables to signify that training decisions depend on the amount of trained labour at a particular moment in time. The particular curvatures of the both curves are as follows (omitting time subscripts):

*Below subsistence*

$$\begin{aligned} d\dot{H}/dH & - (\beta w - E_{\min}) / C \geq 0 \\ d^2\dot{H}/dH^2 & \beta(\beta - 1)w / (1 - H)C < 0 \end{aligned}$$

*Above subsistence*

$$\begin{aligned} d\dot{H}/dH & - \left( T + \frac{T}{H} + \frac{1}{\rho(C+1)} \frac{1}{H} \right) < 0 \text{ if } T > 0 \\ d^2\dot{H}/dH^2 & \left[ T + \frac{1}{\rho(C+1)} \left( 1 + \frac{\mu}{\beta(1-\mu)} \left( 1 + \frac{1}{H} \right) \right) \right] / H^2 > 0 \text{ if } T > 0 \end{aligned}$$

---

<sup>15</sup>Strictly speaking, being either a trained or untrained labourer in this analysis is considered to be a dichotomous affair, as one works either in the untrained agricultural sector or in the trained manufacturing sector. For aggregation, this would imply that—given an initially homogenous labour force—all labourers would devote the same time to training, simultaneously becoming trained enough to enter the manufacturing sector. Since this is not a very plausible way of aggregating individual decisions, we treat the amount of training as translating into trained labour on a one-to-one basis. One way to view this is as if training efforts can be pooled within the agricultural sector, so that all individual training inputs combined result in a certain level of transformation.

Above subsistence, aggregate training decreases over time, as long as the level of training is positive, that is when  $H < \bar{H}$ . Below subsistence aggregate  $\dot{H}$  increases over time, provided that  $\beta w < E_{\min}$ . Hence, whereas the training  $T^S$  positively depends on  $H$ , see earlier, the aggregate level of trained labour is bound to reduce when  $H$  increases. This is a logical outcome of aggregation. While the room for training increases, the number of individuals it applies to reduces.

In Figure 3 we have drawn the (true) time path of  $\dot{H}$  as a function of time for different values of  $\beta$  and  $A$ .<sup>16</sup> We see that for low values of  $\beta$  aggregate training first increases, to then decrease and ultimately become zero. For higher values of  $\beta$ , the decline in aggregate training sets in from the start. This pattern is independent of the value of  $A$ . A higher fertility of land simply implies that the curves move to the left and up, indicating that initial training levels are higher and that subsistence levels of income are reached more rapidly.

*[insert Figure 3 about here]*

Whatever the case, we see that ultimately aggregate training goes to zero. We will refer to this state as the economy's steady state. Since untrained labour always gets above subsistence at some level of  $H < 1$  —if  $H \rightarrow 1$ ,  $w$  goes to infinity— it follows that the steady state level of  $H$  is determined by setting  $(1 - H_t) \cdot T_t = 0$ . By (16) we calculate that the economy reaches a steady state at:<sup>17</sup>

$$H = \frac{\mu}{(1 - \mu)\beta + \mu} \quad (17)$$

which indeed coincides with the threshold level of  $H$  beyond which individual training levels become zero ( $\bar{H}$ ). We also note that the steady state level of  $H$  is independent of  $A$ , the fertility of land.

---

<sup>16</sup>Since  $H$  accumulates over time and we do not allow for distraining — once untrained labour is trained there is no way back — a larger  $H$  can also be seen as a point further in time.

<sup>17</sup>We note that a second steady state equilibrium is possible, which occurs when even at  $H = 0$  wages are below subsistence, so that also  $w - E_{\min} = 0$  would imply a positive steady state level of  $H$ . It is however immediately clear that this is a theoretical equilibrium only, as supposedly any economy has started at some point in time without any amount of trained labour (hence positive  $H$  could never have been reached). The limiting case when  $w - E_{\min} = 0$  at  $H = 0$  is possible though, but highly unstable. Any rise in  $H$  leads to an upward spiral until income is above subsistence level and, subsequently, the stable steady state equilibrium is reached.

## 4 Poverty-induced Comparative Advantage

To model poverty-induced comparative advantage, we apply the model of the previous section to a world where two regions, North and South, are exactly similar, except for the fertility of land. To distinguish between regions, we use an asterisk to denote southern variables and parameters. We assume  $A > A^*$  throughout the analysis, that is North has the more fertile land at its disposal.

In our model, comparative advantage is given by the relative price of manufactures over food. As we have taken food as numeraire, the relative price of manufactured goods is therefore given by (9). Using (12) to substitute for  $r$  in this expression, we get:

$$p = \frac{a_m A \mu}{(1 - \mu)} \frac{\sigma}{\sigma - 1} \frac{(1 - H)^\beta}{H} \quad (18)$$

as the relative price of manufactures in North. Logically, the relative price of manufactures increases when the share of manufacturing in total expenditures increases ( $\mu$ ), when the marginal labour costs of manufacturing production goes up ( $a_m$ ) and when the monopoly power of manufacturing producers increases (as accomplished by lower price elasticity of demand  $\sigma$ ). The relative price of manufactures also increases when the fertility of land  $A$  goes up. Likewise, it follows from (18) that the relative price of manufactures goes down when  $H$  increases ( $(dp/dH < 0)$ ).

For the South an isomorphic equation applies for  $p^*$ . The comparative advantage of both countries is given by  $p/p^*$ . If  $p/p^* > (<) 1$ , we say that North has a comparative advantage in food (manufactures). Applying this to a setting where the two countries are completely identical, except for the fertility of land, we get:

$$\frac{p}{p^*} = \frac{A}{A^*} \frac{H^*}{H} \left( \frac{1 - H}{1 - H^*} \right)^\beta \quad (19)$$

where we have implemented  $\mu = \mu^*$ ,  $\sigma = \sigma^*$  and  $a_m = a_m^*$ . Whenever both countries have an equal stock of trained labour, so that  $p/p^* = A/A^* > 1$ , it follows that South has a comparative advantage in manufacturing and North has a comparative advantage in food. This is in accordance with the natural advantage the North has because of the higher fertility of its land. However, with unequal paths of trained labour accumulation, comparative advantage

might shift. More specifically, at the moment that  $AL^\beta/H < A^*L^{*\beta}/H^*$ , the South has a comparative advantage in food instead of manufacturing. In our framework, therefore, average food production (per unit of trained labour) is an indicator of the (revealed) comparative advantage of nations.

The reason that revealed comparative advantage need not coincide with a country's natural comparative advantage is the existence of poverty. To see this, we verify the conditions under which comparative advantage shifts when countries start at equal, initial amounts of trained labour. When  $H = H^*$  and countries are both above subsistence levels of income, there are no consequences for the relative accumulation of trained labour in both countries, as the training decision above subsistences is independent of  $A$ , see (13). Hence, the accumulation of  $H$  and  $H^*$  follows the same path in both countries, leaving comparative advantage unchanged. If, however, both countries are below subsistence, things change dramatically. When the initial amount of trained labour is equal, say zero, the room for training is higher in the North due to higher northern wages in agriculture (as North has more fertile land). Hence, the accumulation of trained labour is higher in the North than in the South and the relative price of manufactures declines. In fact, it can be shown that comparative advantage always shifts in the first period that training occurs (so in period one).<sup>18</sup>

We illustrate the development of comparative advantage over time in Figure 4. The figure shows that when it is initially the room for training that determines the level of training in society, comparative advantage shifts rightaway, but that it eventually moves back again to its natural order. The reasoning is as before. In the initial situation, where both countries have zero trained labour, the room for training is higher in the North and  $H$  accumulates faster than  $H^*$ . This shifts the initial comparative advantage countries have. As North also reaches the point where incomes get above subsistence faster, the incentive for training declines (while in the South the room for it still increases). Consequently, from that point onward  $p/p^*$  will

---

<sup>18</sup>To see this we determine the relative price of manufactures at the end of the first period and compare it with the relative price at the beginning of that period. This implies  $(p/p^*)_{t=1} = \frac{A}{A^*} \cdot \left[ \frac{\beta A^* - E_{\min}}{\beta A - E_{\min}} \right] \left[ \frac{C - (\beta A - E_{\min})}{C - (\beta A^* - E_{\min})} \right]^\beta$ , so that  $(p/p^*)_{t=1} < (p/p^*)_{t=0} = \frac{A}{A^*}$ . To see that  $(p/p^*)_{t=1} < 1$ , we subsequently take the derivative of  $(p/p^*)_{t=1}$  with respect to  $A$ , while leaving  $A^*$  constant, and evaluate it at  $A = A^*$  (so that  $(p/p^*)_{t=1} = 1$ ). This yields:  $1/A - [\beta/(\beta A - E_{\min}) + \beta^2/(C - (\beta A - E_{\min}))]$ , which is smaller than zero for all  $0 < \beta < 1$ . Hence, having more fertile land implies a comparative advantage in manufactures after the first period in which training could occur.

go up again. This continues also when South surpasses its subsistence level of income. Then in both countries the price of manufactures falls, but as South is further away from the steady state, prices in South fall more rapidly than in the North. As both countries eventually reach the same steady state —  $\bar{H}$  is independent of  $A$  — eventually comparative advantage retains its natural order again.

*[insert Figure 4 about here]*

## 5 On the optimal timing of trade liberalisation

In this section we discuss the consequences of our framework on the desirability of trade liberalisation in the wake of poverty. As shown, poverty affects the development of countries and, as such, influences their comparative advantages. The effects of trade therefore depend on the timing of trade liberalisation.

Comparative advantage changes with the development phase of a country. Initially, North has a comparative advantage in agricultural products, which is in line with its natural comparative advantage. Due to its faster industrialisation, however, North’s comparative advantage immediately shifts into manufacturing once training starts to come into play. Ultimately, in the steady state, North’s comparative advantage is in food again. Qualitatively, trade does not affect this development pattern. Regardless of whether trade does or does not take place, the steady state, in which no more labour is trained, is always the same, as it is determined by internal factors only.<sup>19</sup> In the very long run, therefore, trade has no impact upon development.

This does not mean that trade is irrelevant to development, however. Trade affects the income distribution and, through that channel, is able to influence the speed of development of countries. How exactly depends on the moment that trade liberalisation occurs. The important distinction here is between liberalisation occurring (1) before the southern region has achieved subsistence levels of income, (2) after the southern region has achieved subsistence levels of income, but with still a comparative advantage in agricultural

---

<sup>19</sup>Specifically, the relative consumption shares of agricultural and manufactures products and the degree of economies of scale in the agricultural sector.

goods, and (3) after the southern region has achieved subsistence levels of income and has returned to its natural comparative advantage in manufactured goods.

If trade occurs in the initial phase (1), it will tend to speed up the industrialisation processes sketched in the previous analysis. For this to take place, it does not matter whether trade is liberalised right from the start or later in time. Suppose, for instance, that there is free trade right from the start. Then North will start exporting agricultural products and import industrial goods (and opposite for South)<sup>20</sup>. However, comparative advantages will immediately shift so that the North acquires a comparative advantage in manufacturing. If trade remains liberalised, the new comparative advantage implies that the agricultural sector in the South starts to gain from trade. This accelerates training there, so that South starts to catch up. If it takes place before the southern region has reached the subsistence threshold, trade thus increases the rate of industrialisation in South. It will, by contrast, lower the rate of industrialisation in North as long as this region is still below subsistence. In this stage, therefore, trade tends to counter the entrenchment of poverty-induced specialisation patterns and support the restoration of natural comparative advantage.

After both countries achieved subsistence levels of income, trade has a different effect. Now, the desirability rather than the room for training governs training decisions. Were South still to have a comparative advantage in agricultural goods (phase 2), then trade tends to augment the incomes enjoyed in this sector, while depressing the incomes of the manufacturing sector in South. The result of this is that training becomes less attractive, since the income gains achieved by entering the manufacturing sector fall. In North, the opposite occurs. Trade will boost the incomes of manufacturers, while lowering the incomes in agriculture, thereby supporting training. The overall effect is that trade underscores the poverty-induced specialisation patterns, so that the ultimate shift back to natural comparative advantages is delayed. North reaches its steady state earlier because of trade, while for South it takes longer.<sup>21</sup>

---

<sup>20</sup>To be precise, both countries are either a net importer or net exporter of manufactures, as trade in manufactures will be of the intra-industry type. In equilibrium, therefore, both countries will export manufactures to each other, but one country more so than the other. In line with this, when we speak of specialization in production, we actually mean relativespecialization.

<sup>21</sup>Note that due to differences in fertility, comparative advantage will shift before the

In the case that comparative advantages have shifted back to their natural position again (phase 3), however, the opposite occurs. Now North, confronted with lower manufacturing and higher agricultural wages because of trade, will experience a decrease in the rate of training. In South, on the other hand, the manufacturing sector benefits from trade so that training becomes more attractive, speeding up industrialisation. In other words, the restoration of natural comparative advantage is being further entrenched by trade until both countries have reached their steady states.

For the desirability of trade liberalisation, this has important implications. First, we note that ultimate outcomes of development are not affected by trade, so that these do not enter the evaluation of trade liberalisation. In other words, there are no strict 'lock-in' effects. What trade can do, however, is to affect the moment these ultimate, steady-state outcomes are achieved, either delaying it or advancing it. Second, the analysis lends some support to the economic historian's thesis. To see this, we note that the switch away from natural comparative advantage is not efficient compared to a world where this switch had not occurred. A conceivable alternative world in which the infertile land would have developed a larger industrial base and the fertile country would have specialized in agriculture would be able to achieve a higher global output in both agricultural and manufactured goods. Higher global agricultural productivity because food production takes place in fertile regions means that the world is able to harbor a higher share of trained workers, so that the number of manufacturing companies increase, bringing down costs of manufactures. In other words, although there are clear advantages in allocative efficiency of trade given the circumstances, we should take into account that trade might have an effect on these circumstances, creating an alternative distribution of endowments that would be more efficient. We should thus distinguish between efficiency in allocation of production and consumption, and efficiency in the distribution of endowments. From the latter perspective, protection in the intermediate phase can be considered beneficial, since it brings the more efficient restoration of natural comparative advantages forward.<sup>22</sup>

---

process of catching up is completed.

<sup>22</sup>It could be argued that, although a distribution of endowments in line with natural comparative advantage is indeed preferable to the poverty-induced pattern, there are costs involved in shifting from the poverty-induced state to the natural situation again. As such, individuals already weigh these costs against the benefits of structural transformation when making their decision to train or not. From this perspective, the point raised would still

If we consider the southern, less fertile region, then trade is certainly beneficial to industrialisation in phase (1). Boosting agricultural incomes, the room for training increases because of trade, so that industrialisation can occur at a higher pace. Trade negatively affects industrialisation objectives, however, once South has reached subsistence, while it still has a poverty-induced comparative advantage in agricultural goods. It is only after comparative advantages have shifted back to their natural position that trade becomes supportive of industrialisation again. These results can be summarised in Table 1.

**Table 1: Effects of trade on the pace of industrial development**

|  | <i>North</i> | <i>South</i> |
|--|--------------|--------------|
| (1) below subsistence  | negative     | positive     |
| (2) above subsistence; poverty induced comparative advantage | positive     | negative     |
| (3) above subsistence; natural comparative advantage         | negative     | positive     |

From the point of view of industrialisation and endowment distribution, therefore, our analysis implies that trade is beneficial to the poorest countries, but might be forgone by middle-income countries in the process of catching-up.<sup>23</sup> Through such a strategy, development could be accelerated. However, provide no argument for temporary protection in the intermediate phase. However, it should be noted that price-taking individuals making their transformation decision do not take into account the effects of training that occur via changed global endowment distributions and specialization patterns on the price index. Economies of scale and competition effects in the manufacturing sector imply that a distribution of endowments that allows for a larger manufacturing sector globally has positive welfare effects. Individuals not taking into account these effects train less than the optimal amount from a social perspective.

<sup>23</sup>In this analysis, we only consider trade policy as an option for intervention, since we are primarily concerned with showing that historical poverty can give reasons for intervention. Quite obviously, other forms of intervention might be preferable to trade policy. However, it is beyond the scope of this paper to assess whether trade policy constitutes a first- or second-best solution to the problems warranting the intervention we perceive.

what is also clear from Table 1 is that when industrialisation is what matters, trade liberalisation tends to be a zero-sum game, at least until steady states have been achieved. Whenever North benefits from trade, South does not and vice versa. The only exception occurs in the intermediate phase when North has reached subsistence levels, while South has not yet. In that case, trade is temporarily positive for both countries.

It should be noted that industrialisation is hardly a goal in itself, though. In the end, the income effects of various policy alternatives need to be compared. In this respect, it is noteworthy that whereas industrialisation raises incomes in the long(er) run, trade always brings direct beneficial effects, in terms of increased static allocative efficiency. In other words, the decision whether to open up to trade or not for a middle-income country while catching-up hinges on its particular trade-off between direct income effects and the speed of industrialisation process. If a country puts a stronger emphasis on current income, trade is always beneficial. If, by contrast, a country is willing to sacrifice the gains from trade in the immediate run in order to achieve the higher levels of income associated with industrial development sooner, protection in phase (2) would be optimal. In this stage, trade liberalisation leads to a prolongation of the unnatural, poverty-induced comparative advantage pattern. Consequently, countries seeking fast industrialisation and a rapid dissemination of dynamic income effects will benefit for sure by temporarily stalling the free movement of goods until comparative advantage has resumed its natural order.

## 6 Conclusion

In this paper, the relation between development and trade has been discussed. It has been argued that poverty is a crucial factor influencing the relative speed of industrialisation of countries. As such, poverty has been shown to have a profound impact on the development of comparative advantage over time.

The basic argument we have put forward is that poverty limits people in their economic choices. Confronted with a wage that is hardly sufficient to survive, people are simply forced to supply all the labour time necessary for reaching a subsistence income. In this sense, deciding on one's labour inputs on basis of their preferences about various alternative uses of available time is a luxury that poor people cannot afford.

The main effect of this observation is that in a context of poverty, higher wages will tend to limit labour supply and boost alternative uses of time, such as schooling. It follows that countries whose population enjoys higher agricultural incomes will be able to invest more in training, and therefore develop faster. Thus, it has been shown that countries enjoying a natural comparative advantage in agriculture will develop a poverty-induced comparative advantage in manufacturing. Over time, however, as incomes rise and industrialisation takes hold in less advantaged regions as well, this pattern of comparative advantage will shift back again to its natural position.

Trade has no qualitative effect on these processes. It is able to either prolong or compress the period of poverty-induced comparative advantages, however. Dependent on the specific phase of relative development of a country, it might be desirable to pass by on trade if one's goal is to industrialise as soon as possible. If the other country has the same objective, however, conflicts of interest are likely to emerge. One might suspect that trade liberalisation becomes a very difficult exercise for this reason. Whenever a country puts less emphasis on rapid industrialisation and more on the immediately achievable gains from trade, though, trade is always beneficial.

More generally, this paper supports the critique that poverty disqualifies the standard reasoning (in economics) that free trade is typically good. Poverty has been shown to matter, for both development and the resultant emergence of trade patterns. Dependent on the importance one attaches to dynamic income effects, a temporary phase of protection might therefore be desirable for developing countries. What it also suggests, however, is that such temporary protectionist measures are not benefiting the poorest countries. Opposition to free trade is principally in the interest of middle-income countries in the process of catching-up. This puts the collapse of trade talks in Cancun in a rather different light, since the opposing block of developing nations was led by precisely such middle-income countries. In terms of poverty alleviation, then, free trade is still optimal.

## References

- [1] Amsden, A.H.(1989), *Asia's Next Giant: South Korea and late industrialization*, New York: Oxford University Press.

- [2] Baldwin, R., R. Forslid, P. Martin, G. Ottoviano and F. Robert-Nicaud (2003), *Economic Geography and Public Policy*, Princeton, Oxford: Princeton University Press.
- [3] Bhagwati, J.N., A. Panagariya and T.N. Srinivasan (1998), *Lectures in international trade*, Cambridge, MA: MIT Press.
- [4] Brakman, S., H. Garretsen, C. van Marrewijk (2001), *An introduction to geographical economics*, Cambridge: Cambridge University Press.
- [5] Cipolla, C. (1980), *Before the Industrial Revolution*, 2nd edition, New York, London: WW Norton & Company.
- [6] Dasgupta, P. (1997), "Nutritional status, the capacity for work, and poverty traps", *Journal of Econometrics*, 77, 5-37.
- [7] Wade, R. (1990), *Governing the Market; Economic Theory and the Role of Government in East Asian Industrialization*, Princeton: Princeton University Press.

**Figure 1: The training decision of untrained labor**

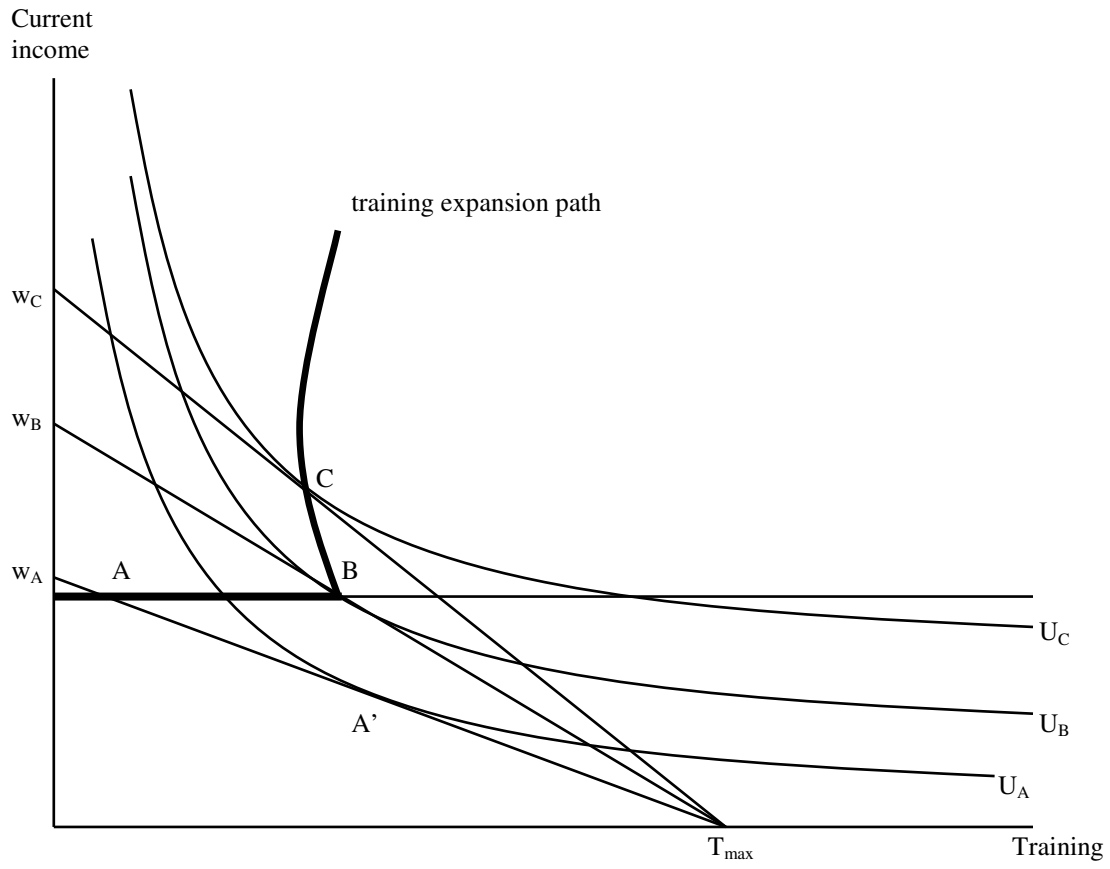
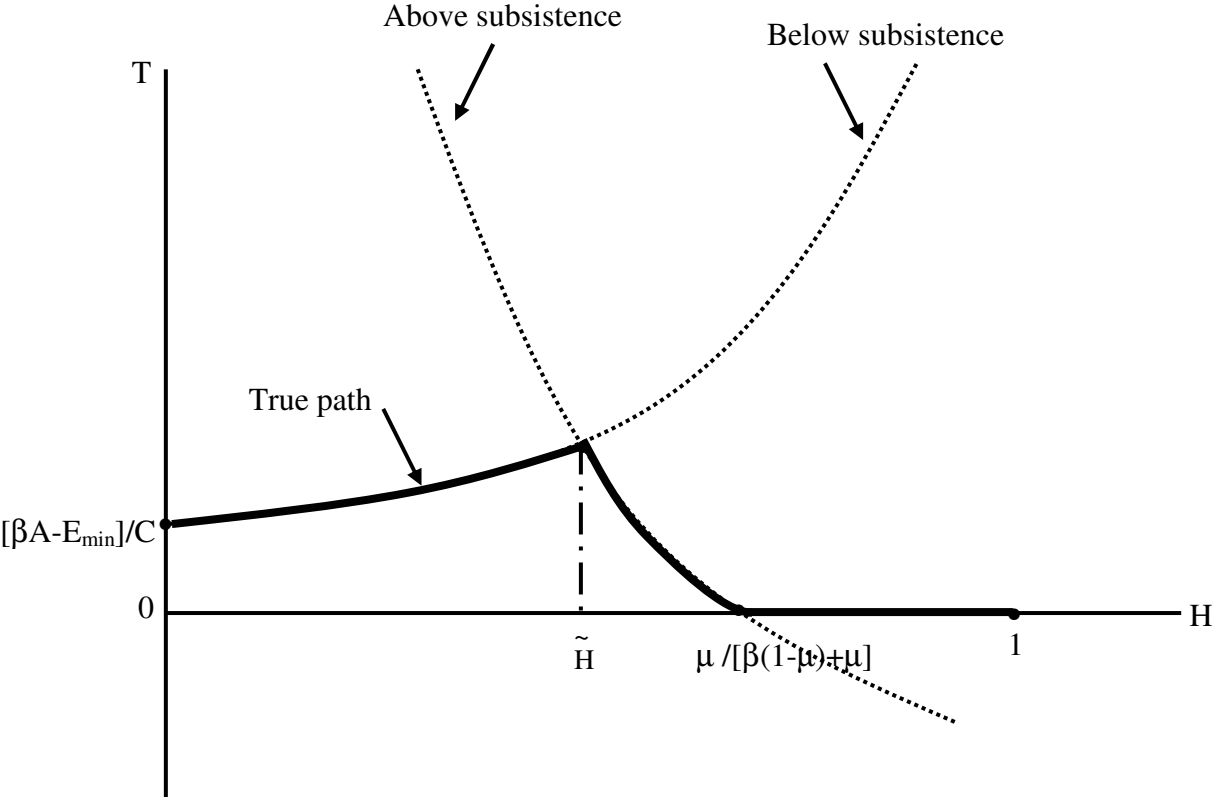
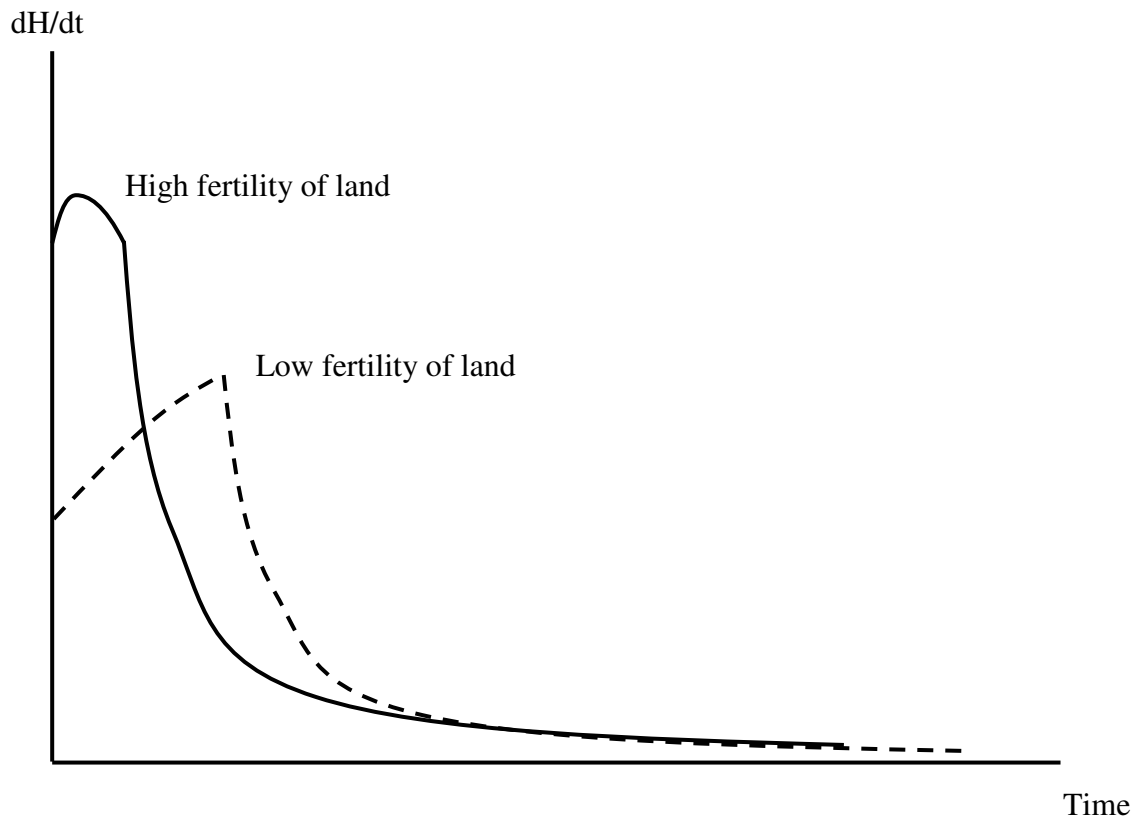


Figure 2: Development of training as a function H



**Figure 3: Development of aggregate training over time and the fertility of land**

Panel A: Low value of  $\beta$



Panel B: High value of  $\beta$

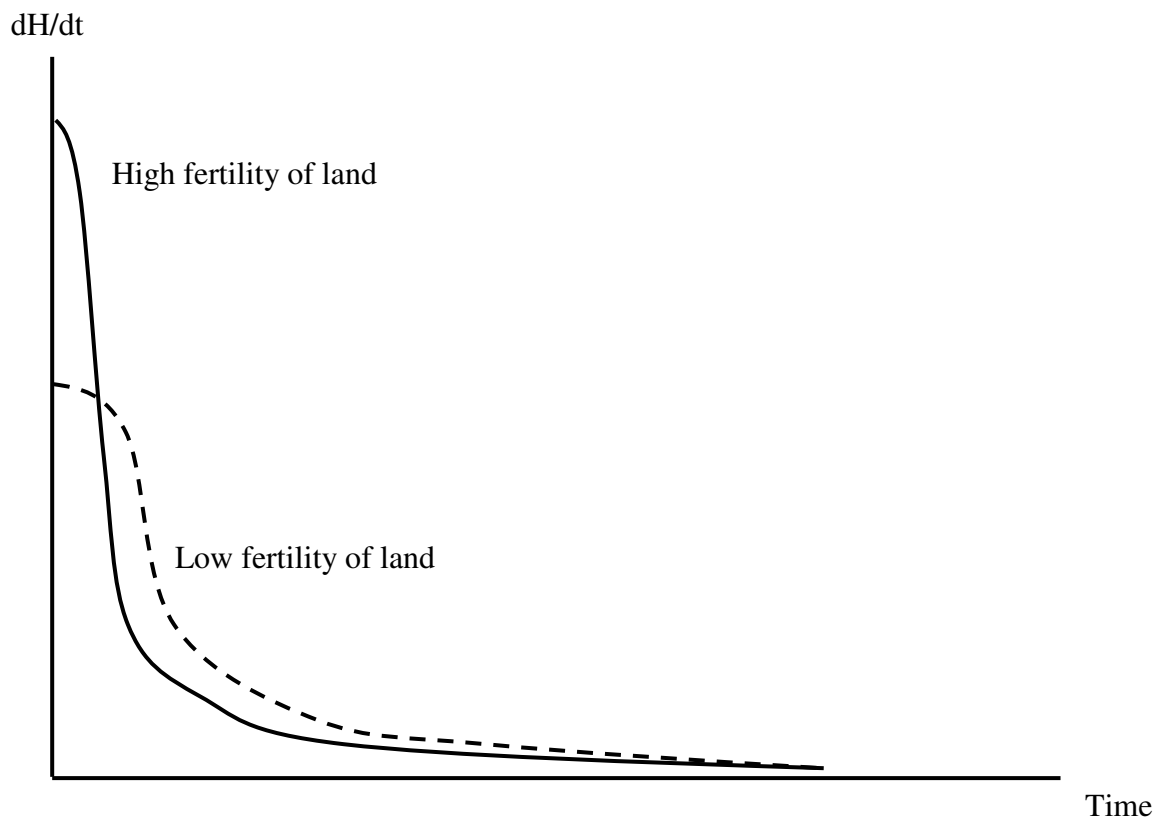


Figure 4: Comparative advantage over time

