DESFIL
Development Strategies for Fragile Lands

ENVIRONMENTAL AND ECONOMIC DEVELOPMENT CONSEQUENCES OF FOREST AND AGRICULTURAL SECTOR POLICIES IN LATIN AMERICA

(A Synthesis of Case Studies of Costa Rica, Ecuador, and Bolivia)

Written by:

Rigoberto Stewart
and
David Gibson

Submitted by:

Development Strategies for Fragile Lands (DESFIL)
AID Contract Number DHR-5438-Q-00-1091-00
April 15, 1994

2000 M Street N.W., Suite 200, Washington, D.C. 20036
Tel: (202) 331-1860 • Fax: (202) 331-1871

ENVIRONMENTAL AND ECONOMIC DEVELOPMENT CONSEQUENCES OF FOREST AND AGRICULTURAL SECTOR POLICIES IN LATIN AMERICA

by
Rigoberto Stewart and David Gibson

This paper draws heavily on the results of case studies in Bolivia, Costa Rica, and Ecuador to explain how sectoral policies have tilted land use decisions against forestry and in favor of agriculture, and to present estimates of the economic development effects of those decisions. The paper summarizes information on forests and forest industries of the three countries, and it describes the framework within which polices are designed. It presents the effects of sectoral policies on land use and forest management, and then quantifies and discusses economic costs of relevant sectoral policies. Conclusions and recommendations for policy reform are offered.

Despite their substantial size and production potential, the forest sectors of the three countries contribute only 1 to 2.5 percent of GDP; 1.5 to 6 percent of exports, and 0.3 to 1 percent of employment. Wood processing is done by individuals with chain saws, by small, old, inefficient sawmills, and by inefficient manufacturing plants.

The policies that influence land use and development of forest industries are components of a coherent government strategies to promote import substitution. In the forest sector, policies intended to develop the industry include log export bans; export bans on other unprocessed forest products; high trade barriers to the import of processed forest products; and some forest taxes.

Trade policies, particularly log export bans, have reduced the profitability of all types of forest management. At the same time, trade measures have protected cattle ranching and selected agricultural activities, which compete with forestry for land. Land tenure policies have encouraged agriculture and have made investments in forest management practices unprofitable. Fiscal expenditure policies have made agricultural projects on forest lands profitable, while failing to invest in forestry research and extension.

The policies analyzed have had economic development effects contrary to the governments' intentions. Domestic value added in wood processing has been negative—economic value is destroyed, not added. Economic costs of job generation in wood processing have been extraordinarily high. The income distribution effect is to transfer wealth from poor forest stewards and furniture makers to wealthy owners of wood processing industries.

The paper concludes that strong antiforestry biases in Latin American policies have causes forest stewards to either convert to agriculture or mine the forest instead of investing in management practices, and that negative economic development consequences of the forest and agricultural sector policies negate the notion that environment is being sacrificed for the sake of economic development. The authors recommend reform of both macroeconomic and sectoral policies.

TABLE OF CONTENTS

B

SECTION I
INTRODUCTION

The observed high rates of tropical deforestation in Latin America and other parts of the world have been explained, not as a consequence of a coherent government strategy followed to achieve pre-determined goals, but rather in terms of a number of government policies, such as land tenure policies (Macdonald, Lambert et al), agricultural input subsidies (Repetto), under-funding of research and extension in both the forest and agricultural sectors (Southgate and Whitaker), discriminating macroeconomic policies (IICA, Valdés).

The underlying theme of these explanations is that macroeconomic and a number of agricultural and forest sector policies each play some role in making agricultural activities more profitable than forest management and, therefore, in inducing forest stewards and land owners to devote the land resource to agricultural activities. Yet, because the relative weight of each type of policy has seldom been measured, little is known about how much each policy or type of policy contributes to the process.

It is also customary in Latin America to present the deforestation problem as a choice between economic development and the environment. But, is this true or can both environmental and economic development goals be achieved simultaneously? This question has not been answered convincingly because the economic development effects of relevant policies—meaning the costs incurred in terms of economic efficiency and income distribution—have not been appropriately quantified.

The purpose of this paper, which draws heavily on the results of three country case studies in Latin America—Bolivia, Costa Rica and Ecuador—and presents the framework in which macroeconomic and sector policies are developed, is to use specific measures or indices to explain how the sectoral policies have tilted the balance against forestry and in favor of agriculture, and to present estimates of their economic development effects.

First, information on the forest and industrial resources of the three countries is presented along with the framework within which polices are designed; next, the effects of sectoral policies on land use and forest management decisions are presented, followed by a quantification and discussion of the economic costs of relevant sectoral policies; next, conclusions and recommendations for policy reform are offered; and finally, a methodological appendix is presented.

SECTION II
BACKGROUND

The three countries selected cover the whole spectrum observed in Latin America in terms of the salient characteristics of the native forests and the principal government policies affecting the forest sector. This section will present those characteristics along with the general framework within which economic policies have been developed.

A. The Forest Sectors

The size of native forests remaining in Latin America varies from about 300,000 ha (hectares) in Costa Rica—one of the smallest to 56.5 million ha in Bolivia—one of the largest (Table 1). Costa Rica's annual extraction, in number of species and total volume, and deforestation rates, however, are proportionately some of the highest in Latin America.

Despite their size, specie richness and production potential, the forest sectors of the three countries make only negligible contributions to the overall economy: 0.9 to 2.5 percent of total GDP, 1.5 to < 6 percent of total exports, and 0.3 to 1 percent of total employment.

Table 1
The native forest resource and economic importance of the forest sector in three Latin American countries, 1990-93

	Bolivia	Costa Rica	Ecuador
Forest Resource			
Country size (mill ha)	109.8	5.1	27.1
Size of native forests (mill ha) a/	56.5	0.2-0.4	11.4
Production forests as % of total	51.4	5.8	42.1
Annual cut (million m3 logs) b/	2.5	1.5	0.1 c/
Deforestation rate (000ha/yr)	80-200	18-40	100-300
Number of predominant species d/	11	60	35
Forest Tenure			
Concessions	Yes	No	No
Private property	No	Yes	No
Active colonization process	Yes	No	Yes
Economic Importance			
Contribution to Ag. GDP (%)	< 12	4.7 e/	6.3
Contribution total GDP (%)	< 2.5 f/	0.94	1.1
Value of sector exports (mill $)	80	25	29
Forest exports as % of total	6	1.5	1.1
Sector employment (000)	6 i/	12 g/	75 h/
Percent of total employment	0.26	1	1

a/ Intervened and non-intervened.
b/ Roundwood equivalent used by industry.
c/ In 1990; only 30% is actually turned into industrial roundwood.
d/ Most harvested commercial species. e/ Only sawnwood apparently.
f/ In 1990. g/ Does not include those in field operations.
h/ Total sector employment. i/ Estimated.

Source: Stewart (1994); IMF, Financial Statistics, 1992; Encyclopedia Britannica, 1993.

The most basic wood processing in Latin America is done by individuals with chain saws who fell and convert logs, in the forest, to rough sawn-wood. They process most of the timber harvested in Ecuador and a significant proportion of what is harvested in Bolivia and Costa Rica. The next level of processing is done by small, old, inefficient sawmills, with processing capacities between 500m^3/yr and 10,000m^3/yr (average 4,400m^3/yr in Costa Rica), utilization rates between 50% and 80 percent, and conversion rates, between 40 and 60 percent (average 48 percent in Costa Rica). The next level of processing is done by a small number of relatively inefficient veneer, plywood, particle board and parquet manufacturing plants (Table 2).

B. The Policy Framework

The set of policies that have strongly influenced land use decisions and affected the development of forest industries in Latin America are not, as it may seem, a collection of dispersed, haphazard measures, but rather components of a coherent government strategy devised to achieve specific goals.

Table 2.
Composition of the forest industry in three countries, 1986-93

Industry	Bolivia 1/	Costa Rica 2/	Ecuador 3/
Sawmills	217	170	435
Plywood and similar 4/	2	3	8
Veneer	5	0	u
Parquet	2	2	18
Box manufacturers	0	0	38
Furniture (all types)	u 5/	390	u
Doors and windows	2	9	u
Railroad sleepers	37	0	u
Match factory	1	2	u

1/ Reported by CDF (Centro de Desarrollo Forestal) for 1990.
2/ Reported by DGF (Dirección General Forestal) for 1986-92.
3/ Reported by CORMADERA for 1987.
4/ Hard board, particle board.
5/ There are about 100 carpentry shops making doors, window frames, parquet flooring in Cochabamba.
u = unknown.

Induced by Raúl Prebisch and the Latin American Economic Commission (CEPAL), most of these countries adopted in the 1950s the import substitution development model, in which imports were substituted by domestic production and high levels of self-sufficiency achieved. In this model, the industrial sector is the engine of development and, therefore, it was to be protected and subsidized until it grew out of infancy. Most of the macroeconomic and sector level policy measures were devised to achieve this goal.

An overvalued currency and very high tariffs on the import of final goods, both industrial and agricultural, were key components of the model's trade policy. The overvalued currency made the import of industrial raw materials cheap, while high tariffs protected the industrial activities from foreign competition. A none-desired effect of overvalued currency was a heavy tax on all exports.

The macroeconomic policies eventually led to high real interest rates and rapid inflation, both of which have been devastating to forestry. Given that the income from forest projects are realized far into the future, interest rates are key determinants of their financial viability. The higher the rates, the lower the profitability of a given project and the smaller the number of viable projects. This is not the same for agricultural projects, most of which are short term.

The farming sector was to provide cheap food—to keep industrial wages low—and raw materials, but rural-urban migration was to be avoided at the same time. Therefore, farming was to be profitable and rural income increased. The policy mix thus included: subsidization of agricultural colonization and farming inputs, such as fertilizers, machinery and credit; investment in rural infrastructure; tariff and non-tariff barriers to the import of basic foodstuff; and the creation of parastatals which, at times, offered high farm-gate prices and sold the product at lower prices to consumers, subsidizing both. In the 1980s the model was somewhat modified and governments began to subsidize nontraditional exports, such as melons, flowers, and hearts of palm.

In the forest sector, the goal was to develop the industry and to provide land for agricultural production. Therefore the policy mix was: log export ban; export ban of other unprocessed products, such as cants, flitches, and even sawnwood in Costa Rica; high tariff and non-tariff barriers to the import of processed forest products, especially plywood and furniture; and some forest taxes.

SECTION III
THE EFFECTS OF SECTORAL POLICIES ON LAND USE AND FOREST MANAGEMENT DECISIONS

Forest stewards and land owners make decisions concerning the choice to manage forests rather than convert to agricultural or other uses on the basis of economic returns. Consequently, government policies which influence the financial returns possible from competing land uses have a direct impact on landowner decision making.

This section uses quantitative estimates from the three case studies and from other sources to illustrate how trade, forest and land tenure and access, and fiscal policies, individually and collectively, made agricultural investments artificially more profitable to private land and forest holders than investments in plantation or in management of native forests.

A. The Effects of Trade Policies

The most influential trade measures in the forest sectors have been log export bans and import tariffs on industrialized forest products. Of lesser importance have been export subsidies of products like plywood and furniture (ranging from 2 to 10 percent) and some non-tariff barriers to imports. These trade measures, which have been devised with the objectives of generating employment, economic surplus and value added through greater domestic processing (industrialization) of forest raw materials, have been detrimental to forest management. The log export ban depressed domestic log and stumpage prices and reduced the profitability of all types of forest management. Nominal rates of protection[1] (NRP) estimates indicate that log and stumpage prices in the three countries have been only 6 to 60 percent[2] of what they would have otherwise been.

While the most relevant trade measures in the forest sector have been designed to subsidize and protect the industrial activities (like plywood manufacture) in detriment of timber farming, trade measures such as import tariffs, export subsidies, and non-tariff import barriers (quotas, permits) have been used in the agricultural sector to protect cattle ranching and selected agricultural activities, most of which compete with forestry for both agricultural

[1] The nominal rate of protection (NRP) measures the percentage deviation (up or down) of domestic (distorted) prices from what is called border (undistorted) prices. The latter are the prices that would have prevailed in the absence of distortions. See the Methodological Appendix and Stewart, 1994 (the Costa Rica case study) for estimation details.

[2] They were 20 to 60 percent of border prices in Costa Rica; 6 to 16 percent in Ecuador, and 25 to 55 percent in Bolivia.

and forest lands. Import tariffs and non-tariff barriers, such as outright import prohibition, permits and quotas, have been the preferred mechanism for protecting grain production (rice, beans, maize) in Latin America. Export subsidies, which were traditionally used by parastatals as a subsidiary mechanism for managing grain stocks, are now going to nontraditional exports, such as ornamentals, hearts of palm, and spices. Some exportables such as beef and sugar have been subsidized through preferred prices in developed countries.

The concerted actions of agricultural trade measures have provided high levels of nominal and effective protection[3] through artificially high farm-gate prices and private profits. The NRP and ERP estimates (Table 3) are indicative of how the prices and profitability of some forest-competing agricultural activities were incremented by such measures in the recent past[4]. The Costa Rican NRPs, for example, indicate that in 1991 bean and maize farm-gate prices were inflated by 31 and 41 percent, respectively, while the ERPs indicate that the return to domestic resources, particularly land, were increased by 53 and 81 percent, respectively.

Table 3.
Nominal and effective protection of some agricultural activities in selected Latin American countries 1987-1993

Crops	Brazil	Costa Rica	Ecuador	Dominican Republic
	.....Nominal Rates of Protection			
Beef	u	u	u	15.9
Cotton	29.8	u	u	u
Maize	74.2	41.2	59.7 a/	143.1
Rice	30.0	17.6	45.0 b/	34.1
Edible Beans	20.0	31.0	49.5 b/	34.1
Timber (logs)	u	-50	-70 d/	u
	..... Effective Rates of Protection			
Beef	u	u	u	u
Cotton	u	u	u	u
Maize	u	81.0	u	55.3
Rice	u	57.0	u	120.8
Edible Beans	u	53.0	123-866c/	66.2

a/ In 1987. b/ Soybeans, in 1988. c/ Soybeans, range across technologies. d/ Average. u = unavailable.

Source: Valdés, 1992; Stewart and Cuesta, 1988; Stewart and Acosta, 1988; and Stewart, Cuesta and Acosta, 1988.

The combination of negative protection of forestry, which reduced stumpage prices by about 50 percent, with positive nominal protection of agricultural activities made the latter relatively more profitable than the former. In some cases the relative profitability has been reversed, as illustrated by the following Costa Rican example. With the two type of distortions in place, the net present value (NPV) of the income stream produced by a 40-year sustainable management of native

[3] Value added refers to the contribution made by domestic production resources (land, labor, capital, management), and is measured by the difference between the price of a unit of the product and the cost of the imported (more specifically, tradable) inputs used to produce that unit. The effective rate of protection (ERP) is the ratio of domestic to economic value added. See the methodological appendix and Stewart, 1994 for a detailed explanation of the concept and methodology.

[4] Given that estimates of protection indices were unavailable for Bolivia, estimates for Brazil and Dominican Republic were included to show how pervasive these measures have been in Latin America.

forest project (the definition of sustainable management was very restrictive) in the Northern Region was estimated at US$707/ha, while the NPV of growing beans for 40 years would be US$1,247/ha. Without the distortions; that is, with doubled stumpage prices and bean farm prices reduced by 30 percent, the NPV of sustainable forest management would become US$1,414/ha, while the NPV of growing beans would become negative. The conclusion from this particular example is that with the distortions land owners will grow beans; without the distortions, they would manage the forests[5].

B. The Effects of Forest and Land Access and Tenure Policies

There are at least three ways in which an individual or firm can obtain access to land and native forests in Latin America: through purchase, colonization, and concessions or extraction permits. Costa Rica is the only country of the three cases studied in which there is a developed market for land and native forest, and therefore, is the only one in which native forests can be bought and sold.

Colonization, which is the most prevalent form of access in Ecuador and very important in Bolivia, is the process through which Latin American peasants, landless laborers, and others invade unoccupied lands—mostly publicly owned and forested—with the main purpose of securing the livelihood of their families through subsistence farming. Latin American governments have traditionally encouraged this process through road building and free land surveys and titling; they have also required the substitution of forest cover with pasture or food crops in order to provide titles and subsidized credit. Unless these policies change, the vigorous colonization processes of Ecuador and Bolivia will destroy millions of hectares of remaining tropical forest, with dire environmental consequences.

Government concessions, the most prevalent means of access to native forests by logging firms in Bolivia, have overwhelmingly taken the form of short term user contracts or extraction permits[6], which have been frequently invaded and partially deforested by peasants, to whom the Government has often granted land titles. The length of the contracts plus the vagueness of property rights translate into tenure insecurity[7] which have made investments in management practices unprofitable. As a consequence, concessions in Bolivia have not been well managed.

---

[5] Under the very restrictive definition of sustainable management it would be more profitable to liquidate the forest than to manage it, but there is another equally valid definition of sustainable management in which sustainable management is more profitable than liquidation.

[6] Until 1992, 90 percent of all contracts granted in Santa Cruz were of three years or less in duration.

[7] The effects of other policies, however, indicate that tenure security is a necessary condition for sustainable management of native forests, albeit not a sufficient one. Southgate et al (1992), for example, used a regression equation to explain deforestation. One of the explanatory variables, which turned out to be significant with 94 percent confidence, was an index of tenure security.

C. The Effects of Fiscal Policies

There are two kinds of fiscal interventions in both sectors which strongly influence land use and forest management decisions: those through which the governments collects revenues and those through which it makes expenditures. The Latin American experience indicates that only the latter has had significant impact on land use decisions.

C1. Revenue Policies

Latin American governments have collected only negligible amounts of revenues in their forest sectors. The sum of the three taxes levied on timber in Bolivia—royalty, and stumpage and reforestation fees—have been less than 6 percent of FOB, Santa Cruz log values; and the sum of stumpage and reforestation fees in Ecuador and Costa Rica have been together less than 7.5 percent of domestic log values. Given these poor records of revenue collection in the forest sector and the virtual absence of agricultural land taxes, it can be argued that government revenue policies have played a negligible role in the struggle for land between the two types of farming activities[8].

C2. Expenditure Policies

In contrast to the above, government expenditure policies have exhibited a strong antiforestry-pro-agricultural bias. Forest sector research and extension expenditures have been negligible in all three countries, and forest subsidies have been nil in Ecuador[9] and Bolivia, and limited in Costa Rica.

On the other hand, many agricultural activities have been stimulated by a number of subsidies unmatched in the forest sector, such as investments in research and extension, export subsidies, price supports, and credit and other input subsidies. Latin American governments have traditionally devoted 0.1 to 2.0 percent of agricultural GDP to agricultural research (World Bank, 1981). Bolivia, for example, invested 0.6 percent in 1989. In the 1980s, these governments also started to subsidize the export of agricultural products,

---

[8] The way in which stumpage fees are set in Bolivia have had a negative impact on how the concessions are managed. Because, in practice stumpage fees are levied on sawnwood, firms have been given a free hand in the forest (without supervision) to choose the trees and logs to be extracted, and they only transported the best parts of the best trees. This has led to significant waste of forest raw materials in the field. Claure (1992) reported that not more than 30 percent of utilizable raw material is recovered at the sawnwood level.

[9] At the time of the studies Ecuador was contemplating a reforestation subsidy program. The two subsidy programs in Costa Rica (for reforestation and native forest management) have failed to neutralize the anti-forestry bias of policies in general because of the arbitrary selection of beneficiaries, the financial inviability of the projects and the forced rationing of limited funds.

especially nontraditional exportables like melons, hearts of palm, ornamental plants[10]. The price support of a number of products competing with forestry (rice, beans, maize, dairy, soybeans) has been financed and implemented by parastatals created specifically for this purpose: CNP (National Production Council) in Costa Rica, ENAC (National Storage and Commercialization Company) in Ecuador. As part of the cheap food program, food crop producers have received substantial credit subsidies. Interest rate subsidies to rice, maize and bean producers in Costa Rica during 1986-91 ranged between 3 and 25 percentage points[11]. In addition, investments in infrastructure, such as roads, silos, warehouses and processing facilities mostly favor agriculture (most forest roads are built by the private sector).

The concerted subsidy effect of all these policies is summarized by the Producer Subsidy Equivalent (PSE)[12], an index used by the World Bank. The PSEs in Table 4 indicate, for example, that the subsidy conferred to Costa Rica's maize producers through price support, subsidized credit and expenditures on research and extension was equivalent to 35.4 percent of the maize value at domestic prices (Stewart, 1991).

Table 4. Producer subsidy equivalents for some crops in Brazil, Costa Rica and Dominican Republic, 1990-1991

Crops	Brazil	Costa Rica	Ecuador
Cotton	123.0	n.r.	n.r.
Maize	-5.7	35.4	54.0
Rice	39.2	21.8	54.9
Edible Beans	125.9	5.0	39.2

At these levels of subsidy, many economically (socially) unprofitable forest-competing agricultural projects become privately profitable, even on traditionally forest lands, as demonstrated by the Costa Rican example. The combination of this result with the high taxation of forestry that results from the policies render forest management projects completely uncompetitive with many agricultural projects and encourage forest stewards to invest in the latter.

[10] Forest sector export subsidies are directed to processed products like plywood and furniture (typically 2 to 4 percent of FOB, port value) and not to primary forest products. And because of policies like the log export ban, forest stewards do not benefit from these subsidies.

[11] To make up for the lack of long-term credit instruments, the Government of Costa Rica has created a fund for financing forestry projects: FONAFIFO (National Fund for Forestry Financing). This is a very new undertaking, however, which is limited and lacks the capability of filling the gap created by the dearth of appropriate financial instruments.

[12] The PSE is the total subsidy per unit of the product (e.g., tm) divided by the value of that unit at domestic prices, and expressed as a percentage. See the Methodological Appendix for calculation details.

SECTION IV
ECONOMIC DEVELOPMENT EFFECTS OF SECTORAL POLICIES

It is clear from the results presented above that sectoral trade, forest and land access and tenure, and fiscal policies have tilted tradeoffs against forestry and in favor of agricultural activities, and thus have been responsible for the environmental destruction observed in Latin America. Deforestation is only one dimension of the problem. Some of those policies have also seriously reduced the economic efficiency in both sectors and have contributed significantly to the worsening of the income distribution among participants in forest products markets. Thus, it can be said that the sectoral policies have been detrimental to both the environment and the economic development of Latin American countries.

This section will first present the nominal and effective protection coefficients for the forest industry and discuss their implications, and then proceed to discuss the economic efficiency and income distribution effects of the policies.

A. Nominal and Effective Protection of Forest Industries

According to the import substitution development model adopted by Latin American countries during the 1950s, the agricultural sector was supposed to provide cheap food while other sectors provided raw materials for industry. This has been very evident in the forest sectors, where processing activities, especially intermediate and downstream, have been strongly protected from competing imports through tariffs and non-tariff trade barriers. Other policies such as the log export ban were devised with the express intent to provide cheap raw materials to those processing industries. The extent to which the tariff and other non-tariff trade barriers and the log export ban protected and subsidized forest industrial activities is captured by the nominal and effective protection indices.

A1. Nominal Protection

Given that the strategy in Latin America has been to promote those industrial activities that generated substantial value added, like downstream processing, the milling activities received negligible or no nominal protection from import tariffs or export subsidies (Table 5). The exception was Costa Rica, a country which has been following a more or less self-sufficient policy in the forest sector, and which not only banned sawnwood exports until 1992, but also imposed high tariff on sawnwood imports (they went from an average of 40 percent and a high NRP in 1986 to 10 percent and a low NRP in late 1993).

As expected, the plywood industries have been well protected at the product level. The combination of import tariffs with monopolistic market structures allowed domestic manufacturers to charge a price inflated by 30 percent in Ecuador and a range of 23 to 122

percent in Costa Rica[13]. The tariff rates were subsequently reduced to 9 and 14 percent, respectively in late 1993.

Table 5. Indicators of the impacts of trade distortions in the forest sector, 1992-1993

Indicators	Bolivia	Costa Rica	Ecuador
Sawnwood			
NRP (%)	n.e.	1-21	n.e.
Private value added (US$/m³) a/	191.6	222.3 c/	n.e.
Economic value added (US$/m³) b/	(103.4)	64.2 c/	n.e.
ERP (%)	n.m.	246	n.e.
Plywood			
NRP (%)	2/d	23-122	30
Private value added (US$/m³) a/	168.2	160.2	314.8
Economic value added (US$/m³) b/	7.5	12	23.8
ERP (%)	2,142	1,230	1,222

Note: Numbers in parentheses are negative.
a/ Value of product minus cost of imported inputs. See Stewart, 1994.
b/ Same as a/ but using economic (undistorted) prices.
c/ For semi-hard species.
d/ There was a 2% drawback on exports, but no protective tariff.
n.e. = not estimated; n.m. = no meaning or close to infinity.
Sources: Stewart, Claure, Gibson (1993); Southgate et al (1994); Stewart (1994).

A2. Effective Protection

Log export bans combined with import tariffs on sawnwood and plywood provided substantial effective protection to milling and plywood manufacturing activities. Given the very low nominal protection, it is clear that in Costa Rica and Bolivia, the log export ban provided almost all of the significant effective protection granted to milling. In Bolivia, the logs used were more valuable than the sawnwood produced. Therefore, the milling process destroyed economic value. This is why the posted economic value added is negative. In this perverse scenario, the index of effective protection (ERP) approaches infinity and thus loses its meaning.

[13] Bolivia, a country which produces negligible amounts of plywood, lifted all tariffs on plywood imports in 1985.

The plywood ERP of 1,200 percent in Costa Rica and Ecuador and 2,100 percent in Bolivia indicate that the returns to domestic factors of production were increased by 1,200 and 2,100 percent, respectively, from what they would have been without the two trade distortions. Most of this increase in returns were captured by plywood manufacturers in the form of economic rents, which implies that the increased returns went to capital (to the shareholders of the manufacturing companies), and not to labor.

In contrast with sawnwood and plywood, and partly as a consequence of plywood protection, the effective protection of doors and furniture in Costa Rica (not shown in the table) were quite low: 9 and 35 percent, respectively. This is ironic since there are indications that the country has a comparative advantage in the manufacture of furniture, but not plywood (Stewart, 1994).

The artificial increases in returns attract resources from elsewhere in the economy to these industrial activities. Past events in Costa Rica are quite illustrative: forest stewards have been liquidating or selling their forests and installing sawmills with the proceeds. Because these resources have been more productive socially (economically) in their previous use, it is concluded that the protection policies are responsible for significant losses in economic efficiency.

B. Economic Efficiency Effects

The high levels of effective protection granted to forest industries, primarily to plywood, have been achieved at significant direct and indirect economic costs.

B1. Direct Economic Costs

The direct economic costs are associated with the log export ban and import tariff on sawnwood and plywood. The combination of low log (the input) prices and high plywood (the output) prices has enabled inefficient manufacturers to produce plywood at high private profits, profits that are mainly transfers from forest stewards and plywood users. At economic (undistorted) prices, however, profits are negative. The logs used are more valuable (measured by what the international market would pay) than the sawnwood and plywood produced. Therefore, the difference between the value of the output and the price of the input (logs) plus the processing cost constitute the economic cost of sawing or manufacturing plywood instead of exporting logs. Table 6 presents these calculations for sawnwood in Costa Rica and Bolivia and for plywood in Costa Rica and Ecuador.

The Ecuadoran situation is very illustrative: plywood manufacturers spend about US$200 to convert US$500 worth of logs (the economic value) into a cubic meter of plywood which could be imported at a cost of US$320 to US$400 (the economic value). The economic loss to the country is US$300 to US$380/m^3 of plywood produced.

In terms of the confessed government objectives of generating employment, domestic value added and economic surplus through domestic processing, the results have been disastrous. Domestic value added was negative in all cases, indicating that, during the process, economic value was destroyed, not added. As for the employment objective, the results indicate that forcing domestic processing has been a very costly way of creating employment, since each job generated in Ecuador through the decision to manufacture plywood instead of exporting the logs had an economic cost equivalent to 19 times the wage paid. This decision was also very costly in terms of foreign exchange earnings, since each job was created at a cost equivalent to 22.4 annual wages. The decision to produce sawnwood instead of exporting logs was also unwise as illustrated by the

Table 6. Direct economic costs of trade distortions in the forest sector, 1992-1993 (US dollars)

Indicators	Bolivia	Costa Rica	Ecuador
Sawnwood			
Economic value of logs, (mills)1/	22.9-27.2	53	n.e.
Value of sawnwood produced	18.7	45.4	n.e.
Milling costs (mill)	2.4	8.2	n.e.
Net value to sawmills (mill)	16.3	37.2	n.e.
Country's economic loss (mills)	6.6-10.9	15.8	n.e.
.....			
Tot. production of sawnwood (000m^3)	44.9	264.6	n.e.
Total jobs created (70/m^3)	642.5	3,780	n.e
Cost per job generated (yearly)	10,272-16,965	4,213	n.e
Yearly wage	780	2,068	n.e.
Cost per job in number of wages	13.2-21.7	2	n.e.
Plywood			
Economic value of 1m^3 of plywood	n.e.	404.6	320.1
Value of logs in 1m^3 of plywood	n.e.	256	500
Mfg. costs of 1m^3 of plywood	n.e.	235	200
Country's econ. loss/1m^3 of plywood	n.e.	86.4	380
.....			
Total production of plywood (m^3)	n.e.	27,000	85,000
Total economic loss (mills)	n.e.	2.3	32.3
.....			
Total jobs created (40/m^3)	n.e.	675	2,125
Cost per job generated (yearly)	n.e.	3,456	15,200
Yearly wage	n.e.	2,068	780
Cost per job in number of wages	n.e.	1.67	19.5
.....			
For. exch. from log exports (mills)	n.e.	7.1	42.5
Foreign exch. expend. on plywood imports (mills)	n.e.	11.2	27.2
Foreign exch. savings from tradable inputs (mills)			
Net potential savings (mills)	n.e.	- 4.1	15.3
Cost per job in terms of F.E. (mills)	n.e.	- 6.085	7.200
F.E. cost in terms of number of wages	n.e.	- 2.9	22.4

1/It was estimated that only 450,000m^3 could be exported in the form of logs.

Sources: Stewart, Claure, Gibson (1993); Southgate et al (1994); Stewart (1994)

costs incurred in Costa Rica and Bolivia[14]

B2. Indirect Economic Costs

The indirect economic costs, incurred as a consequence of the resource misallocation stimulated by the distortions, can be even more important than the direct costs. Yet they are seldom mentioned in the literature, and little attempt has been made to estimate them. A brief discussion of three types of indirect costs follows.

First, costs are incurred because farmers use what was forested land to grow pasture, maize, beans, and other crops whose economic values are lower than the economic value of timber. Conservative estimates indicate that without trade distortions well managed native tropical forests can generate yearly income of US$270 to US$ 450 per hectare per year[15], while most competing agricultural crops yields much less, despite high subsidies. In Ecuador, Southgate (1992) estimated agricultural income of no more than US$20/ha/yr on small farms and cooperatives; and most forest-competing crops in Costa Rica (maize, rice, beans) generate net income of US$90 to US$180/ha/yr, inclusive of subsidies; income from cattle ranching can be as low as US$2.5 to US$3/ha/yr (Stewart and Howard, 1993). In Bolivia, 1990-91 figures indicate that profits for most crops were negative or close to zero. All were less than US$100/ha/yr, except potato (CAO, 1992, and Stewart et al, 1993).

Second, indirect cost is incurred because farmers devote land that was no longer covered with native forest to agricultural activities or cattle ranching, while forest plantation would yield income many times greater (without the distortions, of course). Ston Forestal, a reforestation company, reports average growth rate of Gmelina in Costa Rica of 40m^3/ha/yr. At an average log border price of US$100 to US$120/m^3, the gross income is about US$4,000 to US$4,800/ha/yr, or a net income of about US$3,300 to US$4,000/ha/yr, after costs are deducted. Even if the average growth rate were 20m^3/ha/yr, the net income would be more than the income generated by cattle ranching or any extensive crop in tropical Latin America. **[note: numbers are being rechecked]**

Third, society also incurs indirect costs because more land, labor, and capital are allocated to sawmills and manufacturing plants than is socially desirable. These resources could generate more real economic value and income in other areas. It was pointed out above that the resources used to manufacture plywood had negative returns; economic value was destroyed instead of created or added. This represents enormous economic losses to society.

---

[14] The difference between the cost in both countries reveals the difference in technological development of their milling industries.

[15] Stewart, 1994, used estimated border prices of US$180/m^3 for native Costa Rican species and extraction rates of 20m^3 to 30m^3 every 15 to 20 years and a 10 percent real interest rate, to obtain those results.

C. Income Distribution Effects

Another important type of costs associated primarily with forest sector trade policies are the transfers between economic agents and sectors. By depressing stumpage prices, the log export ban forces forest stewards to transfer wealth to the processing industry: sawmillers and plywood manufacturers[16]. It is estimated that Costa Rican forest stewards transferred annually, in 1992-93, the equivalent of US$86.3 million and US$3 million to sawmillers and plywood manufacturers, respectively (Table 7). Total transfers from Ecuadoran forest stewards to plywood manufacturers were estimated at US$27.9 million per year (production of 85,000m^3).

Table 7. Economic transfers between agents and stakeholders generated by the forest sector trade distortions in Costa Rica, 1992-1993

From	To producers of	Millions of US dollars
Forest stewards 1/	Sawnwood	86.3
Consumers A 2/	Sawnwood	14.5
Total to	**Sawnwood**	**100.7**
Forest stewards	Plywood	3.0
Government	Plywood	0.3
Consumers B 3/	Plywood	3.6
Total to	**Plywood**	**7.0**
Consumers B 3/	Government	0.5
Net to	**Government**	**0.2**
Forest stewards (total)		89.3
All consumers (total)		18.6

1/ Includes the part lost by loggers, which is about 10 percent of the total reported (see Stewart, 1994).
2/ All of the users of sawn timber.
3/ All of the users of plywood, such as furniture manufacturers.
Source: Stewart, 1994.

At the other end, import tariffs on sawnwood and plywood force furniture manufacturers, home builders and other users of these intermediate forest products to transfer important sums to the primary processing industry. Costa Rican users transferred US$14.5 million and US$3.6 million to sawmillers and plywood manufacturers, respectively, in 1992-93. Ecuadoran plywood consumers, who paid about US$100 more per cubic meter because of the distortions, transferred roughly US$6 million per year to plywood manufacturers (estimated consumption 60,000m^3/yr).

In addition to the transfers to manufacturers, the import tariffs force plywood users to transfer important sums to the Government. The Government of Costa Rica, for example, extracted US$18.6 million per year from consumers of plywood and, in turn, transferred some US$0.32 million to plywood manufacturers through the export subsidy in 1992-93.

[16] When these industries are vertically integrated with the forest, as they are in Bolivia, there are no transfers. Because plywood production in Bolivia is negligible (<2,000m^3/yr), transfers at this level were not estimated.

Not unlike many other Latin American countries, the industrialists, especially plywood manufacturers, are few, wealthy entrepreneurs, while most forest stewards and furniture manufacturers are numerous, low income producers. The industry protection policies are therefore very regressive, since they cause wealth to flow from the poor to the wealthy. Removing the distortions will, therefore, not only improve economic efficiency but will also improve significantly the secular income distribution problem that has plagued Latin American countries.

SECTION V
CONCLUSIONS AND RECOMMENDATIONS

The evidence presented here leads to the unequivocal conclusion that Latin America's agricultural and forest sector policies have conspired against the environment since their strong antiforestry bias induced individuals with access to forest to make the rational decision to either convert to agriculture (like colonists) or mine the forest instead of investing in management practices (case of concessionaires).

The reported negative economic development consequences of the forest and agricultural sector policies negate the preconceived notion that the environment in these countries is being sacrificed for the sake of economic development. It is clear from the results that such tradeoff is unnecessary and has not occurred, and that a more neutral (unbiased) set of sectoral policies can achieve the coveted social, economic and environmental goals simultaneously.

Based on these conclusions and in light of the countries' obvious goals of forest conservation and economic development, the general recommendation is to remove the antiforestry bias of sectoral policies, and improve the stability of the policy and economic environments. In order to achieve these goals, the following specific measures are strongly recommended.

A. Forest Sector Policies

- Remove the export ban on all products of species not in danger of extinction.
- Eliminate all tariff and non-tariff barriers to the international trade of forest products and wood processing technology.
- Eliminate all export subsidies.
- Remove all consumption taxes, other than the general sales tax. This includes the "selective consumption tax" in Costa Rica.
- Establish and fully fund research and extension service organizations targeting both natural and plantation forest management.
- Once these reforms are in place, direct incentives for forestry will be both unwise and unnecessary. Therefore, all current subsidy programs—for reforestation and forest management—should be eliminated.

- Provide tenure security in concessions through adjudication or real long-term contracts.

B. Agricultural Sector Policies

- Agricultural sector policies should be devoid of any bias against forestry. Therefore, credit, price support, crop insurance and other policies should be even-handed between the two sectors.

- Eliminate all legal or de facto requirements for gaining title to forested land.

- The agricultural colonization process must stop, or at least include forestry as a genuine land use option.

SECTION VI
REFERENCES

CAO. *Cámara Agropecuaria del Oriente: Memoria 91/92.* Santa Cruz, Bolivia: CAO, 1992.

CDF, Centro de Desarrollo Forestal. "Log production by region." Unpublished tables, La Paz, 1992.

Claure, H. (n.d.). "Política económica de exportación de maderas en Bolivia." Unpublished document.

CORMADERA. "Boletín informativo de precios de productos madereros, No.3." Quito, Ecuador: Corporación para el desarrollo del sector forestal y maderero del Ecuador, 1988.

CORMADERA. *Estadísticas del sector forestal y maderero del Ecuador, 1991.* Quito, Ecuador: Corporación para el desarrollo del sector forestal y maderero del Ecuador, 1992.

Corrales, J. and R. Monge. "Política comercial reciente y subsidios a la exportación en Costa Rica" en *Políticas Económicas en Costa Rica,* ed. Claudio González and Edna Camacho. San José, Costa Rica: Academia de Centro América, 1990.

DGF. *Censo de la Industria Forestal, 1986-1987.* San José, Costa Rica: Dirección General Forestal (MIRENEM), 1988.

Encyclopedia Britannica. *Britannica World Data.* Chicago: Encyclopedia Britannica, Inc., 1993.

Grut, M., J. A. Gray and N. Egli. *Forest Pricing and Concession Policies: Managing the High Forests of West and Central Africa.* World Bank Technical Paper 143. Washington, D.C., 1991).

IICA. *Ajuste Macroeconómico y Sector Agropecuario en América Latina.* Buenos Aires, Argentina: IICA, 1988.

IMF. *International Financial Statistics, Yearbook 1992.* Washington, D.C.: International Monetary Fund, 1992.

Kishor, N.M. and Constantino, L.F. Forest Management and Competing Land Uses: An Economic Analysis for Costa Rica. LATEN Dissemination Note #7. The World Bank Latin America Technical Department Environment Division 30 pp., 1993.

Krueger, A., M. Schiff and A. Valdés. *The Political Economy of Agricultural Price Intervention in Latin America.* San Francisco, California: International Center for Economic Development, 1990.

Pearson, S.R. and Eric E. Monke. *The Policy Analysis Matrix: A Manual for Practitioners.* Falls Church, Virginia: The Pragma Corporation, 1987.

Scnadizzo, P. and Colin M. Bruce. "Methodologies for Measuring Agricultural Price Intervention Effects"; Staff Working Paper No. 394, World Bank, Washington, D.C., 1980.

Southgate, D. et al. "The Economics of Agricultural Land Clearing in Northwestern Ecuador," IDEA. Quito, 1992).

Southgate, D. and M. Whitaker. "Development and the Environment: Ecuador's policy Crisis. Quito: Instituto de Estrategias Agropecuarias, 1992.

Southgate, D. et al. "Improving Incentives for Sustainable Forest Management: An Ecuadoran Case Study. Report prepared for USAID/Washington. Quito, Ecuador, 1994.

Stewart, R., H. Claure and D. Gibson. The Effects of Trade and Concession Policies in Bolivia's Forestry Sector: A Methodological Framework for Analysis. Heredia, Costa Rica: Stewart Associates, 1993.

Stewart, R. and M. Cuesta. "La política de precios del arroz y sus efectos en el Ecuador". Documento de Trabajo No. 1, MAG, Unidad de Análisis de Política, Quito, Ecuador, 1988.

Stewart, R. and M. Acosta. "Efectos de la política de precios del maíz y de la soya sobre el precio y el consumo de productos agrícolas en el Ecuador en 1987". Documento de Trabajo No.2, MAG, Unidad de Análisis de Política, Quito, Ecuador, 1988.

Stewart, R., M. Cuesta and M. Acosta. "La política de incentivos y la ventaja comparativa del Ecuador en la producción de soya." Documento de Trabajo No.3, MAG, Unidad de Análisis de Política, Quito, Ecuador, 1988.

Stewart, R. and I. Hernández. "Política económica y los granos alimenticios en Centro América." Report prepared for RUTA/World Bank by Stewart Associates, Heredia, Costa Rica, 1991.

Stewart, R. "Indices of the Effects of Policies on the Agricultural Sector of Costa Rica". Report prepared for the World Bank by Stewart Associates, Heredia, Costa Rica, 1992).

Stewart, R. and A. Howard. "Forest Sector of Costa Rica: Financial Analysis at the Farm Level." Document prepared for USAID/Costa Rica; Heredia, Costa Rica, 1993.

Stewart, R., H. Claure, and D. Gibson. "The Effects of Trade and Concession Policies in Bolivia's Forest Sector: A Methodological Framework for Analysis." Draft report prepared for LAC/TECH-CHEMONICS, Washington, D.C., 1993.

Stewart, R. "Incidencia de las políticas de comercio internacional sobre la economía del sector forestal costarricense". Documento preparado por Stewart Associates para USAID/Costa Rica, Heredia, Costa Rica, 1994.

Tsakok, Isabel. *Agricultural Price Policy: A Practitioners Guide to Partial Equilibrium* Analysis. Ithaca, N.Y: Cornell University Press, 1990.

Valdés, A. "Impact of Trade and Macroeconomic Policies on Agricultural Growth: The South American Experience" in *Economic and Social Progress in Latin America.* Washington, D.C.: IDB, 1986.

Valdés, A. "Gaining Momentum: Economywide and Agricultural Reform in Latin America." World Bank report No.10921-LAC, Washington, D.C, 1992.

World Bank. *Agricultural Research, Sector Policy Paper.* Washington, D.C.: The World Bank, 1981.

World Bank. *The Forest Sector, A World Bank Policy Paper.* Washington, D.C.: The World Bank, 1991.

SECTION VII
METHODOLOGICAL APPENDIX

The methodology used to measure the economic effects international trade policies in the forest sector of each country draws heavily on the theory of international trade and follows many of the procedures developed and applied by Scandizzo and Bruce, 1980; Pearson and Monke, 1987; and Tsakok, 1990.

According to the theory, all tradable goods have a border price, which is equal to the price foreign buyers are willing to pay for a national product, placed at a given border point (e.g. a port) or at a point within the country; or to the price domestic importers have to pay for a foreign product placed at similar points. Therefore, the border price of importables is the CIF (cost, insurance and freight] cost at those points, while the border price of exportables is the FOB (free on board) export price. Because the international market offers real opportunities to buy or sell a given product, the border price, which is derived from this market, is also the opportunity cost or the economic or social price.

In order to determine the magnitudes of price and market distortions, the theory and methodology developed two very useful indices: the nominal protection coefficient (NPC) or nominal rate of protection (NRP) and the effective protection coefficient (EPC) or the effective rate of protection (ERP).

The NPC is equal to the ratio of domestic border prices (P_d/ P_b). while the NRP = $100*((P_d-P_d)/P_b)$ or $100*(NPC-1)$. A NPC > 1 indicates that domestic prices are above border equivalents, and thus, that domestic producers are being protected or subsidized through trade policies. A NPC < 1 indicates exactly the opposite; and a NPC = 1 indicates either that there are no distortions in the product market or that the distortions cancel each other and, consequently, producers are neither taxed nor subsidized.

The NPCs only account for distortions in the product market, while the EPC, which is equivalent to the ratio of domestic to border value added, accounts for both product market distortions and distortions in the market for tradable inputs. Value added is equal to the price of a unit of the product minus the costs of all tradable inputs used in its production. It is thus the value added by non-tradable or domestic resources of production (labor, land, certain capital, management). There is economic value added (with undistorted prices) and private value added (prices might be distorted).

$$EPC = \frac{VA_d}{VA_b} \quad \frac{P_d}{P_b} = \frac{P_{di} - \sum_i P_i Q}{P_{bi} - \sum_i P_i Q} = \frac{\text{Value added at domestic prices}}{\text{Value added at border prices}}$$

where:

P_d = domestic product price,
P_{di} = domestic price of the tradable input,
Q_i = quantity utilized of the tradable input,
P_b = border price of the product,
P_{bi} = border price of the tradable input.

A CPE > 1 indicates that the value added at domestic prices is greater than the value added at border prices, and that therefore, the returns to domestic factors of production (land, labor, capital) are increased as a result of the distortions. A CPE < 1 indicates exactly the opposite; and a CPE = 1 indicates either that there is no distortion in both product and tradable input markets or that the distortions in each cancel each other to the point where the value added at domestic prices is equal to the value added at border prices.

A. Estimation of Border Prices and Indices of Protection

In order to estimate border prices, it is first necessary to determine whether the country is a net importer or exporter of the product in question or would be in the absence of existing distortions. The second step consistS in estimating equivalent, undistorted CIF costs of FOB revenues at given locations. The third step consistS in comparing domestic to border prices; that is, in calculating the indices. The following procedures were followed, on a product basis.

Logs. Had it not been for the log export ban imposed mainly during the 80s, tropical Latin American countries would have been net exporters of logs of many species. The border prices are therefore FOB, port export prices. And since they were lacking after the mid 80s, it was necessary to estimate border prices indirectly. Three different approaches were followed in the case studies to estimate FOB, port prices: 1) the FOB, prices received in Ecuador for logs of two species in 1988 were used as references to estimate border prices for similar or same species in Costa Rica and Ecuador, for the same year, and adjusted for other years; 2) the prices paid in Asia and Africa for species equivalent to those in Latin America were adjusted for freight and quality differences; and 3) actual FOB prices received by Costa Rican exporters in late 1993 for plantation logs (Gmelina, Teak) were used as references.

The last method does not require discussion. The **first method** consisted in comparing the FOB prices paid to exporters in Ecuador for Brosimum utile and Dialyanthera spp to the domestic prices paid in each one of the three countries for equal or similar species—after making adjustments for difference in freight costs. Although the data is outdated, it is robust since the estimates are based on actual prices paid, and the species are common to the other countries.

Second method. Tropical wood experts provided the equivalencies between Bolivian, Costa Rican, and Ecuadoran species and the species exported from Africa and Asia. It was assumed that, except for minor adjustments, European importers (users) would pay the same for equivalent Latin American species. In the Costa Rican study, for example, Caobilla was compared to Sapele (that the price of caobilla was reduced by 20 percent because of quality differences); Gallinazo and Javillo, with Ayous; Cocobolo, with Iroko; Ceiba, with Ceiba from Ghana; and Cedro, with N'Gallón. All of these, except Ceiba, were exported from Cameroon. FOB, Douala (Cameroon) prices were obtained from *Tropical Timbers* published in England and from *MNS Tropical Timber Report* published in Switzerland.

The cost of freight played an important role in the estimation process, as exemplified by the Costa Rican case. Because of the lack of experience in exporting logs, it was necessary to draw on the experiences from Chile and Honduras. Average freight rates from Chile to its principal markets (Middle East, Japan) are US$45-50/m3. The freight rate from Concepción, Chile to Ambers, Germany for sawnwood is US$32/m3, and US$36/m3 to Towerwharf, England. On the other hand, the freight rate for sawnwood exported from Puerto Cortés, Honduras to Holland, Germany and Belgium was US$84/m3 in 1993. Based on this information, and in order to be conservative, the following two rates were used to approximate the freight cost from Limón, Costa Rica to Europe: US$50/m3 and US$80/m3. On the basis of reports obtained from Cameroon and Ghana, a range of US$50 to US$60/m3 was used to approximate the freight cost from Africa to Europe.

Once the specie equivalencies and freight rates were determined, the border price estimation (upper and lower bound) was straightforward:

FOB, Limón, C.R. = FOB, Douala, Cam. + freight from Africa to Europe - freight from Europe to Limón.

Sawnwood. Due to the absence of significant distortions at this level, NPCs were not estimated for Bolivia or Ecuador. Costa Rica would have been a net exporter of several tropical species, but sawnwood exports were banned until August 1992. As a consequence, actual export prices for the majority of the species were not available. Fortunately, Brazil exports to Europe sawnwood of more than 30 species equal or equivalent to the Costa Rican species, such as Guapinol, Cedro, Níspero, Fruta Dorada, Almendro, Laurel, Botarrama, Nazareno and Caobilla. FOB, Belém, Brazil prices were adjusted, following the methodology described above, in order to estimate equivalent border prices at Port Limón, Costa Rica. Adjustments were also made for differences in drying methods. The Brazilian Association of Industrial Wood Exporters (AIMEX) recommends reducing the price of Cedar US$40 to obtain the equivalent to "[air dried]"; the price of Fruta Dorada was also reduced by US$20 for the same reason. The equivalent FOB prices were thus approximated as follows:

FOB, Limón = FOB, Belém + Freight Belém to Europe - Freight from Europe to Limón.

Plywood. Without the distortions, Ecuador and Costa Rica would have been net importers of piywood. In accordance, there are two ways to obtain the border prices and NPCs: (1) Assume that the NPC is equivalent to the tariff rates, or (2) utilize the information generated by actual imports to estimate the border prices and the NPCs. Due to quality differences, the latter is less precise.

The tariff method. This is the easiest method and the most exact when the tariff is the only distortion. It is assumed that the domestic price is not affected by other factors, and that it is higher than the border price by a percentage equivalent to the tariff (NRP = tariff rate). However, it should be noted that because the structure of the plywood market is monopolistic in both Costa Rica and Ecuador, the NRP is higher than what the tariff alone suggests. In these cases, and in spite of its inaccuracy, the other approach is preferable.

The price difference method. The Costa Rican case illustrates the approach. In terms of species and qualities, the plywood imported from Korea, Brazil, Peru, and Nicaragua is comparable to what is produced in the country. Therefore, the expenses incurred to place the product in San José (its capital) was added to CIF, Limón or Port Caldera prices in order to obtain the equivalent border prices at the ex-plant level in San José. These were then compared to the domestic prices at the same level, for same thickness and quality, to obtain the NPC estimates.

These NPCs represent the protection received by the domestic industry from imported plywood. The portion exported by this industry is obviously not protected from imports; it receives nominal protection via export subsidies (NRP = % subsidy).

Furniture. In the case of furniture and related products, the NRP was equivalent to the subsidy, when exported, and to the import tariff, when sold in the domestic market.

Effective protection. The EPCs were calculated for sawnwood in Costa Rica and for plywood and furniture in all three cases. Detailed costs of production information was obtained from firms in each country. The border prices of the tradable inputs were approximated by removing the distortions (mainly removing tariff and subsidy effects) from observed market prices.

B. Estimation of Producer Subsidy Equivalents

In the case of Costa Rica, this index includes a subsidy from the marketing system or pricing policy, an interest rate subsidy and a government expenditures on research and extension subsidy. To obtain the pricing policy subsidy, the quantities produced were multiplied by the difference between the domestic and border prices. To obtain the credit subsidy, the difference between the interest rates for commercial activities and those paid by small farmers were multiplied by the total amount of credit provided per year. The index is estimated as follows:

PSE = [Sum total of (price subsidy + credit subsidy + Research and Extension expenditures] divided by (Pr*Total Quantity produced)

C. Estimation of the Direct Economic

In the Costa Rican case, these costs were estimated for sawnwood and plywood production. In the first case, it was assumed that the country would have exported 30 percent of its logs without the prohibition, and the revenues that such exports would have generated were compared to the value added by the domestic processing activity. The loss of economical surplus (LES) was calculated as follows:

$$LES = (P_{fl} * Q_l) - (P_{pm} * Q_m) + \text{Cost of sawing;}$$

where:

P_{fl} = border price of the logs; P_{pm} = market price of sawnwood; Q_l = cubic meters of exportable logs; and Q_m = cubic meters of sawnwood produced.

The Costa Rican mills indicate that each $70m^3$ of sawnwood produced per year generate a permanent employment; therefore, total employment generated is equal to $Q_m/70$, and the cost of each job generated is equal to $(LES*70)/Q_m$.

The cost of banning log exports to produce plywood domestically, as well as the cost of each job generated, was calculated similarly.

LES = Economic value of the logs + costs of processing them (it was 50 percent) - the cost of importing an amount of plywood equivalent to what was being produced.