Chapter Title: 5. Resource Endowments and the Real Exchange Rate: A Comparison of Latin America and East Asia

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5.1 Introduction

One of the most important puzzles of economic development is the postwar failure of Latin American economic growth in comparison with the dramatic growth in East Asia. Table 5.1 shows the per capita growth performance of several key countries in each region for the extended period from 1870 to 1990. The table highlights a striking fact: the relative growth performance of the two regions in the most recent period, 1960–90, is the *reverse* of the relative growth performance in the preceding period, 1870–1960. Even the recent Asian financial crisis is unlikely to reverse the long-term difference in growth since 1960. The reversal in relative growth performance over the course of a century should caution us immediately against simplistic theories ascribing Asia's successes, or Latin America's failures, to ostensibly stable social characteristics such as family structure, attitudes toward education, social trust, religion, or attitudes toward authority, which are frequently invoked to explain the differential growth performance of the two regions (though less so since Asia's financial crisis exploded in 1997!).

There is little doubt that much of the explanation of differential long-term performance lies in differing economic policies in the two regions, especially policies regarding international trade (see Sachs and Warner 1995a for a brief historical overview of trade policies, and Bulmer-Thomas 1994 for a comprehensive survey of Latin America). In the period 1870–1910, most of Latin America operated under a liberal trade regime that aimed to foster export-led growth of primary products. Argentina benefited enormously from export-led growth in grains and meat products; Chile enjoyed a boom in nitrates and cop-

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Table 5.1   **Annual GDP Growth Per Capita, 1870–1990: Regions and Selected Countries**

	1870–1910	1910–60	1960–90
Latin America	1.5	1.7	1.5
Argentina	2.7	0.7	0.6
Brazil	0.2	2.2	2.4
Mexico	0.9	1.3	2.0
Asia	0.6	0.7	3.6
China[a]	0.6	0.5	3.8
Indonesia	0.6	0.6	2.7
Thailand[a]	0.4	0.4	4.8

Source: Maddison (1995, app. D).
[a]1913 rather than 1910.

per; Bolivia grew on the basis of tin and silver; Brazil exported coffee and rubber; and so on. Northeast Asian countries such as Korea and Taiwan had few natural resources to support a comparable export boom. In the recent period, by contrast, much of Asia pursued open trade policies and export-led growth based on labor-intensive manufactures, while most of Latin America pursued relatively closed trade policies, with attempts at import-substituting industrialization.[1] In the postwar era, much of Latin America began to open to international trade only in the 1980s, after the failure of the import substitution strategy. *Thus we can say that in both periods, rapid GDP growth was favored by open trade and export-led growth.* The failures of Asian economies that were closed to trade in the recent period (North Korea, Vietnam until 1989, Myanmar, India until 1991) underscore the basic fact that growth has depended not merely on geography but on the trade (and other) policies pursued by the individual countries. Similarly, Chile was the first Latin American country to liberalize trade in the recent period, and its recent growth success demonstrates the possibility of export-led growth in Latin America.

It is easy, nonetheless, to fall into the trap of ascribing all of the difference in economic performance to economic policies. The purpose of this paper is to consider again the role that economic *structure* has also played in the relative growth performance of the two regions. In the late nineteenth century, abundant natural resources were the key to rapid growth in peripheral countries. Primary commodity export-led growth in countries such as Argentina was aug-

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1. The precise nature of the trade regimes in East Asia remains a matter of dispute. Some economies, such as Hong Kong and Singapore, were almost completely free trade economies. Others, particularly several Southeast Asian countries, including Indonesia, Malaysia, and Thailand, were moderately protective for final consumer goods, but nearly free trade for both capital goods and inputs used by exporters (e.g., through mechanisms such as export-processing zones). The northeast Asian economies of Korea and Taiwan were probably even more protective, on average, of final goods markets but similarly provided a regime of "(nearly) free trade for exporters" through duty drawbacks, tax exemptions, tax holidays, export-processing zones, and other related mechanisms.
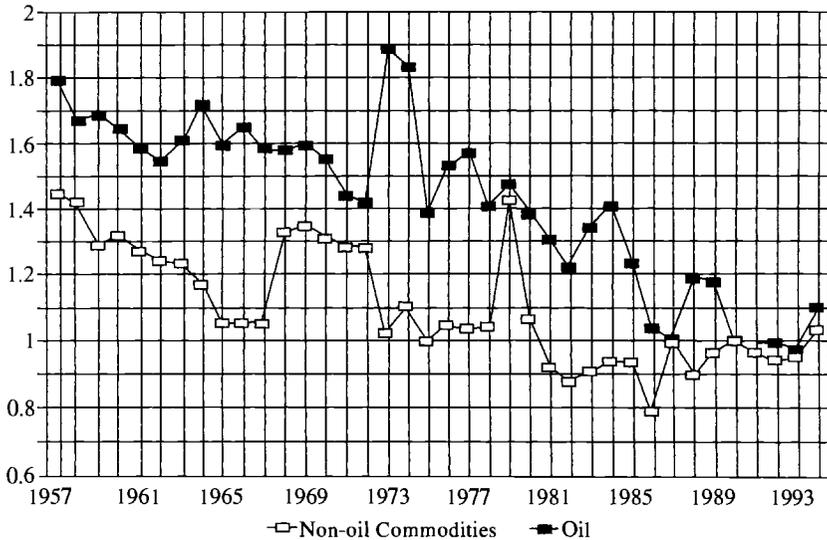
Fig. 5.1 Commodity price index versus industrial country export unit value, 1957–94

Source: International Monetary Fund, *International Financial Statistics* (Washington, D.C., various issues).

mented by rapid capital inflows from the advanced economies to build railways and other infrastructure in support of the export sector (see Bulmer-Thomas 1994, 102–8, for data on foreign direct investment and railway construction). In the past three decades, it has been the export of labor-intensive manufactures—especially apparel and electronics—rather than primary commodities that has played the key role in spurring developing country growth.[2] On one important issue Raul Prebisch seems to have been mostly right: primary commodities were not an effective base for sustained, long-term high growth in the postwar era (see his famous analysis of Latin American development, published as United Nations 1950). There appear to be two main reasons. First, the terms of trade have indeed tended to move against primary commodities over the postwar period, as Prebisch forecasted. Figure 5.1 shows the prices of nonoil commodities and petroleum relative to the unit export values of the industrial countries. The relative prices of both nonoil commodities and oil fell sharply between 1957 and 1994, by around 40 percent in the case of nonoil commodities and 24 percent in the case of oil. Second, productivity increases in manufacturing have outstripped productivity increases in primary produc-

2. The electronics sector in East Asia began with assembly operations (e.g., semiconductor assembly), using low-skilled labor and often in export-processing zones. As a result of increased investments, learning, technology transfer, and upgraded skills in East Asian economies, production shifted from assembly to high-technology operations (e.g., wafer fabrication) and production of more sophisticated consumer appliances.

tion and in services. This is shown, for example, in Chenery, Robinson, and Syrquin (1986), and in Young (1995) in the case of East Asia. Prebisch's serious miscalculations were twofold: first, his belief that manufacturing sector growth could be sustained on the basis of *internal* demand via import substitution and, second, his neglect of the possibility that developing countries could achieve export-led growth in manufactures. The recent path to success has in fact been to hitch growth to the *export* of labor-intensive manufactures, rather than to the substitution of capital-intensive manufacturing imports.

Note that the two factors—the terms-of-trade decline of primary commodities and relatively low productivity growth in the primary sector—are probably the reverse of the pattern at the end of the nineteenth century. In the earlier period, enormous advances in railways, ocean transport, refrigeration, and packaging, as well as the rapid industrialization underway in Europe and the United States, gave a boost to the international terms of trade of primary producers, albeit one punctuated by periodic short-term crises. Moreover, there were rapid technological advances possible through the introduction of new agricultural and mining techniques. We might also note in passing that in the future, technological changes in information processing and communications might once again alter the basis for the economic integration of developing countries into the world economy. Rather than export-led growth in primary commodities or labor-intensive manufactures, the next phase of development might favor export-led growth in the service sectors of the economy.

The theme of this paper is that economic structure, in addition to economic policy, has affected the capacity of countries to enjoy manufacturing export-led growth in the past 30 years, and even to avoid the kind of short-run macroeconomic crises that have plagued much of Latin America. In particular, East Asia's disadvantage at the end of the nineteenth century—the (relative) absence of land and natural resources—has been its *advantage* in the recent phase of the world economy. The striking difference in resource endowments in the two regions is shown in figure 5.2, where we show the population densities for eight East Asian and six Latin American countries. The Asian countries are all more densely populated than their Latin counterparts, typically by a very wide margin. Of course, land endowment is just one aspect of the differences between the regions: Latin America is also mineral rich, while much of East Asia (particularly northeast Asia) is mineral poor.

Broadly speaking, trade patterns match the resource endowments: the labor-abundant developing economies of East Asia have tended to export manufactures, while the land- and resource-abundant developing economies of Latin America have tended to export agricultural and mining products. Some striking evidence in support of this proposition is found in figure 5.3, adapted from Wood and Berge (1997). On the *x*-axis is a measure of relative factor endowments, years of schooling divided by land area, and on the *y*-axis is the ratio of manufactures exports to primary exports. The plot confirms that countries tend to export goods that are intensive in their abundant factors of production. In
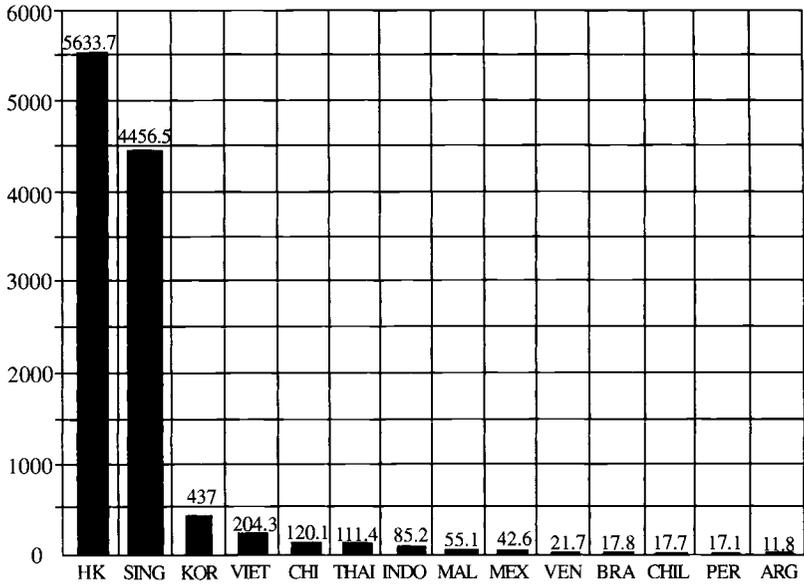
Fig. 5.2 Population density (per square kilometer)
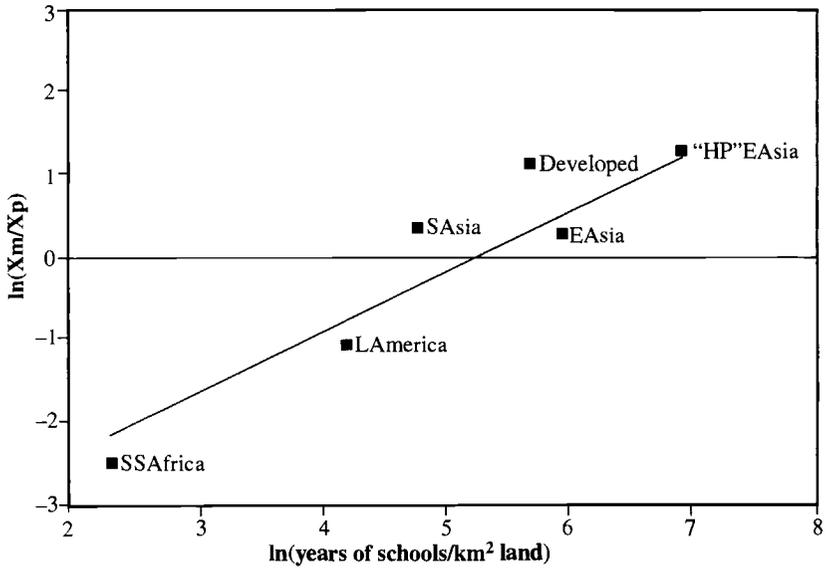*Source:* World Bank, World*Data.

Fig. 5.3 Resource endowments and trade
Source: Wood and Berge (1997).

Table 5.2   **Structure of Exports by Main Category (percent of total)**

Region	1970		1992	
	Primary[a]	Manufactures[b]	Primary[a]	Manufactures[b]
Americas	89.4	10.6	64.2	35.8
Chile	95.7	4.3	83.5[c]	16.5[c]
South and Southeast Asia	56.6	43.5	19.5	80.5
China	52.5	47.5	19.4	80.6

Source: United Nations (1995).
[a]Primary products include all food items, agricultural raw materials, fuels, ores, and metals.
[b]Manufactured products include SITC categories 5–8, except for 68.
[c]1993.

particular, labor-abundant economies tend to export manufactures, while land-abundant economies (Latin America and sub-Saharan Africa) tend to export natural resources. Table 5.2 shows that Latin American exports remain heavily based in natural resources, while Asia is predominantly a manufacturing exporter.

It is very likely that Latin America's low share of manufactured exports is a function not only of resource endowments but also of restricted trade practices. Manufacturing exports require, in general, access to imported primary and intermediate inputs and capital machinery at, or close to, world prices. Latin America's import substitution policies until the past decade certainly limited the scope for manufactured exports. For example, Morawetz's (1981) excellent study of Colombian apparel exports showed that Colombian manufacturers were severely hampered by the lack of access to necessary inputs, especially textiles, at world prices, because of a protective trade regime and inefficient administrative support for would-be exporters. On top of that, however, Morawetz shows that Colombia's coffee boom in the late 1970s also contributed to a real appreciation of the currency and a resulting profit squeeze in the fledgling textile and apparel export sector—the kind of phenomenon stressed in this paper. It is notable that Chile, after almost 20 years of open trade, is still predominantly a resource-based exporter rather than a manufacturing exporter. In 1993, the share of manufactures in total merchandise exports came to only 16.5 percent, as seen in table 5.2. Our focus in this paper is on the role of resource endowments, rather than trade policy, though a complete theoretical and empirical treatment will require the incorporation of both considerations.

The World Bank (1996a) has recently produced calculations on national wealth that underscore the differences in resource endowments by region. On the World Bank's methodology, national wealth is divided among human resources (human capital), produced assets (plant, equipment, structures, and inventories), and natural capital (land, minerals, etc.). As seen in table 5.3, the Asian regions (India and China, East Asia and Pacific) have very high propor-

Table 5.3   **Economic Growth and Sources of Wealth**

	Per Capita GDP Growth, 1985–94 (annual)	Per Capita GDP, 1994 (U.S.$)	Share in Total Wealth		
Region			Human Resources	Produced Assets	Natural Capital
Sub-Saharan Africa	−1.2	460	31	17	52
India and China	5.7	439	73	18	9
East Asia and Pacific (except China)	4.9	860	75	13	12
Latin America and Caribbean	0.6	3,340	50	15	35
Middle East and North Africa	−0.4	1,580	39	29	32

Sources: Annual growth rates and per capita GDP are from World Bank (1996b, table 1, basic indicators). Note that regional GDP growth rates and levels are based on population weights. Sources of wealth are from World Bank (1996a).

tions of wealth in human resources and low proportions of wealth in natural capital (below 15 percent). Sub-Saharan Africa, Latin America and the Caribbean, and Middle East and North Africa, by contrast, have much higher proportions of wealth (over 30 percent) in natural capital. We also see, once again, that resource endowments are at least loosely correlated with growth performance: the regions with a high share of natural capital endowment are also the regions with a low or negative rate of per capita GDP growth during 1985–94.

To summarize the argument of the paper, it seems that the Dutch disease is a disease after all, both with regard to long-term growth rates and short-term macroeconomic crises. As shown in a sample of more than 90 developing countries in Sachs and Warner (1995b), natural-resource-abundant economies tended to grow less rapidly than natural-resource-scarce economies in the period since 1970. Many factors probably contribute to this pattern, including political as well as economic factors. This paper discusses one major channel: the linkages from natural resources via the real exchange rate to long-term growth. Resource-rich and resource-poor economies differ markedly in the patterns of real exchange rate levels and changes, as well as in the linkages of the real exchange rate to income distribution and growth. The differing links of the real exchange rate to income distribution affect short-run macroeconomic management in the two regions.

Section 5.2 introduces an extremely simple baseline model of an economy with three sectors: natural resources, manufacturing tradables, and nontraded goods. Using this simple model, we trace the effects of four variables on the real exchange rate, income distribution, and growth: capital accumulation, capital inflows, currency devaluation, and skill accumulation. Resource-rich and resource-poor economies differ markedly in their adjustment patterns, and it is easy to illustrate how resource-abundant economies can get stuck in a no-

growth trap while resource-poor economies achieve rapid growth. In section 5.3 we then turn our attention to an empirical comparison of East Asia and Latin America, to assess the relevance of resource endowments versus alternative factors in recent economic performance.

5.2   A Basic Theoretical Model

Let us introduce an extremely simple framework to highlight the forces at play.[3] Suppose that there are just three goods: a natural resource R whose output is exogenous at R_0; a labor-intensive traded manufacturing good M, with production linear in labor input L_M; and a capital-intensive, nontraded output N, which uses labor L_N, a sector-specific capital K_N, and an internationally tradable input T_N in a constant-returns-to-scale production technology. (It would be straightforward to introduce more general neoclassical production functions without altering the main themes of the paper.) We assume that the domestic resource sector uses no domestic inputs (and we define the output R as net of any tradable inputs). Thus:

(1)
$$R = R_0,$$
$$M = \theta L_M,$$
$$N = N(L_N, \ K_N, \ T_N).$$

For simplicity, we assume that L_N and K_N are combined according to Cobb-Douglas technology to produce value added V_N, which is then combined with the intermediate input in fixed proportions to produce gross output. In particular,

(2)
$$N = \min[(L_N)^\alpha (K_N)^{1-\alpha}, \ T/\lambda].$$

This implies that the price of output in sector N can be written as a weighted sum of the value-added deflator P_V^N and the price of tradables, which we take to be numéraire:

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3. Of course, many theoretical treatments are available that highlight some of the phenomena at play. The important paper by Anne Krueger (1977) models an economy with a natural resource sector (using land and labor) and a multiindustry manufacturing sector, in which each of the manufacturing industries uses capital and labor in a neoclassical production function, but with varying degrees of capital intensity. A large natural resource sector leaves less labor for the manufacturing sector, and thus a higher capital-labor ratio in the sector. As a result, a natural-resource-abundant economy is more likely to produce capital-intensive manufactures (if it produces manufactures at all) and less likely to produce labor-intensive manufactures. The small size or absence of labor-intensive manufacturing industries is the major theme of the Dutch disease literature, and of this paper. Alan Deardorff (1984) extends the Krueger model to consider the role of trade protection. Edward Leamer (1987) offers a graphical account of a three-factor (capital, land, labor), multisector Heckscher-Ohlin model to show how resource abundance affects the sectoral allocation of productive factors and the economy-wide pattern of trade. Neither the Krueger nor Leamer model includes nontradable goods production.

(3) $$P_N = P_V^N + \lambda.$$

All consumers have identical tastes, which for simplicity we take to be Cobb-Douglas. A constant fraction β of income is spent on tradable goods, which we take as numéraire, and the remainder is spent on nontradable goods $(1 - \beta)$.

(4)
$$C_M = \beta,$$
$$P_N C_N = 1 - \beta.$$

Note that the consumer price index is simply

(5) $$P_C = P_M^\beta P_N^{1-\beta} = P_N^{1-\beta}$$

since the price of tradables is one.

The trade deficit equals final consumption of tradables, C_T, minus total production of tradables net of intermediate inputs of tradables. The trade deficit equals the net resource transfer NRT, which we take to be exogenous and generally set equal to zero:

(6) $$\text{NRT} = C_T - (R + M - T).$$

In addition, nontraded consumption must equal nontraded production:

(7) $$C_N = N.$$

Finally, full employment requires

(8) $$1 = L_M + L_N.$$

The labor supply is normalized to equal one, so that L_M and L_N signify the *shares* of labor allocated to each sector. We assume that the labor force is competitive, so that workers are paid their marginal value products. The marginal value product in nontradables is $P_N^V(\partial N/\partial L_N)$, so that the wage is given by

(9) $$W = P_N^V(\partial N/\partial L_N).$$

The marginal value product of workers in manufacturing is simply θ. If $W > \theta$, then wages are too high for the country to be competitive in manufacturing (barring trade barriers), and $L_M = 0$. Alternatively, if $W = \theta$, then both L_N and L_M are positive. The wage can never be less than θ since manufacturing firms have an unlimited demand for workers at the wage θ.

When R is large enough, L_M will equal zero. The economy relies entirely on its natural resource exports to cover its consumption demand for tradables as well as the derived demand for traded intermediate inputs into nontradable production. As stylized descriptions, we refer to the case of specialization in production ($M = 0$) as the "Latin American case" and the case of no specialization as the "East Asian case." We will discuss the empirical realism of these descriptions in section 5.3. Let us underscore here, however, that these desig-

nations are obviously a caricature. Some Latin American economies, such as Brazil, are highly competitive in manufacturing exports, while some East Asian economies, such as Indonesia and Malaysia, have significant natural resource endowments. Nonetheless, the labeling has broad analytical and empirical merit.

High R eliminates the tradable manufacturing sector through the usual Dutch disease mechanism. High R leads to high demand in the economy, and in particular for nontraded goods. This high demand causes P_N to rise (compared with the case of low R), and labor flows into the nontraded sector. Assuming that P_N is high enough, the entire labor force flows into nontradables, with the marginal value product of labor in nontradables remaining above the marginal value product of labor in manufacturing. Specifically, for the Latin American case to obtain we must have $P_N^V(\partial N/\partial L_N|_{L=1}) > \theta$. Note that the relative price of tradable goods to nontradable goods—that is, the real exchange rate—is simply $1/P_N$. Therefore, a rise in P_N is a real exchange rate appreciation, and a fall in P_N is a real exchange rate depreciation. The most common way to describe the Latin American case is that the large natural resource sector causes the real exchange rate to become so appreciated that labor-intensive manufactures are not profitable.

A key point of the analysis is that real wages tend to respond oppositely to changes in P_N in the Latin American and East Asian cases. In the Latin American case, the nontraded sector is the labor-intensive sector: a rise in P_N therefore raises the real wage. In the East Asian case, by contrast, the manufacturing sector is the labor-intensive sector: a rise in P_N therefore lowers the real wage. As a result of this crucial distinction, real wages—and much else in the economy—respond differently to exogenous shocks in Latin America and East Asia. As a result, the political economy of trade and monetary policy is also different. Patterns of endogenous growth may also be very different.

Consider a numerical illustration based on the following parameter values:

$$\alpha = 0.75,$$

$$\lambda = 0.25,$$

$$\theta = 1.0,$$

(10)

$$K_N = 1.0,$$

$$\beta = 0.5,$$

$$\text{NRT} = 0.$$

In this case, the East Asian case obtains for $P_N \leq 0.58$, while the Latin American case obtains for $P_N > 0.58$. As shown in figure 5.4, in the interval (0.25, 0.58), W/P_C is a declining function of P_N, while in the range (0.58, ∞), W/P_C is a rising function of P_N. (Note that P_N must be greater than or equal to 0.25, so that $P_N^V \geq 0$.)
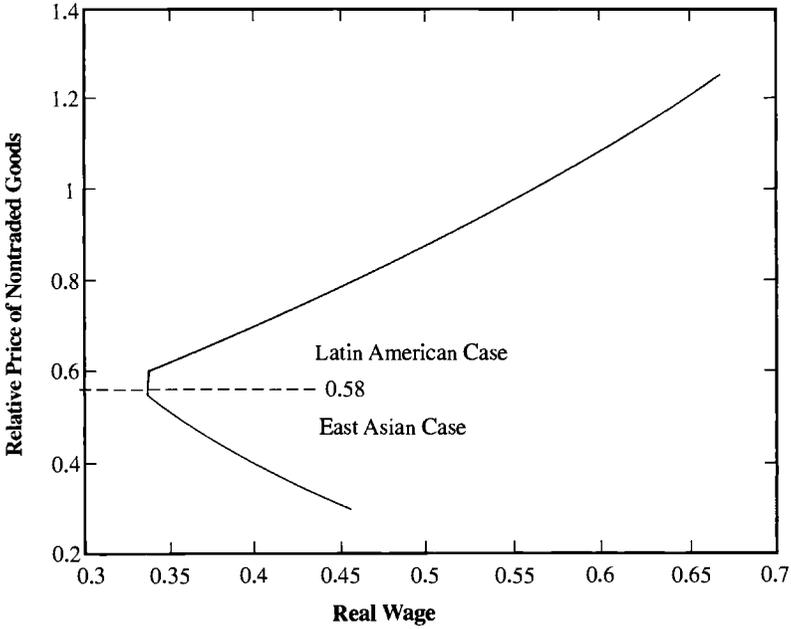
Fig. 5.4   Real wages and the relative price of nontradables

Events that tend to raise P_N have opposite effects on real wages in East Asia and Latin America. For example, a natural resource discovery can actually *lower* real wages in East Asia by bidding up the price of nontradable goods that are purchased by manufacturing sector workers. By contrast, in Latin America, a natural resource boom will tend to *raise* the real wage by pushing up P_N and thereby reducing the relative price that service sector workers pay for tradable commodities. To put it another way, imports look cheap to Latin urban workers during a resource boom. By contrast, housing costs look high to Asian manufacturing workers during a similar boom. The result is depicted in figure 5.5, which shows the relationship between R and W/P_C. As R rises from low levels, the real wage decreases. Eventually (at the point where $L_M = 0$), higher R starts to cause the real wage to increase.

Capital accumulation in the nontradable sector presents a special problem in the Latin American case. Suppose that K_N increases in Latin America. What happens to the real wage? Surprisingly, as shown in figure 5.6, the real wage *may decline,* even though the marginal physical product of labor expands. There are two main effects. On the one hand, W/P_N^V rises, because of the capital deepening in the nontradable sector. This of course tends to push up the real wage. On the other hand, the increase in nontradable production leads to a decline in P_N (relative to the numéraire good, tradable manufactures). This leads to a more than proportionate decline in P_N^V, which is equal to $P_N - \lambda$
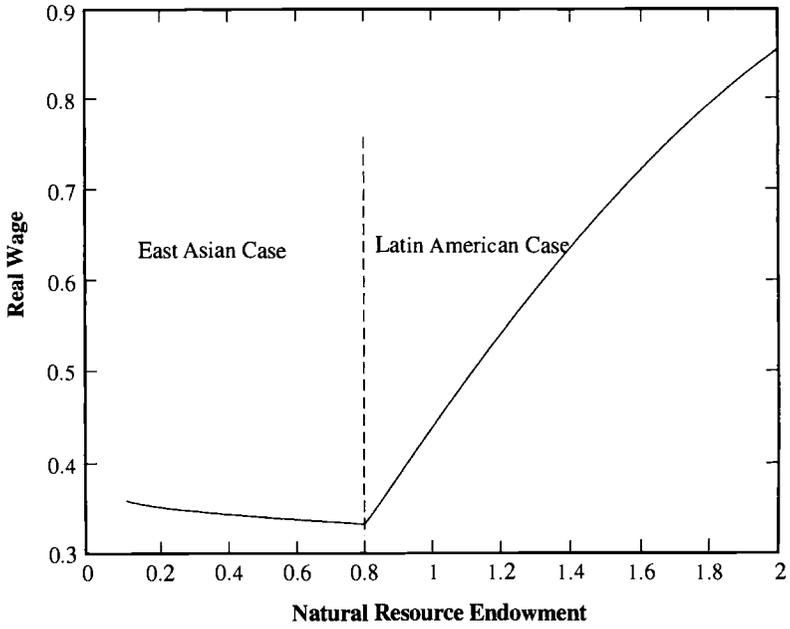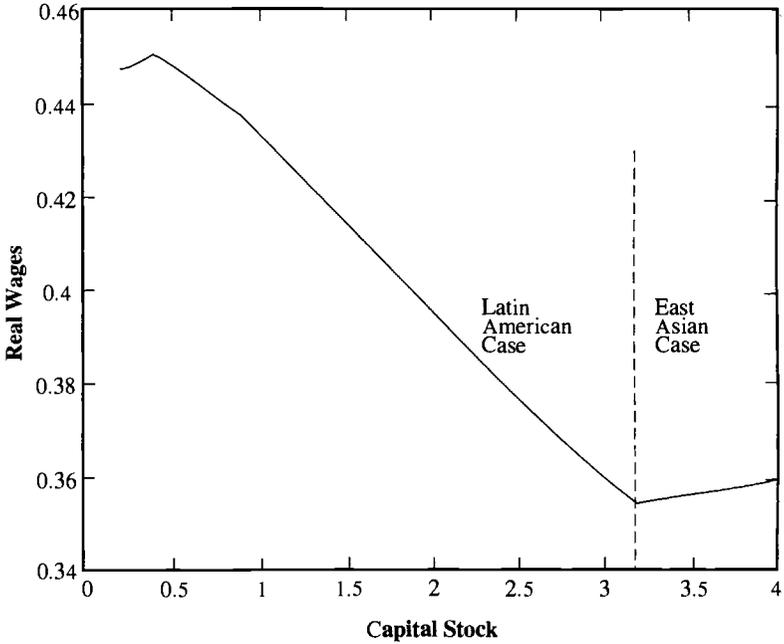
Fig. 5.5 Real wages and natural resource endowment

Fig. 5.6 Real wages and the capital stock in nontradables

(note that the proportionate decline in P_N^V is larger the larger is λ). The decline in P_N^V lowers the marginal value product of labor in nontradables and thus tends to *reduce* the real wage. While the overall effect is ambiguous, it is certainly possible that capital accumulation lowers, rather than raises, the real wage. In fact, the real wage might continue to decline with capital accumulation in nontradables until the wage is so low that the country becomes competitive in tradable manufactures. At that point, the country shifts from the Latin American to the East Asian case.

Consider a country like Venezuela, for example, which lives off a fixed flow of oil export earnings and has virtually no other exports. An improvement in nontradable infrastructure (e.g., financed by the government out of oil revenues) could actually lower real wages by forcing a real depreciation of the exchange rate. The problem would be interpreted by the general public as a balance-of-payments problem: higher nontraded production leads to increased demand for imports, against a backdrop of constant export supply. The real exchange rate therefore tends to depreciate (abstracting from short-run foreign borrowing). The real exchange rate depreciation, in turn, pushes up import costs and can lower the real wage (especially if the import component in nontradable production, λ, is large).

Notice what would happen as growth continues in the nontraded goods sector, pushing P_N and W/P_C still lower. Eventually the real exchange rate depreciates enough that the nominal wage falls to the level θ. It finally becomes profitable to produce labor-intensive exports in the country, and the economy enters the "East Asian region," with positive production of labor-intensive manufactured goods. For a country like Venezuela, with a large but fairly fixed stock of natural resources, the time path of the real wage may therefore be U-shaped. High oil revenues at the start give a high level of the real wage. Over time, as capital accumulates in the nontraded sector, the real wage declines. Finally, the bottom is hit as the country takes on the new vocation of manufacturing exporter. *This basic observation may help to account for the long-term stagnation or even decline in real wages in much of Latin America in the past 20 years. Stagnant primary exports have led to a prolonged slide in real wages, until these economies finally achieve competitiveness in manufacturing exports.*

If accumulation of K_N can lower the real wage in the Latin American case, does accumulation of capital in tradables tend to lower the real wage in the East Asian case?[4] The answer is no: the cases are not perfectly symmetrical. Latin America cannot easily raise export production since R is fixed, while East Asia *can* readily raise nontradable production through increased employment and capital in the sector. Therefore, a rise in capital in the tradable sector in Asia does *not* tend to lead to a sharp rise in the relative price of nontradables,

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4. Note that we do not formally model capital accumulation in the manufacturing sector. This deficiency can easily be removed in an extension to the model in the paper.

as long as nontradable production can expand. The rise in productivity of labor due to higher K therefore tends to outweigh any adverse effects on the real wage due to a rise in P_N.

It is easy to see that a nominal exchange rate devaluation will tend to have different impacts on the real wage in the two cases. Suppose that overall demand is determined, in part, by real money balances M/P_C. A nominal exchange rate depreciation will tend to reduce real money balances (and raise domestic interest rates, in the case of capital controls that isolate the home financial market from the rest of the world). The demand for nontradables will tend to fall, pushing down P_N. In East Asia, the result will be higher real wages (experienced as increased demand for labor in manufactures as a result of the devaluation). In Latin America, the result will be lower real wages (experienced as higher prices for imported manufactures). We can also note that foreign borrowing will tend to raise real wages in Latin America in the short run (by supporting an *appreciated* real exchange rate), while lowering real wages in East Asia. Of course, debts eventually come due and typically require a real exchange rate depreciation in order to pay them off. In Latin America, debt servicing therefore tends to require a sharp fall in real wages, while in East Asia, debt servicing may well be accompanied by an *increase* in real wages.

If we put these pieces together—a long-term slide in real wages of a commodity-rich economy, with short-run real wage movements depending on the nominal exchange rate and foreign borrowing—we can see the outlines of a political economy interpretation of macroeconomic crises in Latin America. For countries like Venezuela that are experiencing a long-term decline in real wages, overvalued nominal exchange rates and heavy foreign borrowing give a way to halt the slide of the real wage temporarily. Of course these are destructive palliatives in the longer term, but palliatives nonetheless. The deeper underlying problem is that export-led growth is blocked by an initially overstrong exchange rate, which undermines the competitiveness of manufacturing exports.

Perhaps the most interesting differences in economic performance relate to long-term growth. We have already referred to evidence in Sachs and Warner (1995b) indicating that resource-poor countries have fared better than resource-rich countries in economic growth over the period 1970–89, after controlling for other variables typically associated with growth, such as initial per capita income, trade policy, and national saving rate. Matsuyama (1992) offered a small endogenous growth model that could account for this pattern. In Matsuyama's model, the manufacturing sector is characterized by learning by doing that is external to the enterprise but internal to the sector as a whole. The resource-rich country specializes in the resource sector and never benefits from the learning by doing, while the resource-poor country specializes in manufacturing and begins automatically to enjoy productivity growth in that sector. The productivity growth, in turn, widens the comparative advantage of the resource-poor country in the production of manufactures, thus reinforc-

ing the initial trade patterns. The resource-abundant economy is more firmly locked into the export of natural resources and the import of manufactures, all with a stagnant economy, while the resource-poor country enjoys long-term growth based on learning by doing in manufactures.

The following (sketch of a) model extends Matsuyama's framework to allow for a nontraded goods sector, while relaxing the assumption of learning by doing that is external to the firm. The latter extension is worthwhile since recent empirical evidence (e.g., Young 1995) casts some doubt on the role of pure technical change in Asia's rapid growth in the past 30 years. Empirical evidence suggests that productivity growth is indeed most rapid in manufacturing, but that the productivity growth is based on higher capital intensity and higher skills of workers, rather than on dynamic external economies of scale or learning by doing. We therefore suggest a simple model that is compatible with these observations.

Suppose that there are overlapping generations of workers, with each generation a constant population size equal to one. Individuals live for two periods. Total population at any time is therefore two, with half old and half young. All workers are born unskilled and work as unskilled laborers in the first period. Workers in the first period may acquire education in order to become skilled workers in the second generation (thus being "educated" and being "skilled" are synonymous in this model). For simplicity, we assume that education is pursued in addition to first-period work (e.g., in night school). The skills obtained in education augment the productivity of workers in the production of traded manufactures M, but not in the production of nontraded final goods N. Young workers choose whether or not to pursue an education depending on the monetary returns to being educated in the second period. There are four sectors in the economy: natural resources, traded manufactures, education, and nontraded final goods.

The education process uses an input of $\sigma < 1$ units of an older skilled worker to convert one unskilled worker into a skilled worker. The level of skill of the worker can be measured by the productivity of the worker in the production of manufactures. An unskilled worker has a constant marginal productivity equal to θ^U, while a skilled worker in period t has productivity equal to $\theta_t^S > \theta^U$. Skilled workers are divided between work in manufacturing L_M and work in teaching L_T. At the maximum, the demand for teachers is given by $L_T = \sigma < 1$, in the case where the entire younger generation enrolls in schooling. In the equilibria that we examine, all younger workers either enroll in education or all forgo education. Therefore, in equilibria in which education is pursued, the entire older generation is composed of skilled workers, $\sigma < 1$ percent of the old workers are teachers, and $1 - \sigma > 0$ percent are manufacturing workers. Since the wage of manufacturing workers is equal to θ_t^S, competitive labor markets will ensure that the wage of teachers is also θ_t^S.

The next assumption is critical. We assume that the future productivity of students enrolled at time t depends on the productivity of their teachers at time

t. Specifically, with θ^S_{t+1} the future productivity of today's students and θ^S_t the productivity of today's teachers, we posit

$$(11) \qquad\qquad\qquad \theta^S_{t+1} = (1 + \mu)\theta^S_t .$$

In this way, each generation is better trained than the previous generation, resulting in sustained, endogenous growth.[5] Consider, now, the choice of a young worker as to whether to pursue an education. Since education makes sense only to join the manufacturing labor force (since nontraded goods do not use skilled labor), the young worker must look to the future skilled wage in manufacturing. The future wage with an education is therefore θ^S_{t+1}. Denote the future unskilled wage as W^U_{t+1}. Workers choose an education if the discounted wage advantage of being educated exceeds the direct costs of an education:

$$(12) \qquad \text{If } (\theta^S_{t+1} - W^U_{t+1})/(1 + \delta) > \sigma\theta^S_t, \text{ then choose education;}$$

$$\text{if } (\theta^S_{t+1} - W^U_{t+1})/(1 + \delta) < \sigma\theta^S_t, \text{ then choose no education.}$$

Now, let us consider the differing dynamics of Latin American–type and East Asian–type economies. Suppose that both economies begin with a young generation of unskilled workers and an older generation of skilled workers with initial skills θ^S_1. Consider first the Latin American case. As usual, the Latin American–type economy has a large constant flow of earnings of R, which pushes up the unskilled wage in services. Indeed, it can easily be the case that $W_N > (1 + \mu)\theta^S_1 > \theta^S_1$, so that *unskilled* workers in services today earn more money than both *skilled* manufacturing workers today, θ^S_1, and *even more skilled* workers tomorrow, $(1 + \mu)\theta^S_1$. In this case, today's skilled workers will work in the service sector rather than in manufacturing or teaching, and *today's young have no market incentive to pursue an education*, since they know that they will earn more as unskilled workers in services than as skilled workers in manufacturing in the next period. As a result, the economy specializes in nontraded final goods, with no manufactures or education. The economy remains stagnant over time.

Now consider the East Asian case. With R small or zero, W_N is less than the wage of skilled workers in manufacturing. The older skilled workers therefore all work in manufacturing or education. Young unskilled workers may be divided between manufactures and the nontraded final goods sector, or they may work entirely in the nontraded sector, depending on parameter values of the economy. As long as the first condition in equation (12) holds, all young unskilled workers choose to become educated, and the skill level of the skilled workers rises in the next generation. Equation (12) continues to hold each period, so that in each period the young generation becomes educated and yet

    5. Notice that in a growth-accounting framework, the endogenous growth would not show up as rapid growth in *total factor productivity* in manufacturing, but rather as a rapid improvement in the skill level of the labor force, which has been observed in the East Asian economies.

more skilled, since each new generation is trained by more skilled teachers than the previous generation. Sooner or later, all unskilled workers work in the nontraded goods sector. The volume and world market value of traded manufacturing production grows at the rate μ, while the value of nontraded sector production, $P_N N$, remains a fixed fraction of the traded goods sector and thus also grows at the same rate (though employment and physical production remain unchanged in the nontraded goods sector).

Why do the two economies diverge after they have reached identical levels of per capita GDP? This divergence results from the *composition* of GDP. In East Asia, GDP is composed heavily of human capital, rather than natural resources, and the returns to the continued accumulation of human capital are high. In the Latin American–type economy, human capital is low, and the returns to human capital accumulation are also low. Schooling is not very effective, partly because the quality of teaching is also low. The Latin American–type economy ends in a low-level-income trap. One way out of the trap is clear. If Latin America could generate a sufficient accumulation of human capital—for example, through a temporary subsidization of education for one or more generations—then skilled workers would work in manufacturing rather than in nontraded production, and the incentive for further investment in manufacturing skills would also be enhanced. The intergenerational equity and efficiency properties of alternative subsidization schemes are yet to be investigated.

The next step of the theoretical argument should be to expand the model to allow for capital accumulation, including foreign-financed capital, in the tradable manufacturing sector. Arguments analogous to the case of education can be established: the strong real exchange rate of resource-abundant economies will tend to crowd out capital accumulation in labor-intensive manufactures. Resource scarcity, on the other hand, will favor rapid capital accumulation and the inflow of capital from abroad. An additional important step would be to consider the interaction between resource abundance and trade policy. For a resource-rich economy, even moderate levels of protection could be sufficient to eliminate the profitability of manufacturing exports, while for a resource-poor economy, manufacturing exports might remain profitable even in the face of moderate import protection. It is at least suggestive that when resource-rich Malaysia embarked on manufacturing exports in the early 1970s, it relied on free trade for exporters (i.e., access to all imported inputs and capital goods free of tariffs) through the introduction of special export-processing zones, especially for the electronics sector. Even moderate protection might have been enough to frustrate the start-up of manufacturing exports.

5.3   Empirical Evidence

As shown in Sachs and Warner (1995b), a standard growth equation, including initial income and other standard variables in cross-country growth models,

confirms the role of structural variables in helping to account for differential growth patterns. Whether we proxy the resource base by population density, the ratio of manufactures exports to total exports, or the ratio of resource-based exports to GDP, we find that resource-abundant economies have tended to grow less rapidly than resource-scarce economies. Of course, other variables also played a role in determining cross-country growth, especially initial incomes, trade policies, and fiscal policies. What is especially notable in examining the high growth performance in East Asia is the crucial role of manufacturing exports, especially textiles and apparel in the early stage of export-led growth and electronics at a later stage. Only two countries in the world with populations in excess of one million have sustained rapid growth during the past decade without a heavy reliance on the growth of manufacturing exports.[6]

Interestingly, growth patterns *within* East Asia also support the general view that structural factors have contributed to long-term growth performance. The fastest growing countries (annual per capita GDP growth) in the region during 1970–89—South Korea (6.8), Taiwan (6.6), Hong Kong (6.1), and Singapore (6.8)—are also the countries with the smallest per capita endowments of land and natural resources. The resource-abundant economies—Indonesia (4.9), Malaysia (4.1), and Thailand (4.0)—have had slower, though still very high, long-term economic growth. Moreover, it appears that for the resource-abundant countries, very rapid sustained growth emerged in the mid-1980s, approximately one decade after the first group, and only when the latter countries embarked on a boom in labor-intensive manufacturing exports.

Table 5.3 provides some further support for the real exchange channel linking resource endowments to growth. For the year 1970, around the start of the rapid growth phase in East Asia, we calculate the ratio of a country's nominal GDP in U.S. dollars (measured at the market exchange rate) to its GDP in U.S. dollars at purchasing power parity, $GDP^{\$US}/GDP^{\$US.PPP}$, and denote this ratio as Π_i for country i. When Π_i is high, domestic prices in the country, converted to U.S. dollars, are above world dollar price levels. If tradable goods prices are approximately equal across countries, and if overall prices are a weighted average of tradable and nontradable prices, then a high ratio will indicate a high relative price of nontradable goods. The theoretical observations of section 5.2 suggest that resource-rich economies should have a high relative price of nontradable goods, and thus a high value of Π_i. Considering a sample of East Asian and Latin American countries, we indeed find that the labor-abundant economies tended to have lower domestic price levels than the resource-abundant economies. This is true not only between East Asia and Latin

6. World Bank (1996b, 188–89, table 1) lists 11 countries with per capita GDP growth during 1985–94 in excess of 5 percent per annum: Botswana, Chile, China, Hong Kong, Indonesia, Ireland, Korea, Malaysia, Mauritius, Singapore, and Thailand. Botswana and Chile remain substantially primary commodity exporters, while the other nine have all had very rapid growth of manufacturing exports.

America but also within East Asia (comparing resource-abundant Indonesia, Malaysia, and Thailand with the labor-abundant economies).

We mention, in conclusion, that two important findings of the World Bank's (1993) *East Asian Miracle* are also consistent with the viewpoint taken here. First, at the start of the fast-growth phase, the East Asian economies had much higher primary enrollment rates than other developing countries at the same per capita income levels (World Bank 1993, 45, fig. 1.8). This is consistent with the view expressed earlier that the returns to education have been higher in the resource-scarce economies, since unskilled wages are not bid up by Dutch disease effects. It remains to check whether, on a cross-country basis, enrollment rates can indeed be linked to the natural resource base, with resource-abundant economies having *lower* enrollment rates at given levels of per capita income. Second, the East Asian economies, not surprisingly, have tended to have a *higher* share of GDP originating in manufacturing than would be predicted by a simple cross-sectional regression of sectoral production shares on per capita GDP and population (World Bank 1993, 306, table 6.15). Once again, it remains to verify on a cross-country basis that the share of GDP in manufacturing is negatively related to resource abundance.

5.4 Conclusions and Extensions

Comparisons of economic performance across countries or regions should be based on three pillars, comparisons of economic policies, economic structure, and initial (historical) conditions. Economic performance differs according to the policies that are pursued; the underlying economic and social structures (including factor endowments, climate, topography, geography, cultural patterns); and specific historical conditions. The earliest comparative analyses of country performance, such as by Montesquieu, tended to put great stress on economic and social structures, but at least since Adam Smith, economists have rightly pointed to economic policies as the centerpiece of comparative analysis. What should be clear, however, is that all three factors are crucial to an adequate comparative analysis of economic performance.

This paper returns to a classic theme of Latin American historiography: the special dependence of the region on natural resource sectors. A century ago, resource-based development was at the center of economic growth; in recent decades, resource dependence has probably contributed to underlying crises and stagnation. If it is true that rapid productivity growth in recent years has come mainly in manufactures, then countries endowed with labor and human capital rather than natural resources might indeed have a structural advantage in reaping the benefits of open trade. (The evidence also suggests, however, that even for resource-based economies, open trade significantly outperforms strategies built on closed trade, viz. Chile). The theoretical models in this paper highlight some of the problems that confront countries with large but relatively

static resource-based sectors. Nonetheless, this work remains very sketchy and preliminary. A number of empirical hypotheses have been introduced but are as yet untested. For example, the specific proposition that the returns to schooling have been higher in resource-scarce economies is testable. Even the basic linkages between resource endowments and high relative prices of nontradables have, as yet, only been examined superficially. On the theoretical side, it is important to extend the analysis to include a richer production structure in the resource sector (e.g., explicitly modeling agriculture), capital accumulation and international capital movements, and various aspects of trade policy.

It is also worth stressing, in conclusion, that the bases for long-term comparative advantage will change along with changes in technology and global resource endowments. Just as Latin America's commodity-based growth of the end of the nineteenth century could not be sustained in the middle of the twentieth century, it may be true that the highly labor-intensive manufacturing growth of the second half of the twentieth century will give way to new kinds of export-led growth (e.g., of labor-intensive services via high-capacity international data transmission). The study of long-term comparative advantage of developing countries seeking to integrate into the world economy remains a high priority of applied research in international economics.

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Comment   Kazuo Ueda

In this interesting paper, Sachs discusses the relationship between the structure
of an economy, as defined by resource endowments, and its potential for
growth led by productivity improvements in the manufacturing sector. He also
seems to open the way to potentially fruitful areas of research, such as the role
of economic structure for the determination of the effectiveness of trade poli-
cies as a strategy for growth.

The main discussion has three parts (presented in sections 5.2 and 5.3). In
the first part a static general equilibrium model of a small open economy is
constructed and used to analyze a version of the Dutch disease problem. Spe-
cifically, a larger endowment of natural resources, by raising income and the
demand for nontraded goods, results in a higher relative price of nontraded
goods and thus in a smaller share of the manufacturing sector. Beyond a certain
point the economy enters a "Latin American region" where there is no manu-
facturing sector at all.

The second part of the paper appends to the model an endogenous growth
story whereby investment in human capital in the manufacturing sector creates
the possibility of sustained growth. Such growth may not occur in an economy
with a large nontraded goods sector. In such an economy real wages in the
nontraded goods industry are too high to create an incentive for human capital
investment for workers. Thus the Dutch disease becomes a chronic disease.

The third component of the paper (section 5.3) is the confrontation of the
implications of the theoretical analysis with the data. Sachs argues that the
model explains very well the divergent growth behaviors of Latin American
and East Asian economies.

Let me make some comments on each of the three aspects of the paper. In
the first part, some special assumptions are made to derive the strong implica-

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tions of the model. For example, the manufacturing (= traded goods) sector is assumed to be more labor intensive than the nontraded goods sector. Moreover, it is assumed that the manufacturing sector uses only labor in the production process.

A reversal of the factor intensity assumption will change some of the comparative statics results. For example, it would change the relationship between the relative price of nontraded goods and real wages. This is serious because many of the results of the paper turn on real wages being relatively higher in Latin America.

The relaxation of the manufacturing sector production function to include capital as a factor of production in the usual way makes Latin America less likely to specialize in nontraded goods (and resources). Under no-specialization, real wages will be equalized between the nontraded and manufacturing sectors. This would make it difficult for the author to argue in the second part that endogenous growth will not occur due to high wages in the nontraded goods sector.

The endogenous growth story based on investment in human capital in the manufacturing sector is neat but does not make clear why Latin America could not grow based on a different mechanism.

The growth story in the paper corresponds to that of Balassa-Samuelson. That is, productivity growth in the traded goods sector, by increasing income and, in turn, demand for nontraded goods, results in real exchange rate appreciation. The empirical evidence on this relationship between growth and the real exchange rate as reported by Ito, Isard, and Symansky (chap. 4 in this volume) is at best mixed. Japan, Taiwan, and Korea conform to the pattern. But the pattern does not seem to hold as clearly for other countries.

To summarize, the paper provides a neat and intuitively appealing story about why resource-poor countries performed well in the age of export-led growth in manufacturing. We are left with the feeling, however, that there could be and will be other types of sustained growth and that explaining changes in the pattern of growth will be a much harder task.