

## A Literature Review on the Log Export Ban Policy in Developing Countries: From the Perspective of Environmental Economics

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**ABSTRACT:** The log export ban (LEB) policy, considered as the most extreme form of log export taxation, was formulated to conserve forest area and trigger growth. However, its effectiveness in achieving the twin goals of economic efficiency and environmental conservation has been widely debated. In this paper, the efficacy of the log export ban policy is reviewed. Using empirical evidence from Indonesia and Costa Rica, the opposite sides of the debate (i.e. the effects of the implementation versus the removal of the LEB) are analyzed. Lastly, alternative policies, e.g. carbon payment schemes, are also briefly discussed.

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### I. Introduction

In search of policies that will help in sustainability efforts, emphasis has been recently given to the use of trade policies to address transnational environmental concerns (Kishor, Mani and Constantino, 2001). One of the major focuses of this debate has been on tropical timber/ log trade. Some argue that the international trade of forest resources harms the environment. In particular, log trade causes deforestation. Thus, trade is believed to cause environmental degradation. Besides contributing to global warming, deforestation leads to loss of water resources, destruction of biodiversity, soil erosion, and the like.

Given the problem above, a log export ban (LEB) is regarded as a second-best policy tool for addressing environmental externalities. It will reduce demand for log exports and decrease deforestation rates. Thus, justifications are offered as to why a timber export tax, and its most extreme form—a LEB should be implemented. Restrictive trade policies have been used to encourage forest-based industrialization. Such were also used to compensate domestic processors for discrimination in developed country markets (Resosudarmo and Yusuf, 2006). On the contrary, in theory, trade restrictions are considered to be welfare-reducing and distortionary. For example, if the specific policy objective is to protect an infant industry, an indirect subsidy through trade restrictions is not the first-best instrument. There might be an unfortunate expansion of an inefficient downstream sector that is wasteful of the cheap primary input.

In this paper, using empirical evidence from the cases of two developing countries (Indonesia and Costa Rica), the effectiveness of the log export ban as an instrument in achieving both efficiency and conservation is analyzed.

### II. Brief Background

#### A. Deforestation and the LEB in Indonesia

Amounting to 144 million hectares, Indonesia's forest cover area is ranked third in the world (FAO, 2005). Forestry-related industries account for 4% of Indonesia GDP (Resosudarmo and Yusuf, 2006). Unfortunately, between 1990 and 2005, Indonesia lost 28 million hectares of forest cover. Indeed, tropical rainforests in Indonesia can be considered as scarce resources. Thus, in 2001, the arguments for and against the LEB has intensified in Indonesia. For the second time, the Ministry of Forestry has enacted a regulation which bans the export of logs from Indonesia (Resosudarmo and Yusuf, 2006). Such ban was proposed because the enforcement of forestry law has been difficult (Dudley, 2004). Accordingly, the main purpose of the LEB policy in Indonesia is to control timber over-harvesting, minimize illegal log exports, and induce growth in forest-based manufacturing industries.

#### B. Deforestation and the LEB in Costa Rica

The forestry sector is also an integral part of the Costa Rican economy. Forest production in Costa Rica accounts for 1% of the GDP. However, most of Costa

Rica’s problem with deforestation is a result of excessive clearing of land for logging (as forest land is converted to farmland). From 4.5 million hectares a century ago, primary natural forest cover decreased to only 1.3 million hectares in 2000 (World Bank, 2002). Like Indonesia, Costa Rica’s deforestation rate is high (i.e. estimated to be 16,000 hectares per year). Thus, in order to protect its forests and encourage the development of the domestic timber processing industry, Costa Rica imposed the LEB on 1986. The LEB isolated the domestic market from foreign competition. The immediate effect was a decrease in domestic log prices (Stewart, 1992).

**III. Conceptual Framework**

**A. The LEB and Economic Welfare**

**1. LEB’s Effect on the Wood-Processing and Log Industries**

Some countries implement export restriction as an industrialization strategy to build their infant industries. It is argued that selling logs only to domestic processing mills would help in the development of downstream industries. These downstream industries, in turn, would increase export product value-added. With the LEB, in getting timber supply, the domestic processing industry need not compete with foreign counterparts. Thus, local players get cheaper timber supply (Bran, 2002).

However, it should be noted that the LEB policy not only affects the wood-processing (downstream) industry. It also affects the raw wood market. From the perspective of the processed-wood market, the log export ban is almost equivalent to a shift in log supply (from  $S_1$  to  $S_2$ ) caused by changes in log prices (Figure 1). In contrast, from the point of view of the raw log market, the LEB drives down the demand (from  $D_1$  to  $D_2$ ) for logs (Figure 2).

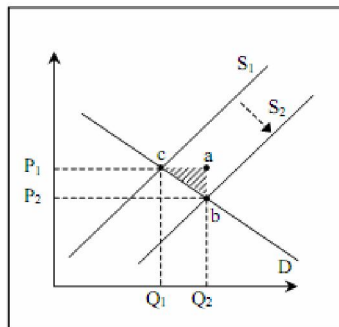


Figure 1. The effect of the LEB on the processed-wood market.

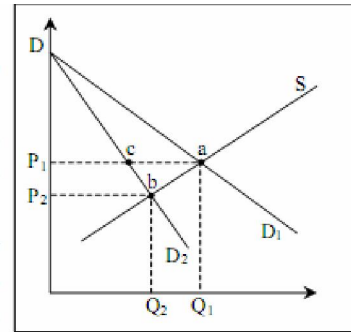


Figure 2. The effect of the LEB on the log market.

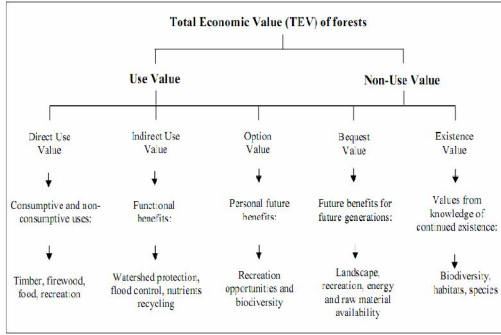
Thus, in equilibrium, the LEB may foster economic efficiency in the processed-wood market. But, from the log market perspective, it is the opposite. Indeed, a trade-off may exist (Von Amsberg, 1994).

**2. LEB’s Effect on Employment**

When LEB is imposed, employment in the unprocessed logging (raw wood) sector is reduced. In contrast, a fall in log prices and an increase in value-added will increase the demand for labor and the creation of more employment in the manufacturing forestry (domestic milling) sectors (Zhang, 1996; Barbier et. al, 1995). Thus, the LEB’s effect on employment is rather vague.

**B. The LEB and Environmental Conservation**

Environmentalists argue that the market supply for logs only represents the private marginal cost of logging, excluding its externalities. Externalities include the use of forest benefits such as water-shed protection, biodiversity, and carbon storage. When only the private marginal cost is considered, the true value (market plus non-market uses) of forests implied in Flowchart 1 are not taken into account. Meanwhile, Figure 3 describes that the inclusion of the true marginal social cost. Accounting for the true marginal social cost should change the supply curve from  $S^L_0$  to  $S^L_1$ . Consequently, the socially optimum extraction of logs should be C instead of B, with  $P_1$  as the world price. With  $P_1$ , timber exports will be reduced and deforestation is expected to decrease. According to Resosudarmo and Yusuf (2006),  $P_1$ ’s result of reducing timber exports can be achieved by a second-best policy tool, the LEB.



Flowchart 1. Total Economic Value of Forests.

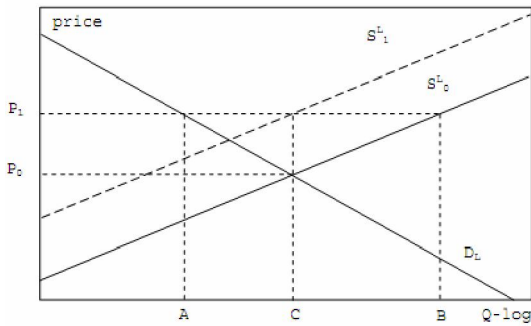


Figure 3. Illustration of the Environmental Concern Argument.

Despite not being the first-best solution, the LEB is considered easy to implement. Hence, the LEB has been associated with protecting forests from overuse. The environmental argument of the LEB is further supported by the prevalence of illegal logging. When the LEB is imposed, lower domestic prices may eliminate the incentive to conduct illegal logging activities (Resosudarmo and Yusuf, 2006).

In summary, as taught in class, markets could be missing for many tropical forest goods. But, even if markets exist for forest products, they may only reflect the opportunity costs of labor and capital, but not the true rents of forested land (Panayaotu, 1993). Consequently, the full benefits of forests are undervalued, as prevailing market prices do not fully reflect indirect – use or existence values of forests.

**IV. Empirical Results**

Studies on the possible effects of a LEB on economic development and deforestation have presented mixed results. On one side, it is believed that the imposition of an LEB policy will encourage the development of domestic forest-based industrialization. Local forest-based industry development is expected to create greater economic added value and more job opportunities in a given country. In addition, it is implied that an LEB policy is a second best policy to

reduce forest exploitation and illegal logging (Resosudarmo and Yusuf, 2006). Furthermore, the decline in log exports may reduce deforestation rates. On the other hand, some researchers have shown that removing the log export ban may increase a country’s revenue from forest-related sector (Gillis, 1988). Some even noted that the LEB policy could discourage the adoption of sustainable practice in timber harvesting (Deacon, 1992). It is also possible that a LEB may reduce a country’s export revenue from wood products (Manuring and Buongiorno, 1997). Furthermore, an LEB’s effect of increasing employment opportunities was shown to be insignificant (Perez-Garcia, et al. 1997). To present the ambiguity related to the LEB’s efficacy, in this section, few researches specific to two developing countries (Costa Rica and Indonesia) are presented.

**A. Costa Rican Log Export Ban**

**1. Net Surplus Estimation**

In an IMF study, Kishor, Mani and Constantino (2001) investigated the effects of the removal of the LEB in Costa Rica. Obviously, they mentioned that the removal of the LEB will cause domestic log prices to rise to the world price level. Hence, they estimated the net surplus derived from the lifting of the log export ban. In particular, Figure shows the aggregate effect of the LEB removal to downstream processors and resource owners. The initial demand of domestic downstream processors is given by  $Q_0$  and the price is  $P_0$ . Removal of the LEB leads to a rise of prices to  $P_w$ . Total log harvests increase to  $Q_w$ . Domestic Consumption falls to  $Q_0'$ . Log resource owners gain  $AP_0P_wC$ . In contrast, processors lose  $AP_0P_wB$  due to higher input prices. Therefore, the net gain in surplus is area ABC (Figure 4).

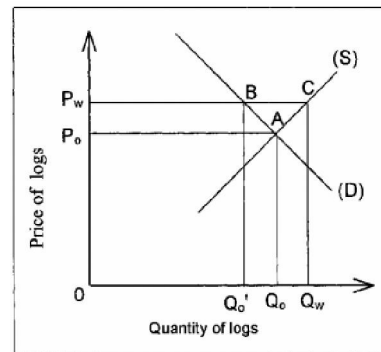


Figure 4. Net Surplus from Removing the LEB.

Besides the elasticity of the supply and demand curves, the net surplus, ABC, will also depend on the initial difference between domestic and world log prices. Using the estimated 67% probable increase in domestic

log prices provided by Stewart (1992), the authors predicted that the net increase in welfare (or efficiency gains from trade liberalization) might range from 6.4 to 23.6 million dollars per year. Overall, productive efficiency gains may go up to 0.1% of Costa Rica's GDP.

## 2. Environmental Costs and Benefits Estimation

The authors also provided a raw estimation of the environmental costs and benefits of the LEB removal. With an assumed 0.1 elasticity in log supply, increased timber supply from existing forest plantations might result in an environmental cost amounting to around 2.2 million dollars. However, if the increase in supply comes from land converted from pastures and farmland to forestry plantations, benefits might result. More specifically, due to the carbon sequestration functions of plantations, environmental benefits are valued to be 75 dollars per hectare or a total of about 380,000-780,000 dollars yearly. Overall, however, the authors warned that a policy reform through an LEB removal is not sufficient.

## B. Indonesian Log Export Ban

### 1. Trade-Off Model

In an econometric study by Gaduh and Roesad (2004), the dynamics of economic adjustments in the Indonesian forestry sector was discussed. Using microeconomic analysis, it was investigated whether or not the removal of the log export ban matters. The authors noted that the LEB and the enforcement of artificially low log have fostered the inefficient domestic wood producers, while neglecting more efficient foreign woodpanel suppliers. However, removal of such policies may increase pressure on Indonesian forests. The lifting of the LEB may move prices to that compatible with the international level, hence increasing harvesting rates. On the other hand, an artificially low log price may reduce supply. Thus, there is a trade-off between economic efficiency and environmental sustainability.

Again, Gaduh and Roesad (2004) attempted to answer two questions related to the LEB's conservation-efficiency trade-off: 1. What impact did the LEB have on the efficiency of the wood-processing industry?; and 2. What impact did the LEB have on logwood production? To answer the first question, the following specification was used:

$$\ln(\text{Eff}/\text{Eff}-1) = 0 + 1 \cdot d8597 + 2 \cdot d9801 + \quad (\text{Equation 1})$$

where Eff is the output-input ratio, d8597 and d9801 are the dummy variables indicating periods of 1985-1997

(LEB period) and 1998-2001 (Asian Financial Crisis) respectively. Given the artificially low price of logs during the LEB period, theory suggests that there might be a downward shift in the efficiency in the use of logs as input, i.e. 1 has a negative sign. Meanwhile, using Equation 1, Gaduh and Roesad (2004) found out that prior to the LEB policy, the log-use efficiency of plywood grew by 48% yearly. Unfortunately, the LEB reduced the efficiency growth in the sector to about 4%.

Meanwhile, to answer the second question, the following model (Equation 2) was used:

$$\ln(\text{LogProd}) = 0 + 1 \cdot d8597 + 2 \cdot d9801 + \quad (\text{Equation 2})$$

where LogProd= timber/ log production. With this, while accounting for structural breaks in the periods of 1985-1997 and 1998-2001, empirical results imply the absence of any change during the LEB implementation period of 1985-1997. In comparison, during the Asian Financial Crisis, once the LEB is lifted, log production notably decreased.

In summary, the authors investigated whether the LEB has encouraged less efficient use of domestic logs and whether it has helped to lessen wood extraction rates. The research suggests that only the former did occur during the LEB regime of 1985-1997. Lastly, the high incidence of illegal logging (caused by relatively low marginal costs of logging) suggests that the quantity of commercial logging stayed above sustainable levels (Gaduh and Roesad, 2004).

### 2. Feedback Loop Simulation Model

In a study conducted to visualize the effects of the log export ban on the Indonesian forestry sector, Dudley (2004) employed a simplified model to provide overviews of possible feedback loops, e.g demand-price feedback loop. In general, the simulation model incorporates some potential costs and benefits of implementing and lifting a log export ban policy in Indonesia.

#### i. Effect of the LEB on Domestic Price and Processing

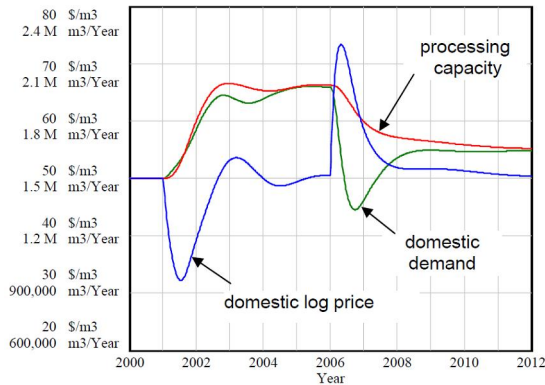


Figure 5. The Effect of the LEB on Domestic Price.

A logging export ban induces a decrease in domestic log price. As exhibited in Figure 5, a drop in domestic price stimulates local processing capacity. In a scenario wherein the LEB is lifted, Dudley (2004) predicted that an inadequacy in log supply and an increase in domestic prices might result. Therefore, processing capacity might go down. On the positive, log production may recover quickly and lower log prices again. Hence, in the case of an LEB removal, it is possible that log harvests be sustainable, i.e. maintenance of domestic processing capacity.

**ii. Effects of Illegal Logging on Demand and Exports With and Without an LEB**

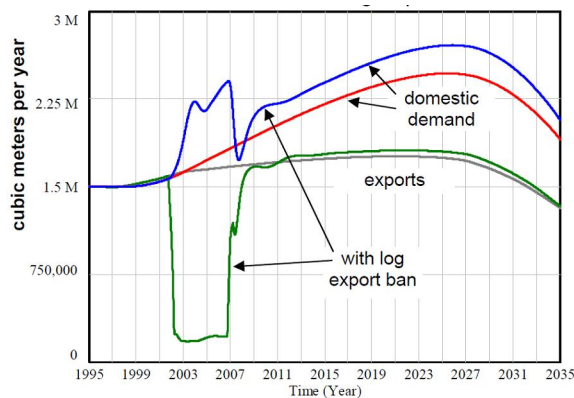


Figure 6. Illegal Logging Effects on Demand and Export with and without a LEB.

Figure 6 incorporates high logging rates coupled with the drop of logging costs stimulated by illegal logging. In such case, a temporary LEB may increase domestic demand (Dudley, 2004).

In conclusion, the simplified feedback loop models indicate that some scenarios may help reduce log harvests and/or deforestation in Indonesia. However, others encourage increased log harvests, e.g. those activities which may result to excess domestic milling

capacity. Hence, for a log export ban policy to be effective, limits must be strictly imposed on possible increases in logging capacity, etc.

Overall, the three models above provide important insights into the potential indirect effects of the LEB through changes in demand resulting from shifts in sectoral income distribution. Unfortunately, even with extreme simplifying assumptions, the models cannot predict how the LEB will affect forest clearing without making additional strong assumptions regarding the elasticities of demand and supply. The models tell us nothing about the exact effect on the extent of deforestation (Kaimowitz and Angelsen, 1998). Thus, careful interpretation of the results' applicability to reality must be conducted.

**V. Synthesis**

In this section, the positive and negative externalities of forest-related activities and LEB's effectiveness as an instrument for deforestation reduction are discussed.

**A. Externalities Linked to Forestry Activities**

The need for a policy like the log export ban is justified by the existence of some positive externalities linked to forests and negative externalities linked to deforestation. According to Turker, Ozrturk, and Pak (2003), there are many positive externalities provided by forests. Such positive externalities include the following: carbon storage or sequestration, erosion prevention, climate regulation, water purification, ecosystem balance, and other similar environmental services of forests. On the other hand, negative externalities due to the interferences to forests, e.g. deforestation. The negative externalities which arise due to poor forest management and deforestation can be summarized as follows: erosion, flooding, biodiversity loss, landscape quality losses, and the like (Turker, Ozturk, and Pak, 2003).

**B. LEB as an Extreme Form of Taxation**

According to the environmental concern argument in Part III, the LEB can account for the externalities caused by forest-related activities. However, the analysis in Part V implies that the use of trade restrictions as an environmental policy is not an efficient instrument in cases of production-related environmental issues. The prohibition of log exports eliminates foreign competitors as a source of demand. This lowers the "stumpage" value of timber in much the same way a tax would (Kishor, Mani and Constantino, 2001). But, taxes (in this case, the log export ban is considered full taxation) cannot sustain Pareto optimum.

Indeed, in the absence of a first-best Pigouvian tax on production (i.e. harvesting of unprocessed logs), indirect economic instruments like trade restrictions can be used (Deacon, 1992). However, such restrictions, e.g. the LEB, will only be second best in maximizing welfare.

### C. LEB as an Environmental Conservation Tool

The debate on the LEB suggests that there is a trade-off between achieving welfare and preservation. The more intense the environmental damage is, the more likely the LEB is to increase social welfare. In this case, an LEB decreases the overall demand for log and reduces deforestation externalities (Resosudarmo and Yusuf, 2006). However, the more elastic the demand for logs as inputs is, the less likely the LEB is to raise welfare. With such an unfortunate scenario, a LEB is more likely to cause an overharvesting of logs and, in turn, intensified deforestation (Kishor, Mani and Constantino, 2001). Therefore, there are views which do not support the LEB's being a second-best instrument. Less efficient domestic wood processing industries will use more logs compared to their more efficient foreign counterparts. Furthermore, lower log prices following the export ban may encourage the substitution of wood for primary inputs, e.g., labor and capital. Also, a lower price for logs may cause disincentives for forest resource sustainability. Because they may not see a financial gain from conservation, loggers may care less about their activities' negative environmental impacts. The decrease in domestic prices caused by the LEB may discourage the use of sustainable log harvesting techniques (Barbier et al., 1995). With all of these, higher deforestation rates might be induced. Hence, the effectiveness of an export ban as an instrument for environmental sustainability is rather unclear. With all the conflicting arguments above, Pearson (2000) further noted that deforestation must not be dealt with export restrictions. Instead, proper assignment of property rights, consumption and production intervention, and market creation might be a better approach.

## VI. Alternative Policies

Because of the distortions caused by the log export ban, other policies aiming to reduce deforestation have been proposed. Examples of such environmental policies are Property Rights Imposition, Payments for Environmental Services (PES), and Local Forest Management (LFM).

### A. Imposition of Well-Defined Property Rights

As already implied earlier, deforestation can arise out of failures in incentive regimes. Economic incentives fail when markets treat the environment as a free resource (Deacon, 1992). Consequently forests are

open access resources, where ownership rights are non-existent or unclear. There are no incentives to use forests in an efficient manner and this leads to over-use of forest resources. Therefore, one of the problems in forest management is the existence of weak property rights. For example, in Indonesia, the state owns all land that lacks formal title, but private entities can own forests. Indonesia's basic forestry law pledged the nation to a decentralized forest regime (Engel and Palmer, 2008). However, the legal rights, responsibilities, and economic benefits of forest investments are not clear. Therefore, secure property rights could be established and enforced to eliminate the open access problem. However, it should be noted that tenure arrangements of forests do not automatically reduce deforestation rates. For example, Jaramillo and Kelly (1997) discussed that policies which required forest clearing to obtain title have weakened the effects of private property rights on sustainable forest use. Individuals may think that their private profitability of keeping forests is lower than that of removing the forest cover for agriculture and livestock activities. Moreover, the provision of forest property through logging concessions is also problematic. Logging concession is a method that grants leases to private concessionaires for logging. Such have been criticized because they devote much attention to timber products and ignore forest resources. There are several possible alternative tenurial arrangements of managing forests: common property rights, restricted individual rights and complementary tax measures. But, seemingly, in order to be effective, property rights must be implemented together with other policies, e.g. PES and LFM.

### B. Payments for Environmental Services

The Payments for Environmental Services (PES) is an economic tool which designed to provide incentives to conservation. PES is based on the twin principles that (1) those who benefit from environmental services should pay for them, and (2) those who generate these services should be compensated for providing them. The benefits of the PES can be explained by Figures 7 and 8.

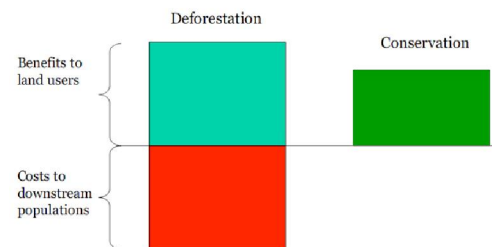


Figure 7. Deforestation vs. Conservation without the PES.

Figure 7 implies that, compared to environmental sustainability, deforestation is more attractive to land users. However, conservation is better for society as a whole. In contrast, Figure 8 shows that a payment scheme makes conservation more attractive than deforestation. Both land users and downstream populations are better off.

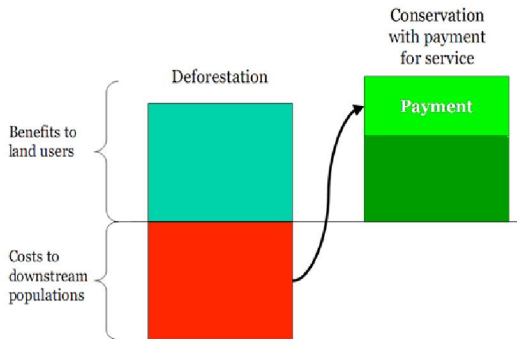


Figure 8. Deforestation vs. Conservation with the PES.

While there are currently no formal PES schemes established in Indonesia and Costa Rica, the PES would be a potential alternative to the LEB. One example of a PES project is the implementation of carbon payments. In particular, Elverfeldt, Schwarze and Zeller (2008) studied the impact of carbon sequestration payments to forest management systems. By using the data from six Indonesian villages, they identified four household categories according to dominant agro-forestry systems. They noted that by implementing carbon credit prices up to € 32 t CO<sub>2</sub>e<sup>-1</sup>, an incentive can be provided. Overall, it was concluded that by implementing carbon credit prices, an economic incentive to reduce deforestation may exist.

### C. Local Forest Management

Local Forest Management (LFM) can be described as “participatory forest-related activities for the purpose of sustaining and improving the economic and social welfare of the people living in and around the forests (Nanang and Inoue, 2000).” The 5 main characteristics of LFM are the following: 1. Access and control over the land and forest resources by local people; 2. Control over local decisions, independent initiatives and self-mobilization; 3. Solutions to competing demands over resources that minimize conflicts; 4. Complementary relationship among different forest users; and 5. Equitable shares of the forest benefits. With these, the LFM project might be an alternative solution to deforestation. For example, in Indonesia, programs based on LFM have been carried out. In particular, in 1995, cooperatives among people living within and near forests areas (e.g. community forest programs) have been created. They provide an

opportunity a “professional-guided participatory approach” and even an “endogenous bottom-up approach” in forest management (Nanang and Inoue, 2000).

### VII. Conclusions

Proponents argue that the log export ban is a second-best policy tool for addressing environmental externalities. But, some argue that log export bans rarely meet their objectives. Using empirical studies of deforestation in Costa Rica and Indonesia, it has been shown that a LEB does not automatically increase welfare. More importantly, it does not necessarily minimize deforestation and its negative externalities. Therefore, a log export ban policy is not an entirely effective economic instrument. However, without an export restriction, if institutions are not functioning properly, free trade may plausibly increase the depletion of forest resources. Therefore, there seems to be no simple solution to deforestation.

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