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Income Distribution, Learning-by-Doing, and Comparative Advantage

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Abstract

The paper examines the impact of the income distribution in a less-developed country (LDC) on its patterns of trade, through its influence on home market demand patterns. In a learning-by-doing model with nonhomothetic preferences, the authors show that import substitution under low inequality generates more focused learning and enhances trade potential more effectively. In addition, relative wages under trade are higher in a low-inequality LDC. The model predicts that high-inequality LDCs are more likely to remain exporters of unskilled/low-skilled goods, whereas low-inequality LDCs are more likely to mature into simple manufactures and beyond—a prediction that is consistent with world trade patterns of LDCs. The authors present descriptive and empirical evidence in support of this link between income inequality, domestic demand patterns, and dynamic comparative advantage.

1. Introduction

This paper examines the role of the income distribution in a developing economy in shaping its patterns of trade and comparative advantage. This influence arises out of the impact that the distribution of income has on patterns of home market demand. In studying this impact, we show how differences in income inequality affect the learning and growth process in developing countries. This link between income inequality, demand, and learning also yields interesting implications for patterns of North–South trade. We provide supportive evidence from cross-country regressions and cross-country comparisons.

In the development literature, W. Arthur Lewis (1980, p. 10) emphasized the importance of the home market learning experience in expanding industry and the trade potential of a developing economy:

> "If the domestic market is too small, it is still possible to support an industrial sector by exporting manufactures and importing food and raw materials. But it is hard to begin industrialization by exporting manufactures. Usually one begins by selling in a familiar and protected home market and *moves on to exporting only after one has learnt to make one's costs competitive* [italics added]."

In this paper, we begin by taking this view of Lewis seriously. Our first basic premise, then, is that a developing economy, by simply opening up its doors to trade, does not automatically see a large surge in its manufactured exports to the world market. To trade competitively in such goods, it must first achieve a degree of industrial maturity through learning experience gained in *actual production*. This argument has been

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made, early on, in the development literature on infant industry protection. (We refer to this literature later.) This is where the influence of the home market arises. It is the natural learning ground where domestic producers must be able to successfully market their output before they can meet international standards.

But domestic producers must produce goods that cater to demand patterns in the home market. It follows that the learning experience that Arthur Lewis talks about must largely be shaped by an LDC's *home market demand pattern*. That an economy's home market demand patterns must greatly influence its trade patterns is our second basic premise—also known as the Linder hypothesis. In his analysis, Linder (1961) further noted that differences in income levels across countries must also affect their trade patterns. This is because individual consumption patterns tend to vary by income level—or in other words, consumption preferences are *nonhomothetic*.

Our point of departure in this paper is as follows. If preferences are nonhomothetic, then it is not only differences in income *levels* across countries that can influence trade patterns; differences in the initial *distribution* of wealth would affect trade patterns as well. We now elaborate.

As Engel's law points out, richer agents spend a decreasing fraction of their income on subsistence goods. But further, as Kindelberger (1989) observes, "Engel's law is not just a law about food . . . it is a more general law of consumption." As individuals get richer, they do not spend their additional income simply on getting more of existing goods; they buy new and more sophisticated goods and thus consume a wider range of goods. This suggests how the distribution of income must matter for demand patterns. For a given level of per capita income, low inequality implies that demand patterns are relatively homogenous across agents; hence market demand is concentrated over a shorter range of less sophisticated sectors. Under wider income inequality, however, the rich consume a much greater range of goods than the poor. Hence market demand is spread more thinly, but over a wide range of sectors—of low, medium, and high levels of sophistication. Consider an initial phase of protection, say under a policy of import substitution. As technology varies greatly across less and more sophisticated sectors, these differences in demand generate widely different production and learning experiences under protection, across developing countries. It is this link between initial income inequality, home market demand, and an economy's learning experience that we address in this paper.

For a given level of per capita income, we show that demand patterns in an LDC with low initial inequality are more conducive to focused learning in low- and medium-technology sectors. Our basic result is that such learning results in a higher level of wages, and enhances the trade potential in a low-inequality LDC. In contrast, high inequality results in domestic demand for a wider range of goods, but demand is spread more thinly across these sectors. Since the learning process depends on the actual extent of output (or production experience), learning is also diffused over a wide range of low- and high-technology sectors. This hinders the economy's ability to compete effectively in the international market.

We also consider trade patterns in a "North–South–South" world—trade between a DC and two LDCs, the latter with different initial distributions of income. We show that their learning patterns result in a world where high-inequality LDCs remain producers (and exporters) of the least sophisticated goods, while low-inequality LDCs graduate to exporting goods in the intermediate technology range. DCs continue to produce and export the most sophisticated goods. We present a discussion of the patterns of industrialization and specialization that emerged in various developing countries, following episodes of import substitution between the 1950s and the early 1970s.

Our analysis above provides an explanation for why the outcomes of import substitution policies differed widely across these countries—raising export potential significantly in some countries, while having little impact in other cases.

Our model ties together two important strands of the trade and development literature. The first is about the effect of nonhomothetic preferences on trade patterns and growth. In the development literature, our work is related to that of Eswaran and Kotwal (1993) who show why, with nonhomothetic preferences, LDCs exporting manufactures are more successful in raising real wages in their economy as compared to those exporting primary goods. While our model generates a similar effect with regard to wages, it also shows that initial inequality plays a significant role in determining this ability of LDCs to export manufactures, as opposed to primary goods. The trade literature uses nonhomothetic preferences to show how differences in the *level* of income across countries can explain trade patterns: Markusen (1986) uses it to explain the observed patterns of intra- and interindustry trade, while Hunter (1991) estimates that such preferences may account for as much as a quarter of interindustry trade flows.[1] In contrast to this focus on income *level*, we examine how differences in the *distribution* of wealth within LDCs at similar income levels can affect trade patterns.[2]

The second strand of the literature that ties in with ours addresses issues of learning-by-doing, infant-industry protection, and import substitution in a trade context. Some early work in this area includes Bardhan (1970) and Clemhout and Wan (1970). More recently, papers by Young (1991) and Stokey (1991) use multigood, dynamic models of learning-by-doing to address questions of trade, economic growth, and welfare. However, these papers assume that agents in rich and poor countries all prefer the same set of goods, irrespective of their income level; hence sectoral demand asymmetries play no role in influencing learning patterns. In Young (1991), setting aside static gains from trade, an LDC always benefits from autarky, because its learning experience increases its growth. This does not seem to be true, considering that import substitution strategies in several LDCs have not entirely been successful in raising their export potential in manufactures. In keeping with this reality, the present paper shows that due to differences in their domestic demand patterns, the learning experience under autarky protection can be very different for LDCs with different initial income distributions. In making this point, we thus forge a link between the trade literature on the role of home market demand and that on protection and learning-by-doing.

Section 2 lays out the model. Section 3 describes the trade equilibrium and analyzes the impact of initial differences in the asset distribution. Section 4 discusses the implications of our analysis for trade in a North–South–South world. Section 5 examines some evidence on the changes in trade patterns across developing countries with different initial asset distributions over the last three decades. Section 6 offers comments on the modeling approach, and section 7 concludes.

2. The Model

We consider a North–South world where production technology is Ricardian and human capital is the only input. The total stock of human capital in the North is H^*, and in the South it is H, where $H^* > H$.

The South has a continuum of agents i, ranked along the [0, 1] interval in increasing order of their human capital endowment, $h(i)$. The distribution of endowments in the North is taken to be fixed over time.

As mentioned in the introduction, we take seriously Lewis' view that a developing country must first gain production experience in the home market before beginning to export. Hence there are two stages in the model—"pre-trade" and "trade". Production experience in the pre-trade stage affects equilibrium outcomes in the trade stage. Our focus, however, is on the effects on the trade stage.

Production

There is a continuum of goods x along the interval $[0, \infty)$. The production function exhibits constant returns to scale in the lone input, human capital:

$$q(x) = A(x)H(x), \tag{1}$$

where $q(x)$ stands for the quantity of good x that is produced, $A(x)$ the technology parameter for good x, and $H(x)$ the quantity of human capital devoted to producing good x.

The North is assumed to have attained the maximum possible productivity (or best practice) in all sectors. We set its productivity coefficients $A(x) = 1$ for all x. The South lags behind; its gap from best practice is taken to be increasing in the index of the good x (see Figure 1). Thus, $A(x) > 0$ for all x, and $A'(x) \leq 0$. There is bounded learning-by-doing within individual sectors of the economy. The higher the pre-trade output level in any sector x, $q_0(x)$, the greater the increase in productivity in that sector, subject to an upper bound on the productivity level at one. If we denote Southern productivity under trade by $A(x)$, it depends positively on the pre-trade output, $q_0(x)$:

$$A(x) \equiv A(q_0(x)). \tag{2}$$

Since the North has already attained the maximum productivity in all sectors, no further learning occurs there.[3] In the South, increases in productivity in sectors for which demand has been satiated frees up human capital resources to be employed in sectors further along the continuum.

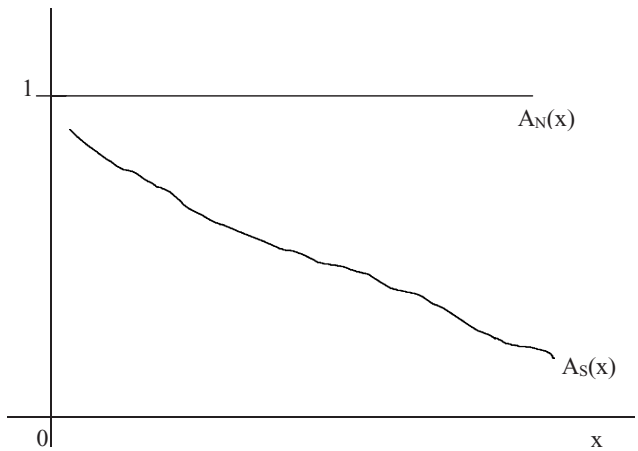

Figure 1. Productivity Parameters in N and S

Preferences

Agents have lexicographic preferences over the goods along the $[0, \infty)$ continuum. Hence they consume in serial order, starting from good 0, until their income runs out. Thus richer agents consume all the goods that poorer agents do, and more.[4]

We can write out an individual i's budget constraint as

$$\int_0^{x(i)} p(x)c(x)dx = h(i)w, \tag{3}$$

where $p(x)$ is the price of good x, $c(x)$ is the quantity consumed, $h(i)$ is the human capital endowment of agent i, and w is the rate of return on human capital, competitively determined in the market for human capital. The right-hand side of (3) denotes earnings of agent i, and the left-hand side denotes his expenditure on various goods, sequentially from zero to his marginal good, $x(i)$. Note that $c(x)$ is a *given* quantity of consumption for each good x; it is not endogenously determined in this model. $x(i)$ is the most sophisticated good consumed by agent i.[5]

This completes our description of endowments, production, and preferences. Given the preference structure, the endowment distribution determines the demand patterns for various goods—and hence the demand curve for human capital. The intersection of this demand curve with the (fixed) supply curve of human capital determines the market-clearing wage rate that describes the labor market equilibrium.

The initial endowment distribution (which we denote by **h**), has two effects on the goods market outcomes. First, it affects the demand (and hence pre-trade equilibrium output) across sectors. If the endowment distribution is relatively equal, the range of goods demanded in the economy is narrower, but the total demand for any individual good in this range is large. If the distribution is relatively unequal, a wider range of goods is demanded, but the total demand for each individual good is lower. The range of goods consumed rises with income (given sequential consumption); hence, we can write the total consumption demand for any sector x as $q_0(x) = (1 - i(x))c(x)$, where $i(x)$ is the poorest agent who consumes good x; $i(x)$ is nondecreasing in x, and it must depend on h.[6]

Pre-trade output levels $q_0(x)$ also induce productivity changes across different sectors in period 2, through "learning-by-doing." As seen in Figure 2, different initial

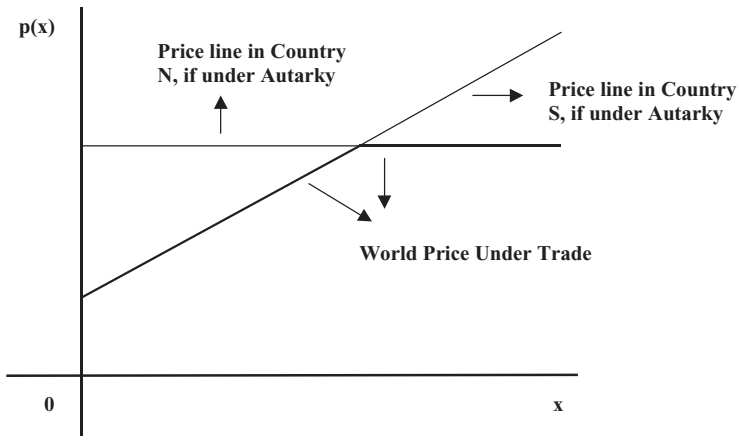

Figure 2. Trade Equilibrium

distributions must induce different patterns of productivity when the South trades: the economy with lower initial inequality should see a bigger increase in productivity in the less-sophisticated sectors, where it is also closer to best practice.

To capture the two effects mentioned above, we model alternative initial distributions in the South in the form of *mean-preserving* reductions in the human capital distribution **h** (to depict greater equality). We examine the impact of the resulting differences—in demand patterns and productivity patterns—on trade outcomes using two criteria:

1. *The range of goods exported by the South under trade.* In the South, the productivity coefficients $A(x)$ are declining in the index of the good; hence its comparative advantage lies in the goods at the lower end of the range $[0, \infty)$. The South must therefore export a band of goods, $[0, \hat{x}]$, $\hat{x}$ being the cutoff export sector.
2. *The equilibrium wage under trade, relative to the North*. Since human capital is the only input to production, wage is the sole mode of income. We denote wage in the South, relative to that in the North, by w. (The wage in the North is thus taken to be the *numéraire*.) A higher w therefore implies better terms of trade for the South.

We shall also briefly examine the welfare implications of the trade patterns that emerge under alternative distributions.

3. Trade Equilibrium

Let us first describe the North–South trade equilibrium. We define the human capital content of the domestic purchases of goods over the range $[0, k]$ by any individual as $\Omega(k)$. Further, $\Omega^*(.)$ denotes the human capital embodied in the exports to the North. We can express these as follows:

$$\Omega(k) \equiv \int_0^k \frac{c(x)}{A(x)} dx,$$

$$\Omega^*(\hat{x}) \equiv \int_0^{\hat{x}} \frac{E(x)}{A(x)} dx,$$

where $E(x)$ denotes the quantity of exports for good $x \in [0, \hat{x}]$. As with $c(x)$, $E(x)$ is a given function, arising from the endowment distribution in the North.

Given perfect competition in all sectors, the South exports lower-end goods in equilibrium, starting at 0. We denote its range of exports by $[0, \hat{x}]$.

The price $p(x)$ for $x \leq \hat{x}$ in the world economy is equal to $p_S(x)$, which would be the autarky price of these goods in the South. For goods such that $x > \hat{x}$, $p(x) = p_N(x) = 1$, where $p_N(x)$ would be the autarky price in the North (see Figure 2).

Under perfect competition, the constant returns to scale (CRS) production function (equation (1)) implies that, for all x:

$$p(x) = (w/A(x)).$$

Since home prices are equal to foreign prices in the cutoff sector $\hat{x}$, and $p_N(x) = 1$:

$$w = A(\hat{x}). \tag{4}$$

Next, consider consumption patterns. Let $h(i)$ be the human capital endowment of agent i. Hence an individual's consumption pattern can be described by a budget constraint (along the lines of equation (3)) as follows:

$$\int_0^{\hat{x}} \frac{wc(x)}{A(x)}dx + \int_{\hat{x}}^{x(i)} c(x)dx = wh(i) \quad \text{for} \quad x(i) > \hat{x}, \tag{5}$$

$$\int_0^{x(i)} \frac{wc(x)}{A(x)}dx = wh(i) \quad \text{for} \quad x(i) \leq \hat{x}. \tag{6}$$

Equation (5) represents the budget constraint for agents whose endowment is large enough to allow them to consume domestically produced goods and imports. The first term in (5) represents agent *i*'s expenditure on domestic goods, and the second term her expenditure on imports of goods $(\hat{x}, x(i)]$. Equation (6) represents the budget constraint for those agents who cannot afford imports. For such agents, the second term in (5) disappears: the resources consumed by them exactly equals their human capital endowment.

Finally, we focus on the domestic labor market clearing condition.[7] This may be stated as follows:

$$\int_0^{\infty} \min\{h, \Omega(\hat{x})\} f(h)dh + \Omega^*(\hat{x}) = H, \tag{7}$$

where $f(h)$ is the probability distribution function of h. In the left-hand side of (7) the first expression represents the labor embodied in the consumption of domestic consumers. The domestic economy produces all goods in the range $[0, \hat{x}]$. If an individual consumes only up to $\hat{x}$ or some good lower than $\hat{x}$, we saw earlier that the human capital embodied in such consumption must equal his own endowment, h.

On the other hand, if an individual consumes beyond $\hat{x}$, her domestic demand for human capital is only what goes into producing goods up to $\hat{x}$; i.e., $\Omega(\hat{x})$. $\Omega^*(\hat{x})$, as we mentioned earlier, is the foreign demand for human capital for goods $[0, \hat{x}]$.

Equations (5), (6), and the labor market clearing condition (7) together describe the trade equilibrium. Total labor supply (RHS of (7)) is fixed at H. Labor demand (LHS of (7)) is increasing in $\hat{x}$. Given that both the LHS and the RHS are continuous functions in h, a unique intersection between labor demand and labor supply (LHS and RHS, respectively) exists. This intersection uniquely determines the cutoff export sector $\hat{x}$. Setting $w = A(\hat{x})$ as in (4) determines the equilibrium relative wage w as well.

Having described the basic equilibrium, we are now ready to study the impact of the initial endowment distribution in the South on its trade patterns. Recall, from our brief description above, that it has two channels of influence. One is through the demand patterns that emerge, and the other is through the productivity patterns generated across sectors. We now proceed to study their impact on the trade outcome, but we examine their effects *individually*. This allows us to separate their countervailing effects on our variables of interest; i.e., wages and the range of exports.

Changes in the Endowment Distribution

Consider a mean-preserving reduction in the spread of the distribution of endowments in this economy, keeping the productivity parameters the same. As shown in Figure 3, this will increase the demand for lower-index goods and decrease the demand for higher-index goods. Proposition 1 (proved in the Appendix) discusses the effect of such distribution-induced differences in domestic demand patterns on the South's range of exports, $[0, \hat{x}]$, and its relative wage w.

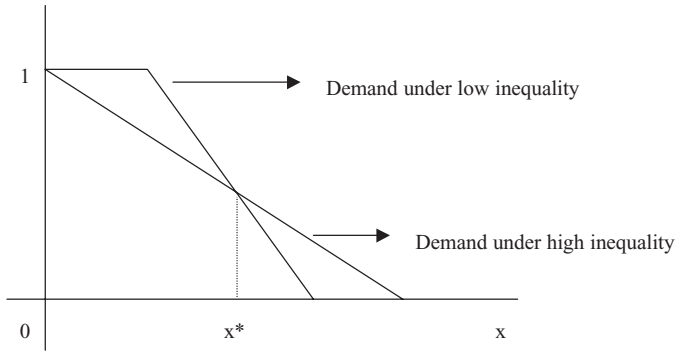

Figure 3. Effect of Different Endowment Distributions on Demand

PROPOSITION 1. *A mean-preserving reduction in the spread of the distribution of endowments increases the domestic relative wage w, but reduces the band of traded goods* $[0, \hat{x})$.

If an economy has lower inequality, its agents face better terms of trade (in the form of higher relative wages)—even as the range of goods they export is smaller. This is because lower inequality increases the demand for lower technology goods and depresses the demand for more sophisticated goods. Since low-tech goods are more likely to be domestically produced, and high-tech goods imported, the terms of trade for the South improve—which is what a higher w really is. Since demand for domestically produced goods is higher at home, the range of exports is smaller as well.

In fact, note that for a given set of productivity parameters, a reduction in the range of exports $[0, \hat{x}]$ is *always* associated with an increase in relative wage w. This is because $A(x)$ is *decreasing* in x and the wage equals productivity in the marginal sector; i.e., $w = A(\hat{x})$.

Next, we examine the effect of productivity changes of the kind described in section 2; i.e., higher productivity in the lower range of goods, but lower productivity in higher-index sectors. (To isolate the impact of differences in productivity parameters, we will assume that the endowment distribution is the same across these two sets of parameters.)

Changes in the Productivity Parameters

We use $HI(x)$ and $LO(x)$ to denote two sets of productivity parameters in sector x, under high inequality and low inequality, respectively.

As depicted in Figure 4, we consider $LO(x)$ such that $LO(x) \gg HI(x)$ for all $x \in [0, x^*]$. x^* is a "pivot" sector, so that $LO(x) = HI(x)$ at x^* and $LO(x) < HI(x)$ for $x > x^*$. We assume that, with either set of parameters, the marginal export sector, $\hat{x}$, lies within its high-productivity range, so that $\hat{x} \leq x^*$. This holds provided export demand, $E(x)$, is sufficiently large. We now examine in Proposition 2 (proved in the Appendix) how productivity patterns *HI* and *LO* affect the pattern of trade and the wages in the South.

PROPOSITION 2. *An increase in the productivity parameters for sectors from* $[0, x^*]$, *where* $\hat{x} \leq x^*$, *results in an increase in the range of goods exported. The effect on the nominal wage w is ambiguous.*

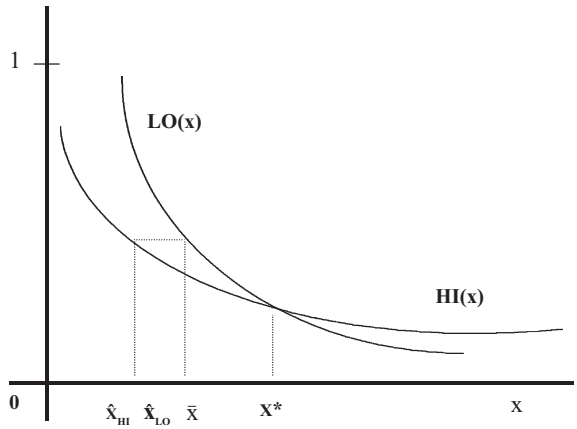

Figure 4. Effect of Changes in the Productivity Parameters

With the rise in productivity, each person's stock of human capital is now able to produce more goods in the lower range of sectors. However, many agents are already consuming and exporting these goods, even before the productivity increase. Hence, at least some of the human capital from these sectors must be applied to production in sectors further along the continuum. Thus, higher productivity at the lower end of the spectrum of goods must expand the range of goods exported.

The wage is equal to the productivity in the marginal sector. Typically, as the range of exports expands due to lower inequality relative wages in the South are higher as well. Wages are nondecreasing (along the productivity curve $LO(x)$) as long as the marginal export sector is at or below $\bar{x}$. (Here $\bar{x}$ is defined as the sector such that $LO(\bar{x}) = HI(\hat{x})$.) But if the marginal export sector lies beyond $\bar{x}$, the wage would fall. This is seen in Figure 4, where w would be as high as before, or higher; under lower inequality, if the marginal export sector $\hat{x}_{LO}$ lies within the range $(\hat{x}_{HI}, \bar{x}]$.

Intuitively speaking, how can productivity increases lead to a *fall* in the wage? Productivity changes in the South have two simultaneous effects. First, they lower the unit cost of production. Due to this effect, the range of goods produced and exported by the South expands; the South now "exports" more of its human capital because it can produce goods more cheaply. Since this induces an increase in the relative demand for the South's labor, this effect would push up the relative wage.

There is another effect that pushes down the relative wage. However, it is important to understand that this wage decline, following a productivity increase here, does *not* come about due to standard "immiserizing growth" reasons. Immiserizing growth is a situation where increases in productivity in a (large) economy's export sector cause the price (wages) of its export to fall significantly, so as to reduce national income. It arises when the demand for the large country's export is relatively inelastic. However, in our particular case, such inelasticity of demand (for labor) is ruled out. Recall that agents consume *sequentially*, along a continuum. When higher productivity creates surplus labor in one sector where demand is satiated, this labor can simply be employed in the next sector. Thus derived labor demand does not decrease with higher productivity, and hence real wages cannot fall for the usual immiserizing growth reasons.

However, an increase in productivity also has the effect of increasing agents' effective endowments. If such an increase in endowment induces a large increase in *import*

demand in the South, the relative demand for *the South*'s labor decreases. If so, the wage in the South may fall.

Such an outcome is unlikely, except when initial inequality is high. Only when some agents are very wealthy (relative to the median agent) will the addition to their endowment be spent on imports rather than (the expanded set of) domestically produced goods. To summarize, wages are likely to fall only under high inequality, where higher productivity induces an increase in import demand that is larger than the increase in domestic and export demand.

Summing Up

We now take stock of the overall effect of the initial income distribution on the trade equilibrium. Here we simply combine the effects arising from the induced demand patterns and productivity patterns.

1. *Effect on the range of traded goods*, $[0, \hat{x}]$. On the one hand, lower inequality narrows the range of exports given greater domestic demand for the simple manufactures (Proposition 1). On the other hand, the higher productivity that it induces tends to widen the range of exports by expanding the agents' effective endowment. Since both of these features are present in the second period, the net effect on the range of exports is ambiguous—the range of exports may either widen or narrow, with lower inequality.[8]
2. *Effect on the relative wage*, *w*. When higher domestic demand lowers the range of exports, it is always associated with higher wages (Proposition 1). From Proposition 2, and the discussion thereafter, we saw that a productivity increase (unaccompanied by changes in the endowment distribution) is typically associated with a higher wage too. Therefore the overall impact of lower inequality is to push up the relative wage (or the terms of trade) for the South.[9]

Thus, lower inequality in the South typically raises its relative wage, even though the effect on the range of exports may go either way.

As for the question of welfare, in moving from a less equal to a more equal distribution of endowments, Pareto comparisons are hard to make. This is because there is an implicit element of redistribution by which some agents must gain and others must lose. Nevertheless, it would be reasonable to posit that higher wages should result in higher real income for most, if not all, agents.

We now apply the results of our analysis to understanding trade patterns in the world. Specifically, we see how the presence of developing economies with different initial income and wealth distributions would affect the patterns of world trade.

4. Trade Patterns in a North–South–South World

To understand how LDCs with different initial distributions would perform under trade, we modify the model to accommodate two South countries that differ only in this aspect. We denote the country with low inequality by South_{LO} and the high-inequality country by South_{HI}. To determine the comparative advantage of the North, South_{HI}, and South_{LO}, we need to compare the domestic relative prices of different goods. These prices, and the emerging trade pattern, is depicted in Figure 5. From Propositions 1 and 2, we know:

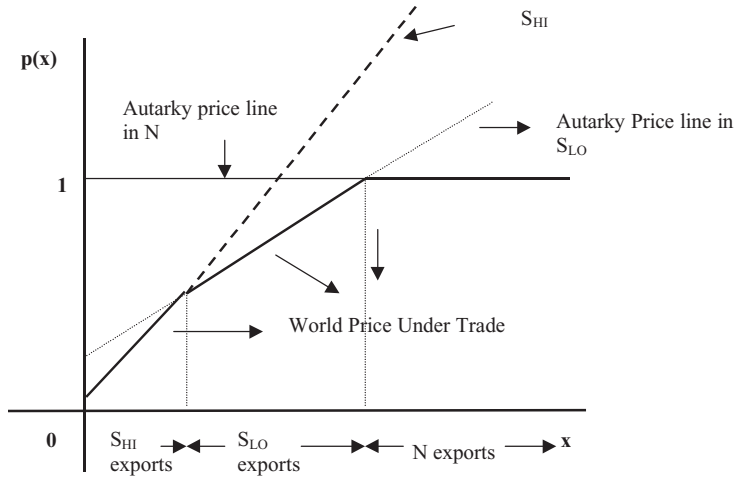

Figure 5. Trade Equilibrium in an N–S–S World

1. South$_{LO}$ will have higher productivity than South$_{HI}$ in sectors that are at an *intermediate* level of sophistication. Productivity in the two countries would be similar in the lowest sectors. In some high-tech sectors, South$_{HI}$ will be more productive than South$_{LO}$, but its limited production experience is unlikely to make it more productive in these sectors than the North.
2. Real relative wages will be higher in South$_{LO}$ than in South$_{HI}$.[10]

Given these observations, the domestic relative prices, and hence patterns of trade that are likely to emerge in this North–South$_{LO}$–South$_{HI}$ world, would be as represented in Figure 5. The lowest range of goods are supplied by the South$_{HI}$, the unequal South country. Goods of intermediate level of sophistication are produced by South$_{LO}$, the equal South country, and the high-tech goods are supplied by the North country.

This pattern arises because South$_{HI}$ has the lowest wage levels, but its productivity is low as well. Its relative disadvantage is hence likely to be smallest at the lower end of the range of goods. South$_{LO}$'s comparative advantage in the intermediate range of sectors is a result of a combination of a moderate wage rate (where $w_{HI} < w_{LO} < w_N$) and high productivity in the intermediate range of goods. The North has the comparative advantage in the most sophisticated sectors, where its high productivity compensates for its high wage, keeping prices low.[11]

These suggested trade patterns bear an interesting resemblance to the patterns of trade that we do see in the world today. In the next section, we present some suggestive evidence that tracks the export patterns of developing countries with different initial distributions of income and wealth.

5. Initial Conditions and Changes in Export Patterns of LDCs: Some Suggestive Evidence

A basic implication of our model is that LDCs with low initial inequality will have more focused learning-by-doing, which will enhance their ability to export manufactures over time. In contrast, diffused learning (across a wide range of sectors) in LDCs

with high initial inequality will hinder their ability to export manufactured goods competitively. In this section, we therefore trace the changes in the export patterns of LDCs over the past few decades.

We present two kinds of evidence. We first look at the shares of primary exports in the total exports of LDCs over a 20-year period, 1970–90.[12] Next, we use more comprehensive export sophistication indices from Feenstra and Rose (2000) to examine how the average sophistication of exports of low- and high-inequality LDCs has changed over the period 1974–94.

Primary Commodity Export Patterns, 1970–90

We trace the changes in the share of primary exports in the total exports of LDCs over the period 1970–90, and examine how these changes vary with the initial asset distribution in these economies in the 1960s. The primary exports data is obtained from the World Bank's World Development Report for various years. While the model is described in terms of (human) capital, comparable data on the initial wealth distribution or the initial distribution of human capital across countries do not exist. Hence, we use data on land distribution (Land Gini index) to represent the initial asset inequality.[13]

We use land Gini index data from Deininger and Squire (1998) (henceforth DS), which provides data for LDCs.[14] We study how changes in the share of primary exports (in total exports) may be affected by the initial land distribution. Of course, we need to account for how comparative advantage, arising out of differences in endowment, may influence this share. To do so, the regression we adopt is a slightly modified version of Redding (1999). We use data on stocks of arable land per capita, human capital, and physical capital (from time periods corresponding to the primary export share data) as our endowment measures. The data on arable land are obtained from the FAO statistics yearbook for various years, and the data on human capital are obtained from Barro and Lee (1996). Physical capital data for all the developing countries in our sample was not obtainable, hence we use the (discounted) sum of investment flows of the previous 14 years (from the *Penn World Tables* 5.6) as our measure of physical capital. Our approach is similar to that of Balassa (1979) who used the sum of *gross* investment flows over a slightly longer prior period as the measure of capital stock in a particular year.

Apart from differences in their comparative advantage, countries have differed considerably in the nature and extent of their trade protection policies during this period. Since protection policies can have considerable impact on trade patterns, we include the percentage of import tariffs as a measure of a country's protection policy.[15]

Our results are reported in Table 1. We examine how the impact of initial inequality (measured by the land Gini index) on the primary export share changes at five-year intervals between 1970 and 1990.[16]

Our regression results indicate that higher inequality results in the persistence of a larger share of primary exports in total exports. This effect remains, even after accounting for changes in the endowments, which affect an economy's comparative advantage. It should be mentioned here that, the samples for 1970 and 1980 being smaller than 30 observations, only the regressions for the years 1977, 1985, and 1990 are reported.[17] Based on our findings, we conclude that the data are consistent with the theoretical prediction that higher-inequality South countries are more likely to retain a larger share of (unsophisticated) primary exports in their total exports.

Table 1. Regression Results

Dependent variable: Ratio of primary exports to total exports (RPX)						
	RPX77	*RPX77*	*RPX85*	*RPX85*	*RPX90*	*RPX90*
Land Gini	0.46	0.48	0.69	0.63	0.72	0.68
	(1.79)*	(1.52)	(3.27)**	(2.51)**	(4.82)***	(4.29)***
ln(*TAL*)	–1.72	1.51	–2.21	–0.82	–4.67	–2.93
	(–0.73)	(0.46)	(–1.13)	(–0.35)	(–1.83)*	(–1.10)
ln(*SSA*)	–12.73	–14.64	–7.24	–7.01	–11.86	–11.85
	(–2.49)**	(–2.42)**	(–1.45)	(–1.27)	(–1.95)*	(–1.75)*
ln(*CAP*)	2.29	1.18	–0.09	1.01	6.6	6.86
	(0.24)	(0.12)	(–0.01)	(0.12)	(0.92)	(1.02)
ln(*GDP*)	2.42	3.42	–5.40	–6.63	–14.01	–16.44
	(0.74)	(0.39)	(–0.85)	(–0.84)	(–2.12)**	(–2.34)**
M-tariff		–0.69		–0.07		–0.56
		(–1.21)		(–0.19)		(–0.58)
Constant	53.09	44.61	98.54	98.91	152.78	166.02
	(1.13)	(0.82)	(2.23)**	(2.01)**	(3.34)***	(3.32)***
R^2	0.27	0.31	0.37	0.32	0.50	0.50
N	38	31	38	33	38	33

Notes: *t*-statistics are in parentheses on the basis of White's heteroskedasticity-consistent standard errors and covariance. The variables are as follows: *TAL*: total arable land; *SSA*: percentage of population with secondary school attainment; *CAP*: capital stock, measured as discounted sum of gross investment flows over the last 14 years; *M*-tariff: import tariffs (%)—for 1975 (in the second column), for 1985 (in the other columns). A single asterisk represents significance at the 10% level, two asterisks at the 5% level, and three asterisks at the 1% level.

Changes in Export Rankings of LDCs, 1974–94

While a large share of primary goods exports in total exports is indicative of a country's slower learning process, it is not a comprehensive measure of export sophistication. In this subsection, we examine the more comprehensive export sophistication rankings developed by Feenstra and Rose (2000). These rankings are based on shares of *all* goods in the exports of individual countries to the United States over the period 1974–94.[18] The export data are also examined in great detail: at the *five*-digit SITC level, and the number of goods adds up to 1434. Given these appealing features of the data, this enables us to examine our basic theoretical prediction more closely.[19]

The Feenstra and Rose (2000) rankings cover a set of 162 developed and developing countries (including some geographical jurisdictions counted as countries). We use the rankings for our set of developing countries, this set being determined by the availability of land Gini data.[20] To examine our learning-by-doing hypothesis, we examine the change in country export sophistication rankings over two time intervals. The two sets of indices we use for this are: "GEARLY", based on exports between 1974 and 1984, and "GLATE", based on exports between 1985 and 1994. *Rankings* of export sophistication are coarser measures than the export sophistication indices underlying them. We recognize this limitation in the available data. We examine the changes in these rankings over the 20-year period, 1974 to 1994. Our results are reported in Table 2.

Table 2. Regression Results

Dependent variable: $\Delta GRANK = (GEARLY - GLATE)$[26]					
	(1)	(2)	(3)	(4)	(5)
ln(*GDP*)	1.68	6.59	5.32		
	(0.45)	(1.29)	(1.08)		
Land Gini	–0.26	–0.32	–0.46	–0.26	–0.40
	(–1.88)*	(–2.10)**	(–2.53)**	(–1.74)*	(–2.77)***
ln(*TAL*)		–0.91	–2.59	–0.99	–2.27
		(–0.56)	(–1.30)	(–0.65)	(–1.21)
ln(*SSA*)		–6.08	–8.53	–3.36	–6.40
		(–1.15)	(–1.71)*	(–0.67)	(–1.58)
ln(*CAP*)		–0.46	3.55	1.92	5.06
		(–0.09)	(1.02)	(0.44)	(1.32)
M-trf85			0.53		0.47
			(2.59)**		(2.75)***
Constant	10.87	–0.85	9.21		32.7
	(0.35)	(–0.02)	(0.38)	(2.2)**	
R^2	0.07	0.12	0.35	0.08	0.32
N	41	41	34	41	34

Notes: The dependent variable is the absolute change in a country's export ranking between the periods 1974–84 and 1985–94. The legend for the explanatory variables is as given at the bottom of Table 1, except that *M*-tariffs are now import tariff rates for 1985 only. As before, figures in parenthesis are *t*-statistics. Given that the initial period spans years, our measure of each variable is the log of values in 1985—the initial year for the period over which change is being measured. The arable land data are from 1984.

Initial inequality has a significant adverse effect on the change in a country's relative ranking. Note that, the lower a country's rank index, the higher its export sophistication. Thus, a positive difference between *GEARLY* and *GLATE* (which we define as $\Delta GRANK$) implies an *improvement* in a country's relative position. Hence, the negative coefficient on the land Gini indicates a smaller improvement in the export sophistication of LDCs with higher initial inequality.

The results suggest that, after accounting for the effect of endowment stocks, a unit increase in the land Gini coefficient lowers the improvement in a country's rank by 0.32 points. If we take into account the protection policies, it slows down the improvement in export rankings by 0.46 points. Interestingly, we find that countries with *higher* initial import tariff barriers see a greater improvement in their export sophistication rankings over this period. A unit (1%) increase in initial tariff barriers improves a country's export rank in this period by around half a point (either 0.47 or 0.53—columns (4) and (3), respectively).

No doubt, the data analysis presented above is limited by the fact that the export sophistication indices are ordinal rankings, rather than cardinal measures of performance. Also, the indices are based on exports aggregated over ten-year periods, so they do not allow a more detailed examination of the more gradual changes in the rankings of LDCs. Nevertheless, the overall picture that emerges, based on both primary commodity export shares and export sophistication rankings, suggests slower improvement in the export potential and sophistication of countries with higher initial inequality.

The development histories of several LDCs in the twentieth century are also consistent with this cross-country picture. In the subsection below, we describe some of these, as discussed in the development literature.

Import Substitution and Export Patterns: Some Country Comparisons

For at least half a century or more, the question of which trade and development strategies are growth-enhancing and develop export potential has been the subject of spirited economic debate. To put this in historical context, several developing economies in the postwar period were trying to figure out the "right" model of industrialization and outward orientation, given the consumption and foreign exchange needs of their growing economies. Their reliance on traditional agricultural exports as a source of foreign exchange for developing countries was undercut, due either to wide fluctuations and large declines in the world price of raw materials/products (such as copper and coffee) or to a paucity of such resources. Thus, it became imperative for these economies to devise policies to develop an industrial base and increase their export potential in *manufactures*. Broadly speaking, most developing economies adopted initial phases of import-substituting industrialization (ISI), followed by greater emphasis on exports.

Notwithstanding this superficial similarity in growth strategies across LDCs, there are striking differences in the patterns of learning, industrialization, and trade that emerged across countries attempting to grow in this fashion. For instance, Bruton (1986) contrasts the Korean approach to ISI of "working its way up the technology ladder," from simple to more sophisticated goods, with the Brazilian "leapfrog" approach.[21] As Gereffi documents, Brazil and Mexico, under their initial phase of ISI, focused not only on simple industries such as food and textiles, but also on very sophisticated ones such as iron and steel, cement, paper, chemicals, and machinery. Korea and Taiwan, on the other hand, focused on food, footwear, and textiles as well as other light manufactures such as wood, leather, rubber, and paper products.[22] As is well known, these Latin American and East Asian economies were at similar stages of industrialization and export strength in the 1950s, but the latter surged far ahead by the 1970s, as the numbers in Table 3 show.

Table 3. Trade Growth Patterns

	Exports (USD billions)		X_m/Y_m		X_m/X		X_a/X		X_n/X	
	1965	*1987*	*1960*	*1973*	*1950*	*1980*	*1950*	*1980*	*1950*	*1980*
Mexico	1.1	20.9	2.6	4.4	7.9	10.9	53.5	14.2	38.6	71.6
Brazil	1.6	26.2	0.4	4.4	na	na	na	na1	na	na
Argentina	1.5	6.4	0.8	3.6	na	na	na	na	na	na
South Korea	0.2	47.2	0.9	40.5	6.4	80.2	82.3	8.9	11.2	10.5
Taiwan	0.5	50.8	8.6	49.9	na	86.2	na	10.2	na	3.6

X: exports; X_m: exports of manufactures; Y_m: output of manufactures; X_a: agricultural exports; X_n: mineral exports; na: not available.
Source: Gereffi and Wyman (1990): Tables 1.3, 5.4 and 8.2(c)–(e).

The sheer volume of the East Asian economies' increase in trade is impressive, considering their significantly smaller size; but in fact the changes in the *composition* of these exports are even more striking. Numerous studies have attempted to understand the rapid advance in the manufacturing sector in East Asia, and also why Latin America, in spite of a slight head start in the process of industrialization, was unable to perform as well in exports.

Felix (1963) addressed this question with regard to Argentina and Chile, given their sizable industrial sectors, both prior to and during their stabilization efforts. His analysis was that an important reason for this poor performance was the divergence of their pattern of capitalist industrialization from the "conventional" one. By "conventional," he referred to industrialization and export patterns of gradual movement from consumer goods with simple technology and low capital requirement to those with a more sophisticated technology and larger capital outlay.

He attributed this divergence to two factors. The first was the highly stratified two-class society in most Latin American countries prior to World War I. This led to the absence of a middle class of farmers and merchants to provide an extensive market for such industries, as also inadequate stocks of human capital. The second factor Felix referred to was the "precocious widening" of the industrial spectrum in these countries, as compared to the "conventional" pattern of capitalist industrialization. He regarded it as precocious because the production of sophisticated goods such as consumer durables was much higher, considering the cost disadvantages of these economies.

A separate analysis by Fajnzylber points to how inequality (which made it difficult to stimulate mass production of basic and standardized goods), coupled with the ostentatious consumption patterns of the rich, induced technology choices that resulted in the "showcase modernity" of industrialization in Latin America. In contrast, he notes how the more equitable consumption patterns in Korea induced the more deep-rooted and "endogenous modernity" of its industrialization pattern.[23]

These points are seen to be strikingly true, for instance, in the production, consumption, and export patterns of automobiles, in Table 4.

From very early on, the consumption of cars was much higher in Latin America; consumption remained much lower in Korea until a little over a decade ago.[24] While South Korea did not export cars earlier in its industrialization process, it had acquired enough technological maturity to make rapid amends for this by the middle 1980s—so much so that it managed to overtake the Brazilian production that was heavily dependent on foreign technology and capital. This maturity, acquired from working its way up the technology ladder, is seen in the high export intensity of Korea's engineering goods, as compared to the other economies.

Table 4. Automobile Sector

	Output (000s)			*Vehicles per 1000 persons, 1980*	*Engineering products X/M ratio (1979/80)*
	1965	*1980*	*1988*		
Brazil	185	1,165	1,069	68	0.58
Mexico	97	490	513	56	0.10
S. Korea	0.1	123	1,084	6	0.71

Source: Gerffi and Wyman (1990), Tables 4.3 and 12.10.

As remedies to this problem of low export growth in Latin America, Felix recommended (i) taxation to alter the structure of consumer demand, such that the tax incidence fell more on consumer durables and sumptuary items; and (ii) a larger share of investment in "T" industries—by which he meant low sophistication manufactures. Rather than an indiscriminate subsidy to all industries, Felix recommended a sharp focus on these industries because of their promise in terms of raising long-term exporting efficiency. These policy recommendations strongly suggest the role of demand factors in influencing production patterns in these unequal Latin American economies during their phase of import substitution, as well as their adverse impact on exports.

More recently as well, the differences in the trade and growth patterns of China and India in the early 1990s bear out our story. The two economies have pursued inward-looking policies for a considerable length of time. Today, while China is characterized by almost universal literacy, human capital endowments in India are far more unequal, with a little under half the population still illiterate. While China has managed to grow rapidly, with a dramatic increase in low-grade manufactured exports, the growth of Indian light manufactured exports has been quite sluggish. The fact that inequality has made it possible for a small fraction of highly skilled workers to generate significant export revenue from hi-tech software exports is only a minor exception to this larger fact.

To summarize, in both sets of country comparisons that we have made here—Latin America vs. East Asia and China vs. India—higher initial income inequality is associated with more skewed patterns of domestic demand and production. As predicted by the theory, this has resulted in a lack of sustained success in promoting simple manufactured exports, together with some sporadic success in higher technology sectors.

6. Comments on the Modeling Approach

We have used a "Ricardian" model, inasmuch as trade between countries is driven by differences in productivity, similar to Dornbusch, Fisher, and Samuelson (DFS, 1977). However, we must hasten to point out several differences relative to the spirit of Ricardo's much richer analysis.

Ricardo's analysis of trade was couched in the larger context of his analysis of growth in an economy consisting of three broad functional classes—landowners, capitalists and workers. In his framework, growth is generated through the savings of capitalists, out of their profits. Capitalists saved more than workers, given their higher initial endowment, and hence their higher marginal propensity to save.

In our model as well, agents are rank ordered along a continuum by their endowment, which is in the form of human capital. However, there are no explicit "classes" in our one-factor economy (as also in DFS). There is no capital accumulation either, because there are no profits or savings. Given this fact, our model (and DFS) is really more suited to addressing issues about patterns of specialization rather than growth in the traditional sense. In our framework, the rise in incomes occurs because the period of initial (temporary) protection fosters productivity growth (at different rates across different sectors) through learning-by-doing. These productivity increases result in higher real earnings rates for all agents, who are each endowed with different amounts of human capital.

Also, we have treated the (endowment) inequality as unchanging. For Ricardo, in contrast, greater wealth accumulation and investment by capitalists resulted in higher income growth in this class than in the class of workers. This was the source of a rise in inequality between workers and capitalists over time. In this spirit, a useful exten-

sion to our present model would be to endogenize inequality in human capital arising from differences in earnings, based on the initial stock.

Finally, both the DFS approach and ours has ignored the issue of the food sector. Also, while the present model has captured nonhomotheticity with a focus on manufactured goods alone, an empirically well-established aspect of nonhomotheticity is with regard to expenditure on food (Engel's law). In fact, the inelasticity of the demand for food and land-based products, with growing world income, was an important issue in the industrialization and outward orientation decisions of LDCs in the 1960s and 1970s. It would be a useful extension to bring in a food sector (characterized by diminishing returns and inelastic demand) and discuss its effects on trade and growth strategies of LDCs.

7. Conclusion

This paper has examined the role of the initial income distribution in shaping the patterns of learning, dynamic comparative advantage, and trade in developing economies. It explains why the effects of import substitution (or temporary/infant-industry protection) may be influenced by the initial income and asset distribution. In doing so, it forges a link between two distinct strands in the trade literature. One dwells on the role of home market demand and nonhomothetic consumption preferences in determining trade patterns. The other emphasizes the importance of learning-by-doing and infant-industry protection for the growth and industrial evolution of an economy.

Low initial inequality in a developing economy gives rise to aggregate demand patterns that are concentrated over relatively low- and medium-technology goods. Under protection, home market demand thus gives rise to production experience that gradually builds the economy's technological capability "from the bottom up." Under high initial inequality, however, demand tends to be spread rather thinly over a very wide range—from subsistence goods to very high-technology goods. The learning experience provided may not be deep enough to bring the economy up to best practice in low-technology sectors, or in high-technology sectors. In a North–South model, we show that a more egalitarian developing economy is able to achieve higher levels of learning and welfare under trade, given its pre-trade home market demand pattern. We extend our analysis to examine trade patterns in a world with one North and two South economies (with different initial income distributions).

The model offers an explanation for differences in the patterns of learning and industrial evolution across different LDCs. It also predicts trade patterns that are consistent with LDC–DC trade flows seen in the world today. It fits well with the patterns of industrial evolution in several countries, particularly the high-inequality countries such as Argentina, Chile, and Brazil in Latin America, as well as the lower-inequality countries such as Korea, Taiwan, and China in Asia.

Appendix

Proof of Proposition 1

Consider the labor market clearing condition (7). $g(h) \equiv \min\{h, \Omega(\hat{x})\}$ is a concave function in h. Fix $\hat{x}$. Then, by the theorems on mean-preserving spreads applied to concave functions, we know that, for the given $\hat{x}$, the value of $g(h)$ under the new distribution of h must be higher. Hence the LHS of (7) rises. However, the RHS is fixed. Since $\Omega'(x) > 0$, $\hat{x}$ must shift to the left to maintain equality in (7). Thus, with a

meanpreserving reduction in the spread of the initial distribution, $\hat{x}$ must fall. Also, since $w = A(\hat{x})$ where $A(x)$ is decreasing in x, this implies that w should be higher after the mean-preserving reduction in the spread.

We must note that $g(h)$ is only weakly concave in the range $[0, \Omega(\hat{x}))$. However, provided the mean-preserving reduction results in a transfer from i, s.t. $h(i) > \Omega(\hat{x})$ to i' s.t. $h(i') < \Omega(\hat{x})$, the wage w is *strictly* higher under regime LO. □

Proof of Proposition 2

Refer to Figure 4. Consider equation (7) once again. An upward shift in the productivity parameters for a set of goods $x > x^*$, where $x^* \geq \hat{x}$, creates a downward shift in the function $\Omega(x)$. This reduces the value of both expressions on the LHS. Since the RHS is constant, the value of $\hat{x}$ must rise so that equation (7) remains valid. Hence $\hat{x}_{HI} \ll \hat{x}_{LO} \leq x^*$.

We know from equation (6) that $w = A(\hat{x})$. We have established that, for $\hat{x} < x^*$, $\hat{x}$ must move to the right with the productivity increase. However, in the new cutoff sector $\hat{x}_{LO}$, it is possible that productivity is either greater or less than productivity in the cutoff sector in regime HI, $\hat{x}_{HI}$. Hence the effect on w is ambiguous. □

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Notes

1. For other theoretical analyses of the effect of nonhomothetic preferences on trade, see Thursby and Thursby (1987) and Markusen and Hunter (1988).
2. A recent paper that focuses on the impact of the asset distribution on trade is Grossman and Maggi (2000). It examines the effect of the distribution of human capital within a country on its trade patterns. In the present paper, too, we model inequality in terms of differences in individual human capital endowment. However, in their paper, the effect on trade patterns arises because of production complementarities, whereas in ours it is through demand patterns.
3. The assumptions on production coefficients capture the fact that the relative gap between the North and the South is greater in higher technology sectors. The assumption of no learning in the North is thus merely a matter of analytical convenience, and does not impinge on the results in any way.
4. A utility function that generates such a sequential demand pattern must have the property that marginal utility is decreasing in the index of the good. Since richer agents consume a longer range of goods than poorer agents, this would also imply that total utility is increasing and concave in an agent's endowment. Murphy et al. (1989) propose a utility function that yields the above demand pattern:

$$U = \exp[-\textstyle\int_0^1(-q(x))^{1/x}dx + \int_1^\infty(q(x))^{1/x}dx].$$

In this function, $q(x)$ is one if good x is consumed, and zero if it is not. The marginal utility of good x is $(1/x)$, so lower index goods are more desirable. This function yields a case where $c(x) = 1$ for all x. While we have assumed a strict sequential consumption structure here, the results of the model would hold as long as the fraction spent on lower index goods decreases with income.
5. From our description of production and preferences, it is clear that we assume a correspondence between the order in which goods are consumed, and their level of technological sophistication. Broadly, this description does match the manner in which consumption changes over

the course of growth in an economy. Kindelberger (1989) echoes this point of view: "Old goods have low income elasticities in rich societies. . . . To sustain growth, the old economies must move on to *new goods with high income elasticities, and technologies not yet in the process of adoption in importing countries*" (italics added). A similar assumption is also made in Markusen (1986).

6. This can be seen using equation (3). For every x, $p(x) = (w/A(x))$, given perfect competition and constant returns to scale (CRS) in production. Hence, the marginal good $x(i)$ consumed by each agent i depends on his human capital endowment, $h(i)$. This implies that $i(x)$ depends on $\mathbf{h}$ for every x.

7. By Walras' law, the goods market must clear if the labor market clears.

8. To see this precisely, look at equation (7) once again. On the LHS, the value of h at the lower end rises with the mean-preserving reduction in the spread of endowments. The endowment distribution is the same across both periods. At the same time, the enhanced productivity in period 2 implies that there is a drop in the functions $\Omega(x)$ and $\Omega^*(x)$. For agents whose endowments are still low enough such that $\Omega(\hat{x})$ does not bind, this causes the first expression in equation (7) to rise. At the same time, there is also a decrease in $\Omega^*(x)$. However, it is not clear whether the increase in h dominates (or is dominated by) the decrease in the value of the $\Omega^*(.)$ function. Hence, this suggests that the effects of redistribution and the productivity changes that result from it, on the band of traded goods $[0, \hat{x}]$, is ambiguous.

9. This may not be true if the initial distribution is so unequal that higher productivity induces a large increase in import demand. However, if initial inequality were indeed so high, then the productivity increase itself would be unlikely. Hence we regard such a wage drop as unlikely and uninteresting for the low-inequality case.

10. The discussion following Proposition 2 explains why a productivity increase is unlikely to result in a *decrease* in relative wages in South_{LO}, given low inequality in its initial income distribution.

11. We must add that it is possible for South_{HI} to be exporting a few of the hi-tech goods or services, provided its wages are sufficiently lower than the North.

12. With respect to the model, a large share of primary goods exports in total exports can be viewed as evidence of less learning.

13. This approach has been used by other papers that examine the effects of inequality on growth; for instance, Alesina and Rodrik (1994) and Persson and Tabellini (1994). The first of these papers also uses data on *income* Gini measures for inequality. However, the high-quality dataset on *income* inequality compiled by Deininger and Squire (1996) is not available for a large enough number of countries in our sample for the relevant date; hence we were unable to try our data analysis using income Gini indices.

14. The dataset has been compiled by the authors and covers 41 of the developing countries in our sample. The set of developing countries was chosen based on the availability of land Gini data, and is consistent with the definition of LDCs used by the IMF.

15. Rodriguez and Rodrik (2000) offer a detailed discussion of the shortcomings of various measures of protection used in the empirical literature on trade and growth. The authors make a strong argument for the use of import tariff percentages as a measure of trade protection.

16. We report the regression results for 1977 instead of 1975 because the data on primary exports for the latter year were unavailable from our source (the World Development Report), and the sample size for 1976 was much reduced as well.

17. The results for the other two years are available from the authors. The constraint is typically due to paucity of data on the primary exports ratio (RPX) variable, the investment flows data, or import tariffs.

18. Feenstra and Rose base their export sophistication indices on countries' exports to the United States because this allows them to include a large set of countries, both developing and developed.

19. Feenstra and Rose (2000) develop both goods-based and country-based export rankings. We use the goods-based rankings; their approach assigns a higher rank to a country which exports higher ranked goods *earlier*. In turn, the goods' ranks are developed based on the *time period*

in which a good gets first exported: an *earlier* date of export for a particular good, across countries, signifies a *lower* ranking on sophistication. For further details on the methodology with which the indices are developed, please refer to their paper.

20. For the set of developing countries, we retain the rankings as in the original data.

21. Bruton (1986) says "the Brazilians tried to leap from where they were in the less developed country area . . . to the most developed country area . . . without moving step by step along the climb. They tried to do things that they could not do. . . . Contrast this with Korea, which depended much less on foreign investment, and hence did not seek to have what they could not themselves construct and manage. Brazil's activities were more often (than in Korea) in more advanced, more volatile activities where technology was changing rapidly."

22. *Source*: Gereffi and Wyman (1990, Table 1.6).

23. Fajnzylber provides an estimate of inequality in the two regions. In 1960, *all* land holdings in Korea and 84% of those in Japan were under five hectares in area, whereas in Brazil, only 1% of holdings were of this size; 44% of land holdings in Brazil were of sizes a thousand hectares or larger!

24. Per capita income in Korea was still a few hundred dollars lower in 1980—$1,700, as compared to Brazil's $2,200. Nevertheless, the difference in consumption numbers is dramatic.