

REINTERPRETING THE AMAZON RUBBER BOOM:

Investment, the State, and Dutch Disease*

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Few periods in South American history have so captured the imagination and begged the attention of scholars as the Amazon rubber boom. For fifty years, the extraction of wild rubber from the jungles of the Amazon fueled unprecedented economic expansion in the region: per capita incomes in the Brazilian Amazon climbed by 800 percent; the regional population increased by more than 400 percent; urban centers and secondary towns blossomed along the river banks; and the vast Amazonian forest lands were integrated into national political spheres and the international market economy.¹ But when low-cost rubber from British plantations in Asia flooded world markets in the 1910s, rubber prices plummeted, sharply curtailing financial returns from wild rubber extraction. The price shock drove scores of traders and export houses into bankruptcy when they were unable to collect debts that were based on the future value of rubber. Urban real estate prices crashed, and service industries withered along with their customers' incomes. By the early 1920s, the boom was over, and per capita income levels had shrunk to pre-boom levels. Today, nearly a century later, such incomes (in real terms) have yet to return to boom levels in many areas despite massive state investment in Amazonia.

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1. For estimates of growth in population and gross domestic product per capita between 1800 and 1970 in the Brazilian Amazon, see Santos (1980, 12–13). The extent to which the Amazon had become a major trading region is evident in data presented by LeCointe (1922, 1:283–84). In 1912 the Brazilian Amazon had the eighth-highest trade coefficient (that is, the value of exports plus imports per capita) in the world (459 francs or 89 dollars per capita), less than Holland (346 dollars) or England (113 dollars) but greater than Germany (83 dollars), France (56 dollars), the United States (26 dollars), and Brazil as a whole (19 dollars).

A rich literature has developed on the Amazon rubber boom that offers a variety of interpretations of social conditions during the era and its cultural, economic, and environmental legacies. Many works have recounted the human story of rubber as one of exceptional opulence, exploitation, and cruelty (e.g., Hardenburg 1912; Wolf and Wolf 1936; Collier 1968). This view continues to hold sway with some analysts (see Glade 1989). Recent scholarly contributions from North and South suggest a florescence of academic interest in the era, with more than a score of books and articles published during the 1980s. Most of these works manifest another longstanding theme that asks why this period of massive growth and prosperity did not lead to sustained economic development in Amazonia. This question is particularly appropriate today as the governments of Amazonian countries look to the jungle as a trove of untold wealth, a vent for surplus investment, and a frontier for absorbing the landless poor, and as they consider how best to promote more economically and environmentally sustainable development in the region.

Our review of the recent literature on the Amazon rubber boom suggests the need for a new look at the era, an opinion based on three observations. First, the central question that has preoccupied scholars requires explaining the counterfactual: why sustained development did not follow the boom. This kind of explanation demands a lot of specific knowledge of the era (that is, all necessary and sufficient conditions for economic development over time). Moreover, the focus on failure becomes distracting and tends to limit attention to the development that actually occurred during the era. Second, recent works have underemphasized microeconomic factors like risk, transaction costs, relative factor scarcities, and the nature of industry competition, all of which have profoundly shaped the organization of the wild rubber industry. Primacy is given instead to the nature and role of social relations in the rubber industry and their effect on development, and yet these same social relations are poorly understood when the microeconomic conditions shaping their structure and conduct are not clearly specified. Third, research on the boom has discounted the degree and significance of geographical variation in the relations of production and development across the Amazon Basin. Most studies have been confined to a specific region or country and have suggested that conditions elsewhere in the basin were similar.² The resulting views of the development process during the boom are therefore oversimplified and underidentified, seeking monocausal factors to explain general as well as specific development

2. Recent studies are available for Brazil (Weinstein 1983b), Peru (Bonilla 1977; Pennano 1988; Flores Marín 1987), Bolivia (Fifer 1970), Colombia (Domínguez and Gómez 1990), and Venezuela (Iribértégui 1987). Often the experience of a particular rubber baron or rubber firm (operating within a large but circumscribed region) has been taken as representative for that particular country or the entire basin.

failures throughout the basin. The result is that few definitive lessons can be drawn to guide proposals for promoting regional economic development or rain-forest conservation in Amazonia.

Our previous work offers a detailed microeconomic analysis of the organization of the wild rubber industry (see Barham and Coomes 1994; Coomes and Barham 1994). We contend that earlier arguments offered about how social relations either thwarted local surplus retention or blocked introduction of more efficient forms of organization are mis-specified. Our analysis presents alternate explanations of the relative inelasticity of supply of wild rubber, the durability of social relations, and the reasons why wild rubber extraction was not replaced by plantation production in Amazonia. Our intent has been to shift the focus of attention toward patterns of accumulation associated with local surplus retention and thus to provide a stronger foundation for studying the main theme of this article: how the private and public investment patterns associated with the boom created an economic structure that was extraordinarily vulnerable to weakness in the rubber sector.

This article will go beyond explaining what went wrong in the rubber era or why development did not happen. Indeed, our principal aim is to understand what actually did occur during the rubber boom in order to identify the major legacies of the era for subsequent regional economic development. Central to this effort is the need to connect the specific logic of activity within the rubber sector with the patterns of private and public investment during the boom and the resulting structural changes in the Amazonian economy. Particularly helpful in this effort is the “Dutch disease” theory of resource booms developed by W. M. Corden and J. P. Neary (1982), which explains the perverse effects of a boom sector on the performance of an open economy. Our article pays attention throughout to geographical variations in the impacts and legacies of the boom to inform understanding of the nature and dynamics of the rubber economy.

PREVAILING VIEWS ON THE RUBBER BOOM AND AMAZONIAN UNDERDEVELOPMENT

Most contemporary work on the Amazon rubber boom examines the question of why the boom did not lead to sustained economic growth and social change in Amazonia. In seeking to understand the failure of development in the region, scholars have studied the history of the boom in several Amazonian countries (see Melby 1942; Santos 1980; Weinstein 1983b; Flores Marín 1987; Pennano 1988; Domínguez and Gómez 1990) and have considered related problems of plantation development (Dean 1987), supply inelasticity (Higbee 1951), and the social and cultural effects of the rubber trade (Murphy and Steward 1956; San Román 1975; d’Ans

1982; Haring 1986; Hemming 1987). In surveying these works, we have identified three basic perspectives on this question: the dependency view, the political ecological thesis, and the Marxist view. We will review the basic arguments for each perspective and draw on our previous work to refute previous explanations as to why the Amazon rubber boom did not lead to sustained development.

Dependency and Underdevelopment

The dependency school provides a macro-level perspective on the problem of limited sustained development in the wake of the rubber boom. This perspective is most evident in accounts of the era in Peru (San Román 1975; Bonilla 1977; Chirif and Mora 1980; Flores Marín 1987). According to this view, exceptional profits that accrued from the rubber trade were transferred out of the region and thus made unavailable for local development. Surplus was extracted within the region through unequal exchange maintained by debt-peonage and coercion. Foreign firms, perceived as operating as a monopoly or monopsony (Bonilla 1977; Flores Marín 1987), and domestic elites (Santos 1980; Haring 1986) extracted the surplus and chose not to invest in the region. The Amazon Basin was thus converted into an extractive enclave analogous to the coastal guano- and nitrate-rich areas of South America (see Levin 1960).

The argument that surplus transfer from the rubber trade caused regional underdevelopment is singularly unpersuasive. High labor and local capital earnings as well as the existence of a variety of labor relations in addition to debt-peonage raise serious questions about the effectiveness of unequal exchange for extracting surplus from the region (see Barham and Coomes 1994). The many firms and markets involved in rubber suggest that trade was not monopolized by foreign or domestic firms and that direct foreign investment came late to the region and was decidedly unsuccessful (Weinstein 1983b). More important, considerable surplus was retained in the region via private investment and state expenditures of export tax revenues or exports. Sufficient evidence suggests that the dependency interpretation is overgeneralized, simplistic, and incompatible with historical data from the period.

The Political Ecology of Underdevelopment

The persistent leading role of extractive industries in Amazonian economic history and the concomitant degradation of rain-forest resources inspires a second view that perceives the main consequences of extraction, including that of wild rubber, to be the underdevelopment of Amazonia and marginalization of its rural people (Ross 1978; Bunker 1984, 1985; Domínguez and Gómez 1990). In their study of extraction in the

Colombian Amazon, Camilo Domínguez and Augusto Gómez conclude, "as each cycle ended, the geographical and social balance left for the region was negative: it had retrogressed rather than advanced. . . . The extractive economy, as such, does not produce development" (1990, 60).

The political ecological thesis of underdevelopment for Amazonia is perhaps best developed by Stephen Bunker (1984, 1985). Extracting natural resources from the rain forests has produced a net outflow of value and energy from the basin that reduces directly and indirectly future options for productive (and extractive) activities in Amazonia. The continual dependence by local elites on resource extraction to generate export earnings shaped a political economy that reinforced the importance of extraction while successively undermining the resource base on which the region depends. The result in Amazonia has been perpetual cycles of natural resource extraction, environmental destruction, impoverishment, and underdevelopment.

The underdevelopment interpretation has a certain intuitive appeal. Anyone who has witnessed firsthand the predatory extraction of one plant or animal species after another from the rain forest and waters of Amazonia or studied the environmental history of the region can appreciate the concern over resource degradation. The political ecological thesis is limited, however, in its ability to reveal the logic of the rubber era or to explain why sustained economic development did not follow the boom. The thesis is neither product-specific nor era-specific but rather treats extraction as a cyclical and long-term process of resource exploitation.³

Martin Katzman has argued in a pithy critique of this thesis (1987) that resource exploitation is not necessarily self-limiting in that the carrying capacity of the environment can be increased or trade can provide for what is unavailable locally. He also asserts that economic behavior cannot be explained adequately by theories of energy value. Moreover, changing world demand has continually redefined the natural endowments of Amazonia and brought new products to market. Although environmental degradation such as deforestation, overfishing, and overhunting has accelerated rapidly, the set of natural (economic) resources demanded from Amazonia has expanded at a rapid rate, probably even faster than extinction due specifically to product extraction. Whereas the set of subsistence resources involved (for example, foods, fibers, and construction materials) may be somewhat more restricted and culturally defined, the

3. Bunker (1984) developed an argument that applies more specifically to the rubber era and why development was not sustained. His argument centers on two ideas: the importance of labor scarcity as the main constraint on the transformation from extraction to plantation production of rubber and the insufficient local accumulation that resulted from the social relations of extraction. We have also used labor scarcity as part of our argument for the plantation question (Coomes and Barham 1994), but we offer an alternative interpretation of local accumulation possibilities.

number of natural products of the rain forest with potential commercial value appears to be very large. Furthermore, not all resources have been harvested in a nonrenewable manner, a case in point being hevea rubber, the main type of wild rubber collected during the boom. Finally, the thesis regarding the political ecology of underdevelopment relies on a purported failure in local surplus retention and on a combination of dependency arguments about unequal exchange and a lack of surplus generation because of the apparent inefficiency of extraction. In sum, the political ecology thesis is perhaps more instructive in studying long-term trends in resource use in Amazonia than in analyzing the specific case of wild rubber and the rubber boom.

The Marxist Thesis of Blocked Development

Barbara Weinstein's work on the Amazon rubber boom has expressed in Marxist terms a coherent, empirically specific, and compelling view (1983a, 1983b, 1985, 1986). She has argued that sustained economic development in the post-boom period was frustrated not by surplus drainage from Amazonia but by the persistence of precapitalist relations of production. Specifically, an alliance emerged during the boom between rubber tappers (who owned the extracted rubber and controlled the means of production) and rubber traders (who controlled the exchange of rubber) that prevented the penetration of capital and the proletarianization of labor. Precapitalist relations effectively blocked regional development by stifling capital accumulation, modernization of the wild rubber industry, and the development of significant internal markets and other sectors (Weinstein 1983a, 135–36; 1983b, 96, 263–65). A related neo-Marxist view acknowledges the importance of untransformed relations of production but adds the *dependentistas'* emphasis on the articulation of domestic and foreign economies in international trade (see Pennano 1988).

The Marxist view resulted from much-needed attention to actual conditions of rubber extraction and trade in Amazonia during the boom and holds considerable currency among students of the Amazon (e.g., Schmink and Wood 1992, 45; Hecht and Cockburn 1989, 62), but the argument is deficient in several respects. In its barest form, the Marxist argument is tautologous: (capitalist) development did not occur because precapitalist relations were not transformed. But the crucial question remains, why did precapitalist relations persist and effectively block development? Weinstein attributes the persistence to tapper resistance, rooted in an overriding need for personal autonomy and a natural disdain for wage labor, and to trader resistance, based on their determination to control trade (1983a, 1983b, 1986). In her view, individual tapper preferences and choices produced *de facto* class resistance to capitalist relations, which monopolistic traders readily reinforced.

The argument developed in Barham and Coomes (1994) suggests that Weinstein's arguments are problematic in several ways. What Weinstein views as autonomy-seeking behavior of tappers cannot be distinguished from the autonomy inherent in the dispersed nature of wild rubber extraction, which makes monitoring of labor effort prohibitively expensive. The argument for tappers' preference for autonomy over more remunerative arrangements can thus be sustained only by assertion. Moreover, the ability of traders to monopolize exchange is dubious given the low barriers to entry in trading, the mobility of river traders, and the abundant opportunities for pirate buying of rubber from tappers along the rivers. A more compelling explanation of the durability of the trader-tapper debt-merchandise contract is its efficiency when compared with other contractual arrangements in this decentralized, labor-scarce environment with high transaction costs (Coomes and Barham 1994). On empirical grounds, considerable evidence shows that surplus was indeed accumulated locally by private parties and by the state and was available for investment in development-related activities in rubber or other sectors. The Marxist thesis cannot explain how such capital was accumulated or why its investment did not lead to sustained economic development in Amazonia.

Evidence on Investment and the Role of the State

The corpus of literature available to inform a closer look at private and public investment patterns and the evolving Amazon economy is rather thin. In part, this paucity has resulted naturally from a literature focusing on the social relations of extraction and exchange in the rubber sector itself. Among more recent writings, works by Roberto Santos and Barbara Weinstein offer empirical information on the relationship between the rubber sector and the rest of the economy. Weinstein (1983b) stresses the tensions that arose between the ascending rubber sector and the region's traditional agricultural interests, drawing on several informative archival sources (such as commercial and individual notarial records). Santos (1980) pieces together evidence on the structural evolution of the regional economy during the rubber boom. Descriptions of Amazonian urban development, like Bradford Burns's (1965) account of the rise of Manaus, provide useful descriptive material for making inferences about investment patterns. In terms of the state, useful snapshots of the taxation and expenditure patterns of regional and federal governments can be found in LeCointe (1922), Fuentes (1908), Pearson (1911), and others.

The scarcity of published empirical information constrains the following analysis of private and public investment patterns and the evolution of the structure and performance of the Amazonian economy. We therefore rely more on deductive reasoning than might otherwise be expected.

LOCAL SURPLUS RETENTION IN THE AMAZONIAN WILD RUBBER INDUSTRY

We have argued elsewhere that local surplus retention was sufficient to justify shifting the focus of discussion of the boom's fragility away from the rubber sector's failure to generate surplus and toward the type of investment patterns that local accumulation engendered (Coomes and Barham 1994). Our argument rests on the observations that the Amazon rubber industry produced substantial surplus and that a significant portion of the surplus, due to the very organization of the rubber industry, was retained by local economic agents that included the state.⁴ Subsequent patterns of investment of locally retained surplus were shaped by the strong market incentives of the boom and were reinforced by state policies, creating an economic structure that was highly vulnerable to a collapse in rubber prices. After demonstrating substantial local surplus retention, sectoral allocation—not the quantity of surplus—becomes our primary focus.

Until Asian plantation rubber swamped world markets in the 1910s, the Amazon was the world's preeminent supplier of rubber. A conservative estimate of the region's market share in the wild rubber era (1860–1910) would be 60 percent of the world supply. Two physical features of wild rubber suggest why substantial surplus was generated by its extraction. First, the native trees that yielded rubber latex, primarily species of *Hevea* (hevea rubber) and *Castilloa* (caucho rubber),⁵ were highly dispersed along extensive and remote frontiers, which meant that opening new areas involved rapidly rising unit costs due to increased setup and transport costs and higher risks. Rapidly rising unit costs for new estates in turn meant the possibility of higher returns to marginal sites. Second, the alternative to wild rubber extraction—plantation rubber—was thought to require twelve to fifteen years for the trees to mature enough to allow sustainable tapping (see Akers 1912, 103). Thus the inelastic supply of rubber combined with expanding world demand to generate large returns from wild rubber extraction.

Evidence abounds of the high returns engendered by wild rubber extraction in the Amazon, even though precise price-cost comparisons

4. We do not argue that locally retained surplus was sufficient to sustain economic development, another problematic counterfactual to construct, but rather that surplus was retained and invested in a manner that engendered fragility. Leff makes a somewhat similar point when comparing the rubber and coffee booms in Brazil (1973, 687). He suggests that rapid growth in income associated with booming exports in rubber was not a sufficient condition for regional industrialization because the resulting market and income expansion may not have reached a scale large enough to sustain industrialization.

5. The most important source of hevea rubber was *Hevea brasiliensis*, found along the southern tributaries of the Amazon River and the interfluvial uplands of Acre. In contrast with hevea, the caucho tree (*Castilloa elastica*; *c. vlei*) which grew on the lower eastern slopes of the Andes from Colombia to Bolivia, could not be sustainably tapped and was felled and bled to extract the less valuable caucho latex.

are difficult due to the poor quality of available data. At the most abstract level, the huge influx of labor and capital over the course of the Amazon rubber boom and the dynamic extension of extraction to the farthest reaches of the basin strongly suggest the lure of higher than normal returns. The sizable ad valorem tax levied on rubber exports by Bolivia, Peru, and Brazil (10 to 20 percent) and the large tax revenues produced by these levies for several decades could only have been sustained if alternate sources were not competitive enough to take advantage of the increased cost of Amazon wild rubber.

Perhaps the most compelling evidence of the accrual of large profits during the Amazon rubber boom is revealed by what did not happen to production levels in the Amazon during the collapse of the 1910s. As prices plummeted following the flood of Asian plantation rubber (from six dollars per kilogram in April 1910 to about a dollar in December 1919), output from Amazonia's main producer, Brazil, did not fall notably (see *India Rubber World* 1910, 295, and 1920, 257).⁶ Given that the technology of wild rubber extraction did not change notably during the period and that ten years was long enough for agents to leave rubber extraction if the industry had become a losing venture for most participants, the persistence of high levels of wild rubber production suggests the magnitude of profits that must have been available prior to the bust.

Our microeconomic analysis of the wild rubber industry offered several explanations as to why local retention of resource rents and surplus was probably substantial (Barham and Coomes 1994). Decentralized extraction and transport operations, ease of entry at the various levels of the industry, the multitude of traders operating on the region's rivers, and the mobility of labor and product all meant that the potential for monopolizing any stage of the industry was minimal and was probably limited to the remotest of rivers where rubber barons were able to rule for brief periods. The resulting competitive structure meant that foreign investors and large concerns could not monopolize readily, as the United Fruit Company did in bananas in Central America or the Aluminum Company of America in bauxite in the Guianas around the turn of the century (Barham 1988; Barham n.d.). Most large-scale foreign investment in production and transport came later in the boom and was largely unsuccessful (Weinstein 1983b, 1720–82).

Local surplus retention was by no means limited to the holders of wild rubber estates. Rubber trees constituted the relatively abundant factor in the Amazon, whereas labor and capital were more scarce. In general, both labor and capital sought high returns that were consistent

6. Between 1911 and 1917, annual wild rubber production from Brazil varied by less than 10 percent of output in 1910, and production in 1912 was even higher than at the price peak. In 1918 and 1919, Brazilian wild rubber output accounted for 75 percent and 84 percent, respectively, of the 1910 production level (see Santos 1980, 236).

with their scarcity, the mobility allowed by most river areas, and the risks involved in wild rubber extraction. In addition, the high cost of such a dispersed extractive activity meant that tappers had certain advantages: they were both difficult to monitor, especially in terms of their sales, and costly to replace. These features suggest that tappers were able to capture on average in a highly variable environment a portion of the profits embodied in wild rubber extraction.

Direct evidence on the average returns to tappers is hard to marshal, but substantial indirect evidence suggests that returns to tapping were attractive. Urban and rural wages for unskilled labor were high during the peak years of the boom, one to two dollars per day, reflecting the opportunity cost of rubber tapping (Akers 1912, 81). Moreover, some tappers became patrons and traders, capitalizing their way into a position of ownership in the industry (Weinstein 1983b, 24). Semi-independent and independent tappers also cleared land, planted perennial crops, and built houses, often in the cities or towns near the area where they tapped, intending to occupy them in the off-season and perhaps move permanently to the cities after accumulating enough assets. Direct evidence of the accumulation patterns of patrons and traders is also lacking, but contemporaneous accounts suggest that their returns substantially exceeded those of tappers because of their additional access to other valuable resources, particularly capital. Some patrons reportedly earned 150 to 250 dollars per year per tapper (see Jumelle 1903, 96–100; Louriero 1986, 109–10).

Much important work remains to be done to identify the patterns of surplus retention across groups, over time, and in different locales where the productivity, costs, and social relations of wild rubber extraction varied. The following discussion seeks to explain why even greater local surplus retention would not have been enough to generate sustainable economic development, given the market incentives generated by the boom itself.

PRIVATE INVESTMENT IN RUBBER EXTRACTION, TRANSPORT, AND LINKED INDUSTRIES

Most private investment during the rubber boom went into expanding the rubber trade, establishing new rubber trails (*estradas*), setting up tappers on estates in the upper reaches of the Amazon, equipping them with supplies, transporting and transshipping goods along the river, and collecting, storing, grading, and trading rubber at major ports.⁷ A closer look at the basic features of investments at these various stages of the industry will reveal their limited utility for other purposes, the few

7. This interpretation is inferred from the tremendous expansion of the rubber sector and the dominant role it played in the Amazonian economy (see table 1). No reliable estimates of sectoral investment behavior have been constructed in the literature.

linkages they encouraged, and the fragile foundation they provided for Amazon development.

Rubber Industry Investments

At the estate level, the main physical investment involved laying out the tapper's rubber trails. The cost of one to two hundred dollars per estrada was product-specific and sunk in that estradas had limited economic use beyond rubber extraction.⁸ Compared with the working capital needs of recruiting, transporting, and equipping labor, especially for the upper reaches of the Amazon, capital costs at the estrada level were small. The major investment consisted of the working capital provided to tappers—on the order of five hundred dollars for recruiting, transporting, and supplying—and several hundred dollars per year thereafter to equip them with basic provisions. At any given time, the capital value of these loans depended entirely on the price of rubber to sustain future repayment because no other extractive activity in the Amazon, particularly in the upper reaches, could generate sufficient earnings to support the costs of these provisions. Thus the value of these working capital investments, while neither inherently product-specific nor sunk like estradas, rested on the vitality of the rubber sector. The potential for recovering loans through any other extractive activity was therefore limited.⁹

Rubber transport required two types of investments—vessels and infrastructure. The main forms of transport were steamers and canoes, whereas passages for portage, warehouses, and ports made up most of infrastructure. Boats (the classic example of mobile capital) can be used to service other industries or to move to other regions. But this mobility can cut either way: the embodied capital can support alternate economic activities in the area or can exit. The fact that many of the boats would have been too costly to relocate to other areas of the world (indeed, some were very expensive to situate in the upper rivers in the first place) meant that after rubber went bust, a general abundance of shipping capacity existed in the region. How well the boats were serviced and maintained was another matter; many of them were abandoned by the late 1910s and early 1920s. Meanwhile, investments in infrastructure were sunk but not product-specific, except in terms of their location, which was tied directly

8. A typical estrada began at the tapper's hut and looped through the forest, linking eighty to as many as one hundred and fifty hevea trees over an area of three to five square kilometers.

9. The approximate investment level for rubber estates at the peak of the Amazon rubber boom can be constructed by using estimates of fixed and working capital investments per tapper and the number of tappers involved in rubber extraction. Two hundred dollars for fixed capital plus four hundred dollars for working capital per tapper times one hundred and fifty thousand tappers in the Brazilian Amazon (per Santos 1980, 66) gives an estimate of about ninety million dollars entailed in rubber estate activity.

to the trade flow of rubber and was therefore highly dispersed. The fact that no subsequent extractive activity in the Amazon generated a similar volume of export-import trade meant that much of the infrastructural capacity became superfluous. Moreover, infrastructure deteriorated rapidly in the tropical environment, especially outside the major cities. Portages and estradas became overgrown. Floods washed away ports. Warehouses fell into disrepair. Trading posts closed, and traders moved on.

In the main port cities of Belém, Manaus, and Iquitos, products were not refined beyond grading and sorting the rubber by quality. Urban investment in physical capital directly related to rubber was mostly for transshipment facilities like ports, warehouses, grading facilities, markets, and traders' offices. Port facilities, the most costly of these investments, were publicly subsidized to a significant degree although they were often privately operated. Urban infrastructural investment too depended on a high volume of trade to justify its maintenance, and much of the cities' infrastructure also deteriorated rapidly after the bust.

Most of the direct capital investment in rubber extraction and transport was spread out spatially yet was concentrated in the form of working capital, information, and transportation networks that were highly specific to the particular extractive activity. Most physical capital was sunk, and much of it was product-specific either inherently or because so few alternative extractive goods could sustain even the upkeep costs for the boats and infrastructure left behind by rubber extraction. Therefore, when rubber prices collapsed, it seemed as if much of the capital associated with rubber industry investments simply disappeared because it could not be reallocated and utilized effectively in other extractive activities. Many of the managers and traders left the region, thus reducing the expertise available for promoting alternate trade and production in the Amazon.

Linkages

Wild rubber extraction generated few local linkages. Tapping required minimal fixed physical capital. Establishing estradas largely involved a labor expense to find the wild rubber trees and lay out the best circuit for tapping. Implements were limited to a few manufactured items, such as tapping hatchets, cups for latex collection, pails, and guns for hunting and self-protection. In general, these items were cheaper to import than to produce locally in the high-cost environment of the Amazon because of limited demand, the highly decentralized population, and a basic competitiveness problem in producing tradable goods.¹⁰ A major exception

10. Tradable goods are generally defined as items that can be readily supplied from outside a region or country without engendering prohibitive transport or transaction costs.

on the input side was the manufacturing of soap, which was used to coagulate certain types of rubber latex (such as caucho). As early as 1862, twenty-four soap manufacturing establishments existed in Belém (Santos 1980, 188). Another linked industry that arose in the region was construction of wooden boxes for rubber shipment.

The other manufactured goods that served rubber extraction were mostly common consumer items, especially those that took advantage of local raw materials and had relatively high transportation costs, such as cashew wine, rum, chocolate, rice, beef, and furniture. Most of the production from these industries served the populations of the urban centers that grew up at the base of the rubber trade. In the transportation sector, the major linked industry was provision of wood for steamers, which offered additional labor opportunities but little investment or diversification.

On the downstream side of the industry, rubber manufacturing was undergoing rapid and complex technological changes in the industrial centers of the United States, England, and Europe.¹¹ Local manufacturing ventures in Amazonia were distant from innovations and information on changes in consumer needs and industrial user specifications. The rapid expansion of innovations effectively left behind the incipient and artisanal rubber-processing industry that had started to develop in Pará when the boom began.¹² Only after the boom, when some production technologies had become more standardized, did rubber manufacturing return.

Because the technology of rubber extraction was both simple and specific to rubber, no significant technology or learning spilled over to other extractive sectors. Probably the most important linkages generated by the sector were the extensive transportation networks established throughout the basin and the development of major urban centers. The nature of rubber industry investments thus left the economy vulnerable to a bust in rubber prices. On the one hand, investment did not generate diversification into more self-sustained economic activities, and on the other, the capital invested in rubber extraction and transport did not prove to be easily transferable to other economic activities or sectors.

Not all physical goods are tradables. Concrete, for example, is too costly to move great distances. The distinction between goods and services, with the former being largely tradable and the latter being largely nontradable, is useful. Buildings and construction projects that generally can be moved only short distances at great cost are essentially nontradables.

11. Such innovations are well represented in the advertisements, patent reports, and news releases in trade journals like the *India Rubber World and Electrical Trades Review* (1889–1899) and its successor, *India Rubber World*, published in New York.

12. For a description of the early rubber-processing industry near Breves, see Edwards (1847, 179–80).

Investment Alternatives in a Boom-Sector Economy

Investment alternatives during the rubber boom were biased against other tradable goods and toward nontradables, particularly urban real estate and service industries. Rural investment, unrelated to rubber extraction and transport, was limited and occurred mostly on smaller or downriver estates where owners sought to delineate their property rights, often by clearing land and planting perennial crops. The regional accumulation of wealth was nevertheless spectacular during the boom. Belém, Manaus, and Iquitos became major urban centers boasting the most modern of amenities, services, and consumption activities. But the future value of this wealth continued to depend on the price of rubber because so little diversification of the base economy was achieved during the boom and so much of the accumulated wealth was invested in real estate and property rather than in more potentially productive facilities.

Reasons on both supply and demand sides explain why profits or savings from the rubber industry were not generally channeled into producing other tradable goods. Geographic factors were paramount: the remoteness of the locale and the associated high costs made production of tradable goods unattractive. Basic inputs had to be shipped long distances into a tropical environment, implying high shipping costs, especially given the fact that such inputs were often many times larger and heavier than finished or semi-finished goods. The high costs of extraction and agriculture, partly due to high wages required to keep scarce labor out of the remunerative rubber sector, meant that most inputs could not be procured readily within the region.

On the demand side, low population density and a rather small and poor population meant a limited market for developing import-substitution manufacturing ventures of significant scale. Such efforts were further discouraged by the potential competition from imports that could be backhauled on empty rubber boats at relatively low unit cost from the major industrial areas, where economies of scale or better production conditions reduced costs far below the similar activities in the Amazon. Hence the tradable goods sector of the Amazon faced formidable competitiveness problems on several fronts related to the isolation and specific endowments of the region.

Dutch Disease Effects on Sectoral Investment Patterns / Weakness in the tradable goods sector was further exacerbated by the very success of the rubber boom. The Dutch disease model developed by Corden and Neary (1982) and others demonstrates how a booming resource sector can perversely affect the structure of a small, open economy by the way in which the boom sector influences resource allocation among the other sectors of

the economy. This model helps to explain how the boom in rubber became the bane of other tradable sectors (such as agriculture and nascent industry) and the boon of the nontradables sector (such as real estate, construction, and services).

At the heart of the analysis is the boom sector—rubber in this case—where high prices generate substantial economic returns. The high returns, reflected in rising wages and capital earnings, lead logically to a movement of productive resources into the booming sector, as evidenced by the rapid diffusion of rubber extraction activities throughout the Amazon Basin. If no labor and capital flow into the region of the booming economy, then the movement of productive resources into the booming sector must lead to a reduction in production of other tradable and nontradable goods.

The movement of resources out of less productive sectors and into the boom sector is known as the “resource allocation effect.” For the Amazon, where the costs of recruiting labor and establishing capital investment were high, it is reasonable to assume that productive resources were not perfectly elastic, although labor and capital flows into the region were substantial during the boom. Thus a sizable contraction in the relative share of the other tradable sectors with some aggregate expansion is more likely than an actual decline. Another feature of the resource allocation effect is its uneven impact on other sectors. In particular, agriculture and industry are hit harder than services and real estate because external competition will hold prices down in the tradables sector, whereas in the nontradables sector prices can rise to compensate for higher wages and capital costs. Put differently, the ability to pay higher wages and capital costs allows the nontradables sector to maintain or expand production levels more readily than the non-booming tradables sector.

The booming sector also generates “spending effects.” Increasing wages and returns in the economy push incomes and expenditures higher for both tradable and nontradable goods. This was especially true with rubber where this boom sector product was entirely exported. Again, the effects of increased spending work differently in the two sectors. In the non-booming tradable goods sector, price rises are still constrained by competition from imports. In the Amazon, this effect was reflected in the inflow of everything from fine champagne to basic food stuffs from Europe, England, North America, and other parts of Brazil and Argentina. Higher expenditures thus translated into more imports but little additional production in tradable goods.¹³ In the case of nontradables, prices should have risen (and did rise) with expanding

13. Production of tradable goods other than rubber probably accounted for less than 10 percent of total economic output in the peak decades of the boom, 1890–1910. Further evidence on the small share and relative stagnation of production in tradable goods is presented in table 1.

demand, leading resources and investment to flow into that sector and thus pulling even more productive resources from the tradable goods sector.

Evidence of Dutch Disease Effects during the Rubber Boom / The Dutch disease effects of the rubber boom can be seen clearly in table 1 (reproduced from Santos 1980, 178). The table gives the total value in current *milreis* of product and the relative contributions for three sectors (primary, secondary, and tertiary) and for the subsectors within each sector. In the primary sector, the impact on agriculture is quite apparent. Whereas the boom in rubber can be seen in the expansion of the second subsector ("plant extraction") from 37,914 *contos* in 1890 to 197,811 in 1910 and a 5 percent increase in the proportion of economic activity accounted for by extraction, the total product of agriculture was essentially at the same level in 1910 as in 1890. Moreover, agriculture's share of total product dropped from about 8 percent to 2 percent during this period.

Apparent stagnation in the agricultural sector actually hides two other interesting phenomena. The first is revealed by the 1900 figures indicating that agricultural production doubled in the 1890s and then contracted by the same magnitude in the 1900s. The expansion is overstated due to inflation occurring in the 1890s, but the contraction of the 1900s corresponds to the period of highest rubber prices, with rubber prices peaking between 1908 and 1910. This contraction is consistent with the decline that would be expected in other tradable sectors. Second, growth experiences varied across different commodities, with output of export crops like rice and cacao declining sharply while the production of some crops destined for local consumption (manioc, tobacco, and rum) rose to meet local demand during the boom. Although the agricultural sector did not experience wholesale collapse, as some observers might suggest, the Dutch disease effects on agriculture are apparent.

In the secondary sector, industrial activities expanded over the two decades, but growth in aggregate terms was only one-tenth of that in the primary sector. At the peak of the boom in 1910, industry accounted for only 3 percent of total economic product in the Amazon region, and much of that was in industries processing raw materials for rubber extraction and transport, such as soap to coagulate caucho latex and saw mills to construct shipping crates for rubber, and in the urban nontradables sector, such as whitewash and wood for construction. Many of these larger industrial ventures collapsed with the decline of rubber in the 1910s. Overall, however, industrial activity expanded in the decade of the rubber bust. This growth can be attributed to the decline in labor and capital costs associated with lowered earnings in the wild rubber trade and to the fact that food-processing firms, clothing manufacturers, furniture makers, and chemical producers found a market among the urban

TABLE 1 *Total Economic Product by Sector in the Brazilian Amazon, 1890–1920, in Contos de Réis*

<i>Economic Sector</i>	<i>1890</i>	<i>1900</i>	<i>1910</i>	<i>1920</i>
Primary	53,953 (51)	181,040 (49)	218,287 (45)	123,507 (36)
Agriculture	8,143 (8)	20,833 (6)	9,593 (2)	31,251 (9)
Plant extraction	37,914 (36)	141,484 (38)	197,811 (41)	57,182 (17)
Animal products	7,896 (7)	18,723 (5)	10,883 (2)	35,074 (10)
Secondary	548 (1)	6,222 (2)	19,605 (4)	24,632 (7)
Mineral extraction	—	—	—	59 (0)
Industry	147 (0)	3,054 (1)	15,684 (3)	20,579 (6)
Civil construction	401 (0)	3,168 (1)	3,921 (1)	3,994 (1)
Tertiary	51,721 (49)	183,877 (50)	247,941 (51)	197,450 (57)
Wholesale and retail	36,003 (34)	102,216 (28)	149,606 (31)	134,595 (39)
Government	7,793 (7)	51,220 (14)	53,270 (11)	28,870 (8)
Other services	7,925 (8)	30,441 (8)	45,065 (9)	33,985 (10)
Total	106,222 (100)	371,139 (100)	485,833 (100)	345,589 (100)

Source: Roberto Santos, *História Econômica da Amazônia (1800–1920)* (São Paulo: Queiroz, 1980), p. 178, with the explanation of the product estimates presented in his methodological appendix, pp. 318–38.

Note: Figures in parentheses are percentages for the adjacent number.

population for lower-quality import-substitution products because local incomes were no longer large enough to afford higher-quality manufactured imports.¹⁴

14. A 1920 census of industrial concerns in the Brazilian Amazon found that more than half the operations had been established during the 1910s, with the most rapid expansion occurring in food processing and clothing manufacturing, where 82 of the 156 new firms were found. These figures (as reported in Santos 1980, 189) are vulnerable to the criticism that, over time, natural exit of firms would tend to bias the proportion of establishments accounted for by new firms. Santos also offers earlier data from the state of Pará in 1892 on industrial establishments, suggesting the existence of few food-processing and clothing

During the boom, the main growth area beyond rubber was in the tertiary sector, especially in wholesale and retail trade and government services. As demonstrated in table 1, when combined with rubber exports, trade and government accounted for more than 80 percent of total economic product during the peak years of the boom, whereas industry and agriculture accounted for a mere 5 percent.¹⁵ The huge imbalance between the booming sector and the nontradables sector is captured by these figures and exemplifies the essence of the Dutch disease phenomenon. This imbalance changed rapidly with the collapse of rubber (table 1). By 1920 the share of industry, agriculture, and animal products had risen to 25 percent whereas the share of rubber, trade, and government had contracted to 65 percent. Note, however, that even though retail and wholesale trade declined during the 1910s, this subsector actually represented an even larger percentage of total economic product in 1920 than at any other time over the boom period. This observation would suggest that local purchasing power from earnings during the boom may have sustained the nontradables sector well beyond the crash.

Bradford Burns's account, "Manaus, 1910: Portrait of a Boom Town," describes the urban achievement of what was then the rubber capital of the world. Located nine hundred miles up the Amazon River, Manaus had been a relatively poor and undeveloped jungle river port of five thousand inhabitants only thirty years earlier: "An excellent system of waterworks, efficient garbage collection and disposal system, electricity, telephone services, handsome public buildings, and comfortable private residences attested to the modernity of the city. . . . This capital of 50,000 inhabitants was bound together by a steel band of fifteen miles of electrical railway, whose streetcars came and went from the *praça* (main plaza)" (Burns 1965, 401). He also depicts the high life of Manaus, which included fine French fashion, fancy restaurants, sporting clubs, opera and music halls, movie theaters, high-quality newspapers and periodicals, and numerous well-funded public and private schools, along with the seamier side of boom-town life such as gambling halls, brothels, and bars. Similar kinds of urban development were realized in Belém and Iquitos, which exemplify the bias of a boom-sector economy toward investing in nontradables.

The tremendous expansion of the rubber and urban nontradables sectors summarized in table 1 need not have been a problem (at least in principle) for the economic development of Amazonia. If the price rise in rubber had proved to be permanent, or if capital, labor, and other productive resources could have shifted easily back into the production of

manufacturers at that time (Santos 1980, 188). This inference supports our view that the sector expanded significantly in the years following the crash, rather than merely replacing old firms with new ones.

15. If we include the other tertiary services, then rubber and nontradables accounted for more than 90 percent of the total domestic product in the Brazilian Amazon in 1910.

competitive tradable goods after rubber prices fell, then this expansion would have meant sustained rising incomes and welfare for the region. In the case of a permanent price rise in rubber, participants in Amazon rubber production would have continued to enjoy the gains from specialization and trade. In the case of costless shift of resources into producing other tradable goods, income gains and capital accumulated during the boom would have resulted in increased consumption and improved possibilities for future production after the boom.

What made the Amazon rubber boom problematic was the high cost and difficulty of shifting productive resources out of the booming and nontradable sectors into other tradable goods. This problem arose in part from the product-specific and sunk nature of capital investments noted in rubber extraction and transport. No alternate high-value extractive activities were available to sustain the infrastructure developed to serve the highly dispersed industry of rubber extraction. The value of most investments made outside of rubber (in the urban nontradables sector) depended on the underlying vitality of the tradables sector. Although industry and agriculture grew in the decade following the rubber bust, aggregate expansion made up for only about half of the contraction in rubber revenues (see table 1) and probably much less than half of the economic surplus that rubber had generated over the previous decades.

When rubber prices collapsed in the 1910s, the underlying fragility of the boom economy was exposed. Investments in rubber extraction and infrastructure rapidly lost value and could not be transferred readily to other tradable activities. At the same time, activities in the nontradables sector rapidly lost the large inflows of income from the rubber trade that had sustained them. Agriculture and industry, two alternate tradables sectors, did not have similar potential for generating income after years of minimal attention, especially given the scarcity of local labor and the region's remoteness from world markets. In a sense, the combination of the collapsing nontradables and boom sectors led to capital evaporating, as the value of investments from the boom era plummeted. Although agriculture and industry began to expand, they started from a low level of technology and a minimal productive base. Years of income growth and apparent economic development had been lost. In sum, the fragile boom economy of rubber and an overdeveloped nontradables sector gave way to an economy based on activities yielding much lower returns—agriculture, extraction, and local industry.

PUBLIC INVESTMENT AND THE STATE

The rise of the lucrative rubber trade marked a period of intense development and transformation of relations between the state and the region. The state aggressively sought and captured substantial rubber

revenues that were then to be available (at least potentially) for promoting regional development through public investment in industrialization, diversification, and economic reform. We suggest, however, that much of the state's rubber revenues, rather than being destined for promoting reform or diversification, was absorbed in prosecuting and protecting territorial claims, establishing regional administration, and developing local infrastructure and services to support the rubber trade. Such expenditures reflected strong emergent political and economic pressures on the state to direct rubber revenues back into the booming sector of this relatively free, open economy. These pressures reinforced patterns of private investment and heightened the regional economy's vulnerability to a collapse in rubber prices. The centrality of public spending in understanding the development path and legacies of the rubber boom indicates the need for more comprehensive attention to the role of the state in Amazonia during the rubber era.

State Revenues and Capture of Rents

Amazonia was endowed with a natural monopoly on the world's finest wild rubber that endured for half a century until large quantities of cheaper Asian plantation rubber came to dominate world markets. States in the Amazon Basin took advantage of this favorable market position to capture substantial profits from the trade through taxation at custom houses in the developing port cities and towns along the Amazon and its tributaries. Duties were collected on exports of rubber and other extractive products as well as on goods imported to the region. Such duties were very effective given the isolation of Amazonia, the limited potential of local production of food and other supplies, and vibrant foreign demand for wild rubber.¹⁶ The direct cost of collecting duties probably accounted for only a small fraction, certainly less than 10 percent, of the revenues generated by the customs houses.¹⁷

Duties levied on Amazonian exports and imports made up most of government revenues captured locally by the state during the boom, often more than 90 percent. Frequently, duties on imports were substantially higher than duties on exports—up to five times the duty on exported rubber—and although the value of exports typically exceeded imports (primarily consumer goods) during the boom, the largest share of government revenues from the rubber industry came from duties on imports rather than on exports. Typically, duty rates rose with rubber

16. Even as late as the 1940s, the region reportedly exported some 80 percent of its production and imported 90 percent of the goods for local consumption (Netto 1945, 90).

17. According to the proposed 1906 budget for the department of Loreto (which contained the main customs house for Peruvian rubber exports at Iquitos), the customs service was to be granted 6.4 percent of the revenue expected that year (Fuentes 1908, 1:271–87).

prices, which varied among the Amazonian countries according to relative market power, and were maintained well after the boom's peak by Brazil, the main producer. At the peak, merchants paid 100 percent import duties on goods brought into the Brazilian Amazon, and all such proceeds were destined for the coffers of the federal government. Import duties in neighboring countries of the upper Amazon were considerably lower: merchandise imported into Peru was taxed at rates of 8 to 30 percent ad valorem, depending on the type of goods. Imports to Bolivia were duty-free, and Brazilian tariffs were adjusted along the borders in an attempt to discourage a vibrant transboundary contraband trade that developed during the boom.

Although export duties were lower than rates on imported goods, the duty on wild rubber was substantial, particularly when compared with government taxation of natural resources elsewhere.¹⁸ Export duties on Pará fine rubber at the peak of the boom varied significantly across the basin: the state of Pará (22 percent ad valorem), the state of Amazonas (19 percent), Bolivia (14 percent), and Peru (14 percent) (Pearson 1911, 58, 98, 142, 160). In Brazil and Peru, revenues from export duties were destined for state rather than national coffers, and municipalities in Brazil also levied a 1 to 2 percent tax on exported rubber (Pearson 1911, 58–59).¹⁹ In the federal territory of Acre, the Brazilian national government imposed a 15 percent export duty on rubber (Pearson 1911, 165). Such high export and import duties provoked persistent complaints and conflicts within and among countries in the basin.

Total revenues captured by Amazonian countries over the rubber boom were probably very large in today's terms, perhaps even "gigantic," as Randolph Resor has suggested (1977, 350). Between 1902 and 1910, federal and state governments in Brazil received in duties 18.5 percent of the total value of imports and exports from the region, about twenty-five million dollars per year (derived from LeCointe 1922, 2:405, 424, 427).²⁰ Municipal duties and taxes would have added approximately 10 percent (two and a half million dollars per year) to government revenues destined for federal and state governments (see Santos 1980, 193). In Peru over the same period, the state captured 10.6 percent of the total value of rubber trade, equaling about seven million dollars, two-thirds of which came from duties on imports (derived from Maúrtua 1911, 27, 28; Pennano 1988, 204). Duties collected on rubber exported from Bolivia for the period

18. For example, around 1900 and for a few decades into the twentieth century, ad valorem rates of government taxation for bauxite and bananas elsewhere in Latin America were about 4 percent and 1 percent, respectively.

19. See LeCointe's discussion of frivolous municipal taxation (1922, 2:432–34).

20. U.S. dollars as converted from local (or other foreign) currency at the official rate of exchange for that year, according to the U.S. Mint *Annual Report of the Director of the Mint, 1890–1920* (Washington, D.C.: Government Printing Office).

totaled almost three million dollars (derived from Ballivián and Pinilla 1912, 248–49). A conservative estimate of the surplus captured in Brazil, Peru, and Bolivia by all levels of government in 1910 at the peak of the boom would be about forty-seven million.²¹ Over the boom period from 1880 to 1920, as much as half a billion dollars in state revenues may have been generated by the rubber trade in the Amazon Basin.

Although secondary information on the disposition of state revenues throughout the basin is limited, some data are available on the general balance of revenues and expenditures. In Brazil, the distribution of rubber revenues favored the central government, which captured perhaps half of total revenues, followed by the state governments of Pará and Amazonas securing about one-third of revenues, and their municipalities, receiving less than one-fifth (see Santos 1980, 193; LeCointe 1922, 2:412, 440). Federal expenditures in the Brazilian Amazon were relatively modest, on the order of 10 to 25 percent of received revenues, whereas state and municipal governments sought to match expenditures to revenues (see LeCointe 1922, 2:412, 440; Santos 1980, 194; Ministério da Agricultura, Indústria e Comércio 1917, 256–336). In Peru, the department of Loreto received the revenues collected by the customs house at Iquitos, and proceeds appear to have been used primarily in the region, with any remaining surplus going to the federal treasury (see Fuentes 1908, 1:290).

Public Expenditures

With substantial revenues available for disbursement and demands building from regionally based groups for a share of the growing public wealth, governments at all levels became major investors in Amazonia with the potential to shape the expanding regional economy and guide development via public spending and investment. In the Brazilian Amazon, for example, public expenditures at all levels of government doubled from the equivalent of six million dollars in 1890 to twelve million in 1900 and doubled again to twenty-five million at the peak of the boom in 1910.²² State and municipal governments consistently budgeted to spend their entire projected annual revenues. Although few comprehensive accounts of state spending during the boom are available, we surmise from the secondary literature that much of the rubber revenues was destined for serving geopolitical ends, establishing the state apparatus in

21. Surplus captured is estimated for 1910 in Brazil as \$45,346,290 (see Santos 1980, 193, using \$0.33 per milréis); in Peru as \$1,341,207 (see Bonilla 1976, 226, using \$4.8665 per pound sterling); and in Bolivia as \$747,062 (see Ballivián and Pinilla 1912, 248–49, using \$0.389 per boliviano).

22. Reported by Santos as 13,282 contos de réis (1890), 65,390 contos (1900), and 75,625 contos (1910), converted respectively at 0.46 dollars per milréis, 0.19 dollars per milréis, and 0.33 dollars per milréis (see Santos 1980, 194).

the region, and promoting the rubber trade. As revenues rose during the boom, public spending increased and centered ever more tightly on the rubber sector.

Territorial Claims and Concessions / The long-standing struggle for Amazonia was a geopolitical contest between Portugal and Spain that intensified during the rubber boom as serious boundary conflicts erupted between Brazil and her neighbors over forest lands in the basin. The region had been subject to competing colonial interests since the late fifteenth century, with treaties dividing the basin increasingly westward in favor of the Portuguese crown, according to rights of possession de facto rather than de jure (Tambs 1974). Dissolution of the Spanish American empire blurred the boundaries separating the new republics, although each republic soon recognized the need to exercise dominion over its claims in the face of imperial Brazil. Peru, perhaps the most aggressive of the new republics, established a naval base at Iquitos in 1861 (Romero 1983, 21), signaling its intent to protect territorial claims and contest the Brazilian *marcha para oeste* (Tambs 1974). In addition, Peru and Bolivia encouraged scientific exploration in the region and sponsored colonization and immigration (particularly by Europeans), although neither succeeded in augmenting significantly the population of its Amazon territories (see Fifer 1972; Chirif 1989).

The rise in rubber prices accomplished what no previous colonization program had managed to do: it drew tens of thousands of migrants into the basin, up from the east in Brazil and down from the Andean high jungle of the Upper Amazon in search of rubber. Rubber workers penetrated the remotest reaches of the basin where the limits of activity were marked not by international boundaries but by hevea estradas and fallen caucho trees. Brazilian *seringueiros* settled in forest lands claimed by Bolivia and Peru, while the more transient Peruvian *caucheros* combed forests claimed by Brazil, Columbia, Ecuador, and Bolivia for the castilloa tree. The rich rubber fields of Acre became hotly contested, bringing Brazil to the brink of war in 1902 with Bolivia and two years later with Peru (see Ganzart 1934; Tambs 1966). After several skirmishes and intensive negotiations, the conflict with Bolivia was resolved by a 1903 treaty in which Bolivia ceded nearly two hundred thousand square kilometers of land to Brazil in return for 5,460 square kilometers, a ten-million-dollar indemnity, and the promise of a railway around the cataracts of the Madeira River. The large capital expenditures made by the Brazilian federal government in Acre for construction of the Madeira-Mamore railway and restitution to Bolivia were offset almost completely by rubber and import revenues collected in the region between 1903 and 1910 (see LeCointe 1922, 2, 413). Brazil's boundary dispute with Peru was settled by treaty in 1909, with Peru ceding some four hundred thousand square kilometers in

the upper Purus and Juruá region to Brazil in return for thirty-nine thousand square kilometers (Ganzart 1934, 438–39, 447). Less acute conflicts also arose over the borders between Peru and Bolivia, Peru and Colombia, and Peru and Ecuador.

Thus the Upper Amazonian republics sought to establish and protect their claims to territory in the basin, and such efforts implied spending rubber revenues. Peru maintained a substantial naval fleet at Iquitos throughout the boom (see Romero 1983), and a sizable proportion of customs revenues was spent on supplying and maintaining the fleet. For example, the budget proposed for the department of Loreto for 1906 allotted 56 percent of revenues expected from import and export duties to the military (derived from Fuentes 1908, 1:271–87). Resolution of boundary conflicts also implied extraordinary expenditures of state funds, when armed forces were dispatched by Brazil, Bolivia, and Peru to their borders to protect or retake territory.

In addition, the central governments of several republics granted special navigation and land concessions to rubber entrepreneurs and firms for exceptionally large areas in the remote borderlands to minimize loss of rubber revenues and to assert territorial claims. In return for a concession, grantees typically would be required to provide transportation services to the region, sponsor colonization, establish public services, and maintain order. In Peru, Peruvian cauchero C. F. Fitzcarrald was granted a transport monopoly on the Madre de Dios River a year before his death in 1897 (Reyna 1942). Similarly, via Peruvian trader J. C. Arana, the British Peruvian Amazon Company was granted an extensive area and navigation rights in the disputed Putumayo region. In late 1905, the Colombian government granted Colombian Dr. L. Cuervo Márquez title to four hundred square kilometers and a concession to a similar amount of forest.²³ In Bolivia, the Barbo contract of 1880, land concessions to N. Suárez and A. Vaca Díez, and the Bolivian Syndicate (the Aramayo contract) grant in Acre were all intended to buttress Bolivian hegemony in the region (Tambs 1966, 263, 270). Such concessions may be considered as indirect subsidies from the state, sometimes supplemented by direct payments or loans. Although most concessions were granted for long periods (typically twenty-five years or more), few lasted the duration. In general, concessions were less successful in securing territorial claims than the more expensive strategy of maintaining a significant military presence in the region.

Regional Articulation and Administration / The advent of the rubber trade, enabled by free navigation and steam transportation on the Amazon River, furthered incorporation of Amazonia into the national economic

23. See *U.S. Monthly Consular and Trade Reports*, no. 298, for 1905, pp. 218–19.

and political spheres of the countries sharing the basin. Prior to the boom, Amazonia was a vast and little-known region yielding an array of modest and peculiar riches. Petty traders carried medicinal plants, dyes, fibers, and waxes from the lowland rain forests and Panama hats brought down from towns along the eastern Andes, propelled by oar and sail, to exchange their products for crude manufactured goods at Belém. Except for this port city at the mouth of the Amazon, the river and its tributaries had neither urban centers, financial institutions, nor telecommunications—only minimal political authority and the barest of civil administrative apparatuses.

With the growing promise of rubber in Amazonia, new opportunities and challenges emerged for the state: taxes had to be collected and redistributed, a variety of services provided to promote trade, and territory defined and protected from internal and external threats. Mounting rubber revenues brought calls for increased local autonomy, and secessionist movements sprang up across the basin that threatened national territorial claims and access to tax revenues. Although most revolts were urban-based (like those at Iquitos, Manaus, and Belém) and ultimately inconsequential, the Acre conflict began with Brazilian tappers declaring their independence in Bolivian territory (see Ganzart 1934; Loureiro 1986, 123–27). A certain measure of autonomy was granted to the regions by the respective central governments (particularly in Peru and Brazil) by delegating powers of authority, taxation, and administration. Entire regional and local governments were established along with new states, departments, provinces, municipalities, and districts run by well-paid functionaries. Duties collected on exported rubber allowed regional administrations to borrow on foreign markets to finance periodic deficits and large capital projects, a practice that led to large external debts by the peak of the boom.²⁴ Rivalries developed between administrations as each vied for importance and power in the rubber trade. Indeed, the construction of grandiose public buildings like the Manaus opera theater was partly a manifestation of the fervent rivalry that developed during the boom between administrations in Manaus and Belém.

State Subsidies, Grants, Concessions, and Development Policies / Between 1880 and 1910, Amazonia's impressive growth in public facilities and services included high-capacity port facilities, subsidized steamer routes covering tens of thousands of miles each year to connect the remotest rubber post with New York and Liverpool, and telegraph and wireless communications that linked the Amazonian port cities with their respective capital cities. Public investment was concentrated almost entirely in

24. The state of Amazonas and the municipality of Manaus, which had no public debt in 1892, owed some 61,087,160 francs (\$11,789,822) in 1902, and 132,408,333 francs (\$25,554,808) by 1913, 60 percent of which was owed to foreign lenders (LeCointe 1922, 2:435–36).

the urban areas of Belém, Manaus, and Iquitos. These cities flourished as vibrant socioeconomic centers, boasting the era's finest utilities—waterworks, light and power, telephone, and tramways—as well as schools, hospitals, and public services to meet the needs of burgeoning populations engaged in the rubber trade and related activities (see Cruz 1967).

To stimulate the development of public facilities, regional administrations granted concessions by tender to private firms that would be responsible for completing the works and operating them for the period specified. Concessions were granted almost entirely to foreign firms for everything from the Manaus slaughterhouse, public markets, city water works, and tramways to Amazon telegraph cable and steamer transportation in the basin. Among the largest grants were concessions to the British Manaus Harbour Limited and to the U.S. Port of Para Company, which undertook the needed expansion of dock facilities and operation of port facilities under long-term contracts (the Brazilian government retained the right to purchase the facilities before their reversion when the concession expired). Important subsidies were also provided throughout the boom to foreign and domestic shipping companies to support steamer service along the Amazon and its tributaries.

In addition to providing grants and subsidies to support the development of infrastructure and services (used mostly by the rubber trade), the state also attempted to diversify the economy by means of public expenditure and investment. State governors and administrators were well aware of the growing dependence on the rubber sector during the boom. The state of Pará, the original locus of the rubber trade and the strongest seat of nonrubber interests in Amazonia, made several attempts to promote colonization, agricultural development, and industrialization in the Belém area (see Weinstein 1983b, 110–23, 92–94). The limited success of efforts to diversify the rural economy stemmed primarily from the economic environment created by the rubber boom: the extractive sector drew immigrants away from the colonies to work in the more lucrative rubber trade because agricultural estate owners could not afford the high wages demanded to retain labor. Industrial ventures supported by the state faced not only the labor scarcity problem but undercapitalization, high input costs, and low effective demand in the region (Weinstein 1983b, 92–93).

Fundamentally, the political economy of Amazonia during the era was increasingly shaped by the high returns in the rubber sector. Although government entities at various levels had access to substantial revenues from the trade that could be directed toward diversifying the economy, powerful forces directed public investment into expanding infrastructure and facilities required by the rubber industry over other enterprises. The legitimacy of ascendant local state officials was constantly tested during the boom by rising expectations among the increas-

ingly powerful rubber constituency for public investment to support the trade. As the boom developed, groups connected with the rubber industry assumed positions of power in local and regional administration, thus increasing pressure to invest public funds around the rubber trade. Allocating state revenues to other sectors in an effort to diversify the economy required spending political capital that flowed increasingly from the economic power associated with the rubber trade. For example, the Lemos administration in Pará during the early 1900s cut off funding of projects begun by previous administrations to promote diversification and deliberately consolidated power around surplus captured from the rubber trade (Weinstein 1983b, 133–36). In the newer regions born of the rubber trade, centering around Manaus and Iquitos, nonrubber economic interests were little developed prior to the boom, making the problem even more acute. The centering of the regional political economy on the rubber trade further reinforced dependence on the extractive sector and heightened vulnerability to a fall in rubber prices.

After rubber prices plummeted and the region slid into economic crisis, the private sector turned to the state for urgently needed assistance and support. Although the state's efforts to support and reform the trade by such measures as the national campaign known as *Defesa da Borracha* and to promote industrial diversification ultimately failed, the fact that the state was called on to remedy such a variety of local problems suggests that the state had become a major player in Amazonia during the boom.²⁵ As the rubber trade diminished, the private sector receded, leaving the state to dominate the region, a legacy that persists to this day in most Amazonian countries.

CONCLUSIONS

Understanding the Rubber Boom Economy

Previous accounts of the rubber boom and Amazonian economic development have pointed toward a failure in capital accumulation, arguing that surplus was drained by unequal exchange and foreign investors, that surplus creation and reinvestment were thwarted by inefficient “pre-capitalist” relations in wild rubber extraction, or that competitive production methods in the form of rubber plantations were limited by the environmental impediment of South American leaf blight (Dean 1987). Our explanation shifts the focus to the geographic, market, and political factors that shaped the form of accumulation in such a way that substantial savings, investment, and growth occurred, greatly expanding the geographic scale of the regional economy but without transforming its highly fragile and undiversified economic base.

25. For more on this national campaign, see Weinstein (1983b, 225–29).

The basic factor endowments of the Amazonian economy and the dispersed nature of wild rubber extraction provide the takeoff point for understanding why the rubber sector proved so durable in its form of social organization yet so unable to respond to the competitive challenge of Asian plantation rubber. The scarcity of labor and capital, the relative abundance of wild rubber, and the opportunity costs of wild rubber extraction together enabled high returns to labor and capital in rubber extraction and made investments along the extensive frontier attractive (Barham and Coomes 1994). By contrast, the high costs of monitoring tapper effort and sales in such a highly decentralized environment, where tappers collected relatively low daily volumes of rubber, precluded introducing wage labor relations. For this reason, attempts by foreign investors to introduce wage relations on large estates failed, probably well before leaf blight could become a relevant obstacle (Coomes and Barham 1994).

Debt-merchandise relations between tappers and traders or between tappers and patrons provided the most efficient means of reducing the barriers posed by high transaction costs and risk for this extractive activity (Barham and Coomes 1994). Labor mobility, monitoring costs, and the long maturation period for planted rubber trees severely limited the range of incentives (or threats) that owners could use to encourage tappers to contribute to cultivation of planted trees within their estates. For international investors seeking to establish rubber plantations, Ceylon, Malaya, and other areas in Asia had plentiful labor, with no comparable opportunity costs or potential for mobility with a competing extractive sector, as well as suitable locations for cultivation that were much more convenient to ocean shipping and provision of low-cost inputs (especially food for the workers). Only in the case of independent or semi-independent tappers in Amazonia might rubber tree planting have been pursued without confronting major incentive problems. Even there, the opportunity costs of labor and capital involved in extending estates, becoming patrons, and seeking more immediate returns in the rubber sector probably discouraged most tappers from moving in the direction of plantation-style cultivation (Coomes and Barham 1994).

The profitability of wild rubber extraction during the rubber boom led to a remarkable expansion in the industry, which began during the 1860s in the areas surrounding Belém and extended into the uppermost reaches of the Amazon Basin by the early 1900s. The associated investments in establishing estates, setting up tappers, developing information and transportation networks, and building transshipment facilities proved to be highly specific to rubber extraction due to their inherent nature (as with estradas) or the lack of other extractive activities in these areas that could generate comparable returns. Furthermore, the linkages and technological spinoffs to other industries were minimal. When rubber prices collapsed after 1910, the value and use of most of the invest-

ments in rubber extraction and transport dropped dramatically. Capital that could be mobilized was removed from the region in search of more profitable uses. Much of the rest of physical capital was effectively scrapped or put to less intensive use in extractive activities with much lower returns than rubber.

Investment beyond rubber extraction and transport was found largely in the nontradables sector. Prices and incentives of the rubber boom favored nontradables over other tradable goods, and few ancillary, self-propelling industries spun off from the rubber trade. The income needed to support the capital value of investments in real estate, urban construction, and service industries (and their potential as a source of wealth for financing structural adjustment after the boom) depended directly on the vitality of the tradables sector as well as on the sector's ability to maintain regional incomes. Unfortunately, the viability of the few incipient import-substitution industries that had developed (as in making paper, beer, and soap and packing meat) also depended on demand driven by income generated by rubber.

Basic competitiveness problems in the region, including the high costs of inputs and transportation, small market size, and high transaction costs, were not solved by the boom. The drop in labor costs after the bust was not enough to improve industry's competitive position substantially on these other fronts, partly because much of the labor force migrated out or went into the hinterland in search of agricultural land. Agriculture proved to be a source of growth for the region in the wake of the boom, but its potential was limited by the low level of investment made during the boom and the competitive disadvantages of growing basic food crops in the Amazon Basin for interregional and international trade. Average incomes in agriculture remained well below those of the rubber era, and production was destined more for subsistence consumption than for sale. In the extractive sector, subsequent expansion of export of Brazil nuts and other forest products provided revenues nowhere near those of rubber. With the tradables sector far less vibrant than during the boom, the urban nontradables sector shrank dramatically, leaving decaying urban splendor as a haunting reminder of the earlier boom.

State activity played a crucial role in shaping the region's development. Revenues captured by the state via major import and export taxes gave it the financial potential to guide the path of the boom. Nevertheless, state actions tended to reinforce the logic of the private market, which was to push rubber extraction and transportation investments to the furthest frontiers and to expand the nontradables sector. Territorial claims among the various Amazonian countries and the ambitions of regional governments alike depended on establishing and extending economic activity throughout the basin. Securing territorial claims in frontier areas, articulating regional governments, and developing the administrative capaci-

ties to govern consumed much of the state's resources, especially for the smaller countries of the Upper Amazon like Peru and Bolivia. Brazil's westward expansion threatened their claims to vast low jungle areas. Both Peru and Bolivia lost significant areas on their eastern frontiers where rubber tappers, patrons, and traders linked, by hook or crook, to Brazil provided the basis for legitimizing the larger country's territorial claims. State consolidation and expansion of rubber extraction during the boom were inextricably linked in Amazonia.

Abundant income and the availability of foreign credit created by import taxes on consumption goods and export taxes on rubber allowed nation-building goals to be advanced rapidly enough that the state also was able to play a significant role in shaping development policy through projects and major social expenditures. At first glance, state investments faced the same basic returns and incentives as private-sector activities, and thus it is not entirely surprising that public spending reinforced the dynamics of the boom economy by investing where returns were high, specifically in rubber extraction and nontradables. Such an assertion, however, would slight the repeated efforts of state leaders to sponsor diversification projects, particularly in subsidizing incipient industries, and to search (often via public commissions and task forces) for ways of creating a more balanced regional economy. State development strategists and politicians were aware of the precarious nature of the boom, yet most of the project revenues were spent on facilitating the expansion of rubber or promoting activity in the nontradables sector of urban construction and infrastructure development. Revenues were not built up for later disbursement, nor were price incentives altered dramatically to change the balance of sectoral activity. Instead, foreign credit allowed even more rapid investment in these sectors than would otherwise have been possible, so that by the time the crash came, foreign debt was substantial among the major rubber exporting states and (like many other investments of the era) fundamentally unbankable without a continued stream of rubber revenues. Further surplus retention would not have led Amazonia to a more sustainable development path because it was the surplus derived from the boom that distorted incentives for private and public investment and fostered the growth trajectory of a fragile and vulnerable economy.

Sorting out the reasons why state policy fell into the Dutch disease trap is a challenge for future research. The problem lies in choosing among a rich variety of potential explanations. Regional competition among the urban centers of the rubber trade, particularly Manaus and Belém but also Iquitos, pushed municipal and state governments to improve infrastructure and the urban setting in order to attract or secure the heavy commercial activity associated with rubber. Restraining state expenditures on public development projects when revenues and foreign

credit were abundant seems to have been nearly impossible for state officials under pressure from a variety of constituencies to distribute the gains from the boom or to reinvest the gains in new endeavors. Moreover, the ascendant classes, especially in the new cities of Manaus and Iquitos, were those most closely tied to the dynamic sectors of the boom. State promotion of their activities, particularly given its huge fiscal resources, reinforced their positions and their wealth. The labor-intensive nature of construction, urban maintenance, public schools, and other urban infrastructural investments also made these activities popular with the burgeoning urban labor force. The alternative—setting aside earnings for a future bust and slowing expansion of the burgeoning sectors via taxation and subsidization of other tradables—would have been singularly unpopular with all but the old-guard Paraense *fazendeiros* and planters. A closer look at the historical evolution of the political economy of Amazonian states during this era would clarify the primary forces behind state policy formation, how such policy shaped regional economic structures, and why states failed to pursue alternate development paths.

Development Legacies of the Rubber Boom

Prior to the boom, only Belém was integrally linked to the international economy. But by the peak, few areas along tens of thousands of miles of rivers and even the vast interfluvial uplands had been left untouched. Floral and faunal resources had been substantially affected by settlement and intrusion. Native peoples had been driven deeper into the upland forests or incorporated into the burgeoning rubber trade. The landscape of the Amazon Basin had been transformed: estradas had been cut and land cleared for cultivating perennials and cattle along the Amazon and even on some rubber estates. Transportation and communications networks had been extended into the upper reaches of the more remote rivers. Major urban centers had been developed by investing substantial public and private resources in modern amenities. Property rights and territorial boundaries were defined in ways that proved to be rather durable. Administrative structures of the state and government authority had been established. In sum, the market and the state had become the dominant forces shaping the region's development and landscape, and their organization bore the stamp of rubber.

Several legacies were central to the organization and operation of the post-rubber economy. One was the establishment of the private estate as the dominant form of tenure throughout the basin, a legacy that persists in many areas of the Brazilian Amazon where tappers now work their own estates or continue to tap rubber on the patron's property. In more marginal rubber-producing areas, private estates provided the basis for developing a patron-tenant relationship similar to the land-labor

interlinkage of hacienda agriculture elsewhere in Latin America. Tappers became tenants, and patrons granted access to land for agricultural and extractive activities, generally in a sharecropping relationship that sometimes involved the tenant providing direct labor to the patron. Private estates, especially in areas near the major urban centers, became the base for the region's post-rubber tradables sector, providing a mixture of commercial agriculture (in rice, sugar, cotton, coffee, and cacao) and extractive activities (gathering Brazil nuts, timber, vegetable ivory, and rubber). A more geographically specific account of the configuration of landholdings and resource use as well as the evolution of property relations during and after the rubber boom is crucial to a fuller understanding of development after the boom. Examining these issues would also offer additional *ex post* evidence on the outstanding question of the size and distribution of returns from rubber activities during the boom.

A second legacy has been the extension of trading networks throughout the Amazon Basin. The volume of trade to the Upper Amazon fell dramatically after the boom, but even in the far reaches of the basin, rubber continued to be tapped, Brazil nuts gathered, and other products extracted for export to foreign markets. Whereas the mix of economic activity on these distant estates included considerably more agriculture, hunting, and extraction for subsistence than at the peak of the boom, trade networks established in the previous era linked these areas to international markets and integrated them to varying degrees into the development process in their respective countries. What was originally frontier had become incorporated into national and world economies.

A related legacy was the form of trade relations that governed extractive activities along the river. The main contractual forms during the boom were barter trade among indigenous communities and traders as well as debt-merchandise trade among traders, patrons, and tappers. These basic relations (and variants such as share extraction and contracting) have proved to be durable and pervasive forms of trade contracts, particularly in the more remote reaches of the basin. This durability can be traced to the continuing emphasis on extraction and both the risky nature and potentially high costs of monitoring these activities under any other type of contractual relation.

A fourth legacy was the pattern of rural and urban settlement in the Amazon region. During the boom, native peoples were often displaced, pushed away from upriver lowland areas and into the upland forests. Perhaps the most invasive and disruptive force was the Peruvian and Bolivian rubber workers, who swept through the upland forests in search of caucho trees, displacing, harassing, sometimes murdering and sometimes incorporating native peoples into their efforts to gather rubber. The establishment of rubber estates based on the hevea tree and trade

activities along rivers throughout the basin also affected native groups, adversely by cutting off their access to areas of traditional use and spreading immigrant diseases rapidly and perhaps less adversely by providing access to steel tools, weapons, and other useful foreign goods. In many areas, however, tribes were pushed by the advance of the rubber trade or retreated from it into the remotest reaches of the basin, where they remain today.

For immigrants to rural areas of Amazonia, rubber estates defined the pattern of settlement during and after the boom. During the boom, population was highly dispersed, as tappers were separated by their estradas along the thousands of miles of riverfront and upland properties. Along the main stem of the Amazon and other tributaries where rubber trees were scarce, agricultural estates and small service communities were established. As the boom collapsed, individuals left the cities in search of land to work and many became tenants on agricultural estates or old rubber estates that had turned to other extractive products. In some areas like northeastern Peru, rubber estates begat loose communities and eventually villages, as tenants moved in closer to their patrons or to centers of estates, where they worked as farmers as well as tappers, hunters, and collectors of forest products (see Coomes 1992). The location and organization of these villages on the rubber estates, agricultural estates, and surrounding the secondary towns are a direct legacy of the pattern of economic activity generated by the rubber boom. Another area where further research would be useful is in determining the extent to which agricultural investments made during the rubber boom, in the form of clearing land and cultivating old and new crops, shaped post-boom possibilities, illuminating perhaps the dynamics of the boom and the ensuing patterns of development.

One more legacy of the boom was the establishment of major urban centers in the jungle, specifically Manaus and Iquitos. As the primary focus of investment in infrastructure for trade and almost the exclusive recipient of investment in the nontradables sector, the rubber boom created modern cities on the Amazon. Even with the declines they suffered following the collapse of the boom, Belém, Manaus, and Iquitos continue to play decisive roles in the region as service centers linking the surrounding rural areas to international markets for extractive goods, as direct sources of demand for agricultural and forest products from the region, as poles for future economic development projects, and as vents for public investment. In establishing these cities, the rubber boom created a legacy of urban-oriented bias that continues to shape Amazonian development.

Finally, the rubber boom firmly established the presence of the state throughout the basin. During this period, territorial rights were redefined, regional governments were created and articulated with cen-

tral governments, and structures were set up for regional administration. The state became a major participant—as beneficiary, regulator, and investor—in forming the region’s economy and thus in providing the basis for state-sponsored colonization and settlement projects and major infrastructural undertakings elsewhere in the region. What remains to be ascertained more systematically is how the particular state structures, ideologies, and groups that emerged during the Amazon rubber boom affected the subsequent evolution of the state and development in the region.

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