

Log export restrictions and trade policies in the Philippines: bane or blessing to sustainable forest management?

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Abstract

Since the 1990s, the Philippines has begun to adopt the tenets of sustainable forest management (SFM) with respect to the use and management of its forests. Consequently, government policies affecting the forestry sector have been evolving, to reflect the new forest management paradigm. Although the country's forest policies have been mostly economic-oriented, such policies are now directed at multiple goals including social and environmental goals, either through deliberate considerations or on an ad hoc basis. Most of the policies affecting the forestry sector have been implemented since the 1970s. Such policies include the partial ban on log exports as well as trade policies directed at the exportation of logs and lumber and the importation of pulp. In the 1970s, the forestry sector was notably 1 of the top 10 sectors with respect to export earnings, mainly from the exportation of raw logs. For a country concerned with addressing poverty and deforestation problems, these socio-economic contributions seemed invaluable. However, the negative effects of logging on the forest resource overshadowed the economic benefits derived from such activities. The forest resource base was greatly reduced; consequently, the government implemented a log export ban policy aimed at mitigating deforestation problems. This export ban was also directed at improving the efficiency and competitiveness of the wood processing industry. With the global adoption of SFM and the mounting pressure from lending institutions for policy reforms as instruments of growth and development, the issue is revisited to examine whether these Philippine government policies promote or discourage such multiple goals. This article discusses the repercussions of the log export ban and trade policies on the Philippine government's multiple targets for the economy and for the environment. Using an aggregation of the global trade analysis project model, a computable general equilibrium model, the impacts of these resources and trade policies are analysed.

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1. Introduction

Forest management in the Philippines is multi-objective, aiming to provide a range of social, environmental and economic benefits on a sustainable basis. In the 1990s, this paradigm shift in forest

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management, from being traditionally economic-oriented to one that espouses sustainable forest management (SFM), has necessitated the introduction of laws to support SFM (Executive Order 263, 1995; Republic Act 7586, 1992). Executive Order 263 adopts community-based forest management strategies to ensure sustainable forestry, while Republic Act 7586 ensures the protection of ecosystem services such as biodiversity and protection of habitats. SFM aims to provide a broad spectrum of economic and non-economic benefits, thus, social equity and environmental quality have also become valid goals with respect to the sustainable use of forest resources. The challenge for policy makers, then, is to address goals such as generation of employment, income and revenue and the maintenance of ecosystem health and social opportunities for the population, including those for the indigenous community.

However, like many developing countries, the Philippines is confronted with problems such as a diminishing forest resource base, immense population problems and institutional constraints. It is not surprising, then, that in the past three decades, government forest policies have been aimed on an ad hoc basis at addressing multiple goals. Such goals include revenue generation, saving foreign exchange through import substitution, regional development and improving the competitiveness of the domestic wood processing sector, as well as forest conservation. Addressing these goals is difficult, because of their conflicting nature. For example, promoting forest conservation implies reduced revenues from the exports of raw logs and lumber. The presence of national institutional problems, such as corruption and a lack of political will to implement such policies, also exacerbate the issue (Boado, 1988; Repetto and Gillis, 1988).

With various and changing goals for forest policy, an analysis of government policies is important. Apart from changes in environmental and social considerations, there are also mounting pressures from lending institutions and from consumer countries on tropical wood producers to evaluate national and sectoral policies and to adopt SFM practices. Lending institutions recognise that national and sectoral policies can be as effective as project loans in attaining growth and development, hence the increasing stipulation of policy evaluation and restructuring as one of the con-

ditions on borrowing. This recognition is coupled with increasing concerns about wood resource security by consumer countries and a growing global recognition of the role of tropical forest resources with respect to biodiversity conservation and global warming. Therefore, a review of the effects of several forest-related policies on the structure of the wood industry and their implications for SFM in the Philippines is timely.

The objective, in this article, is to evaluate the effects on the Philippine's forestry sector of the policies that were implemented during the 1980s. This period was chosen because the policies, which were implemented at that time, have since been advocated for other countries and it is important to evaluate their effects in the Philippines, as a basis for assessing their soundness.

The structure of the article is as follows. A description is provided, of the effects of government policies, on resource allocation, in general (Section 2). Against this background, a description of forestry policy and problems in the Philippines is given (Section 3). The modelling approach adopted, namely the global trade analysis project (GTAP) computable general equilibrium (GE) model, is justified and the policy experiments to be evaluated are presented (Section 4). The results generated by the policy experiments which were conducted are presented and discussed (Section 5). The implications of the results obtained and some conclusions are drawn (Section 6).

2. Effects of government policies on tropical forest resource use and wood product trade

Government policies can affect resource allocation in various ways. Policies can exacerbate the depletion of natural resources due to: (1) undervaluation by the government and the public, in general, of the benefits from forest resources; (2) overestimation of the net benefits from the extraction of timber and its subsequent processing; (3) lack of adequate biophysical knowledge of resource capabilities and the economic effects of development policies; (4) heavy dependence by policymakers on the tropical forest resources to provide the necessary fiscal, economic, social and political solutions; (5) failure of national governments to invest in the necessary resources to manage the

natural resources adequately; and (6) failure of national governments to recognise the traditional uses of the forest resources and to draw on local traditions for forest management (Repetto and Gillis, 1988). Sustainable development of natural resources would mean, correcting these policy weaknesses in addition to adopting a few of the measures suggested by Reed (1992). These include the establishment of a measurable criterion for environmental performance, strengthening institutions for monitoring the impact of economic activities on the natural resource base and provision of an adequate awareness and involvement of the local population in forest management.

Policies can also be counter-productive and can lead to inefficient use of natural resources instead of conservation, regional development and socio-economic welfare (Repetto and Gillis, 1988; Barbier et al., 1994). The setting in many developing countries, where much of the rural population depends on forest lands for income, leading to illegal timber harvesting and the demand for timber exceeding its supply, complicates the delivery of well-intended policies. On the other hand, policies can be beneficial when guided by market prices, and when policies are pursued for long-term goals, including export expansion (Winrock International, 1991). Examples are Asian countries such as Taiwan, Korea and Malaysia, whose economies expanded rapidly through these means in the two decades prior to 1990. Other studies, exploring the potential effects of government policies on wood products trade, include those of Goldin and Knudsen (1990) and Goldin et al. (1994). On the other hand, trade policies such as import tariffs on wood products could change the commodity composition of world trade (Zhu et al., 2001). The authors showed that eliminating import tariffs on wood products, shifted export trends from raw logs to more processed wood products.

3. An overview of Philippine forestry

Forest lands in the Philippines are publicly owned with administration and management being undertaken by the Forest Management Bureau of the Department of Environment and Natural Resources (Department of Environment and Natural Resources, 1992). For two decades after the late 1960s, the

forestry sector was a major source of revenue, foreign exchange and employment, and a catalyst for regional development. In 1974 alone, 32.5% of total foreign exchange earnings were attributed to trade in forest products. The combined contribution of agriculture, forestry and fisheries amounted to 30% of gross domestic product from the 1970s to the late 1980s (Department of Environment and Natural Resources, 1992; National Statistical Coordination Board, 1992). Forest charges from the harvest of and trade in wood products, were also a major contribution to the Philippine economy, along with the provision of employment to approximately 274 000 people. In addition, approximately 1.2 million people depended on open forest lands for subsistence farming. These contributions declined as a result of inefficient forest management and utilization, and social problems (Repetto and Gillis, 1988; Asia-Pacific Forestry Commission, 2001). Currently, there are approximately 20 million people including indigenous people residing in public forests. The deforestation rate was one of the highest in the world at approximately 300 000 ha per year in the late 1970s to early 1980s. This rate has been reduced, to approximately 100 000 ha per year, through various government programs, which are mostly foreign-funded. It is not surprising, then, that deforestation reduced the forested land area from 56% in 1930 to approximately 21% of total land area in 1991. Of the 17 million ha of forest land in 1930, only 5 million ha of residual and old growth forests remain (Department of Environment and Natural Resources, 1992; Asia-Pacific Forestry Commission, 2001).

In an effort to revitalize the wood industry, the country adopted measures to improve the reliability of log supply and provided incentives for wood-based industrialization. These included bans on log exports, on exports of lumber, coming from old growth forests, and on logging in old growth forests. Such policies redirected quality logs into domestic processing and encouraged value-adding. Given these measures and the supply constraints of the remaining Philippine forest resources, wood-based industrialization was encouraged (Boado, 1988; McGauhey, 1990; Department of Environment and Natural Resources, 1992).

In order to mitigate the loss of forest resources, the country also introduced commodity taxes, in the form of forest charges, as early as the 1960s. However, the tax rate of less than 7% of the wholesale log value

from the 1950s to the 1990s (Bautista, 1990), was often criticised as, not appropriately, reflecting rent for the use of forest resources. Furthermore, a commodity tax can serve as a disincentive to harvest logs, because it reduces profit.

Various models have been used in analysing the effects of forest policies. These include econometric models (Adams and Blackwell, 1973), global trade models (Lonndstedt, 1986), input–output analysis (Koljonen, 1983; Haltia and Simula, 1988); bivariate time series analysis (Uusivouri and Boungiorno, 1991) and recently, multi-criteria decision-making (Hjortso and Straede, 2001). Studies conducted on the forestry sector in the Philippines, include demand and supply projections (Krittanon, 1974; Segura, 1977; Bonita and Revilla, 1977; Sibal 1978), trade linkages among the ASEAN tropical timber producers (Canonizado, 1986), and comparative advantage of the wood industry (Floro, 1978; Power and Tumaneng, 1983). The use of a computable GE model, in analysing the effects of policies in the wood-based industry, has not been explored.

4. Methodology and theoretical framework

4.1. An overview of the GTAP model

This study used a particular aggregation of the GTAP model (see Hertel and Tsigas, 1997 for an overview of the model). Purdue University's Department of Agricultural Economics, the Australian Industry Commission and the United States Department of Agriculture's Economic Research Services developed the GTAP model during 1991–1993. Such GTAP version has 37 regions and 15 commodities.

Simulations of the various policy scenarios were carried out using the general equilibrium modelling package (GEMPACK) release 5.0 software (Harrison and Pearson, 1993, 1994). GE models refer to economy-wide models, where factor and output markets are cleared in equilibrium using a system of simultaneous non-linear equations. Assuming perfect competition where both consumers and producers are optimisers, within their given constraints, their behaviour leads to equality of demand and supply for any given output and input, hence, an equi-

brium. Economic profit is zero and total revenue is equal to consumer expenditures. There is also full employment of capital and labour, factor income is equal to factor costs, unit costs are equal to selling prices and consumer expenditure is equal to consumer income.

The study used a computerised general equilibrium (CGE) model, which is a GE model that uses computer-based algorithms. CGE models have the capacity to simulate a real economy by using demand and supply functions and empirical data. Some of the strengths of CGE models include their capacity to estimate the welfare effects of a policy and the cost of policy restrictions, enabling policymakers to assess sectoral needs, to evaluate alternative policy regimes and to rank policies (Scarf and Shoven, 1984). These types of models also give a better picture of intersectoral linkages and allow the measurement of the distributional impacts of a set of policies (Goldin and Knudsen, 1990).

4.2. Product definition and regions

The GTAP aggregation used in this study, consists of 10 sectors: logs, lumber, pulp and paper, machinery and equipment, other manufactures, construction, trade and transport, other services, food products and the rest of the economy. The particular regional aggregation used, consisted of seven countries: the Philippines, Malaysia, Indonesia, Japan, Korea, Thailand and a Rest of the World region. These constitute the 'regions' in the terminology of the GTAP Model. Most are countries in the ASEAN bloc. Japan was a significant importer of Philippine logs. Like the Philippines, Indonesia and Malaysia have been major sources of tropical logs in South East Asia and have implemented somewhat similar log export policies. Only the effects of the policies in one country, the Philippines, were analysed, given the scope of the study.

The economic environment modelled, is assumed to be in the long run, which reflects a 5–10 year period after a policy has been implemented. The simulations, therefore, are reflections of the adaptations of the Philippines within 5–10 years of the implementation of a policy. The other regions are exogenous and, therefore, are held constant.

4.3. The equations

There are five groups of equations in the GTAP aggregation, used in this particular study: consumption, production, prices, market clearing and miscellaneous equations. The price equations yield domestic prices as affected by input–output relationships, world prices and exchange rates. The market clearing equations give equilibrium conditions for demand and supply for both commodities and factors. The equations also provide information on the volumes and prices of internationally trade goods and the welfare effects of changes in policies. Fig. 1 summarises the system of price changes in the international market. The production structure of a single output industry is also shown in Fig. 2.

Due to time and data constraints, this study used a comparative static, single-region GE closure of the model. Thus, the results show only the effects of policy changes, both existing and simulated ones. This single-region GE model narrowed down the analysis, to the effects of policy on the wood industry in the Philippines, keeping exogenous, the effects that changes in Philippines's policies would have on international trade in forestry products. A GE closure was used, since a partial equilibrium closure does not capture the feedback effects of the

simulated policy changes, on an economy-wide basis.

The GTAP model was deemed appropriate for the study, since alternative tools of policy analysis, such as effective protection rates and partial equilibrium models, were found to be insufficient in determining the relationship between resource and trade policies and sectoral changes in the wood-based industry, and economy-wide adjustments. There are some limited applications of CGE models in the analysis of Philippine agriculture (Habito and Manasan, 1992) and the effects of tariff restructuring and exchange rate devaluation (Cororaton, 1989). This study is a pioneering attempt in using CGE models to analyse policy impacts on the Philippine wood industry.

4.4. Policy simulations

The policies investigated in this study included (1) a commodity tax on logs, (2) export taxes on logs and lumber and (3) an import tax on pulp together with an export subsidy to encourage the expansion of wood processing. Except for export subsidies, these were existing policies in the two decades prior to 1988, the base year scenario of this study. Table 1 shows the

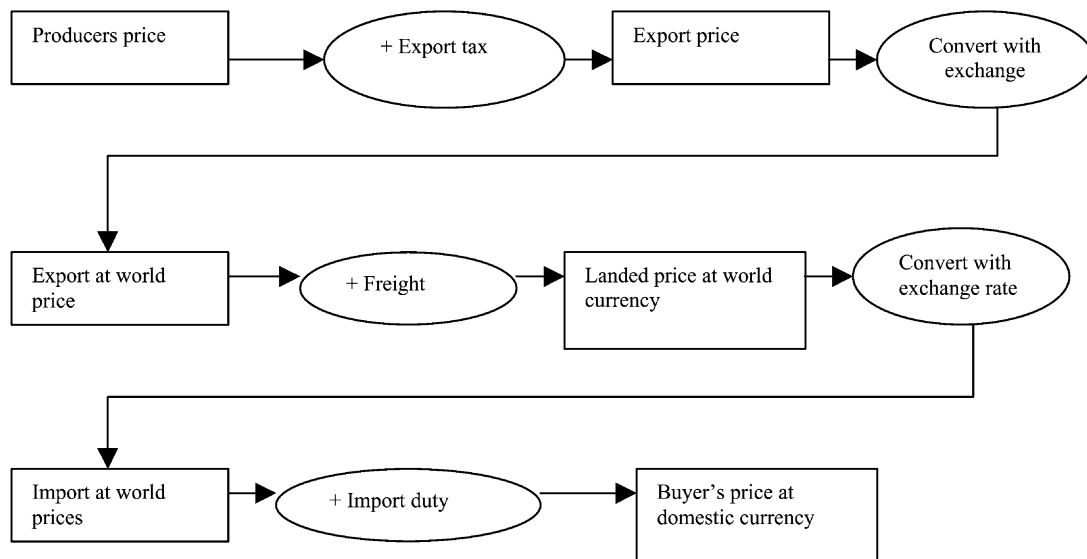


Fig. 1. The system of price changes in the international market.

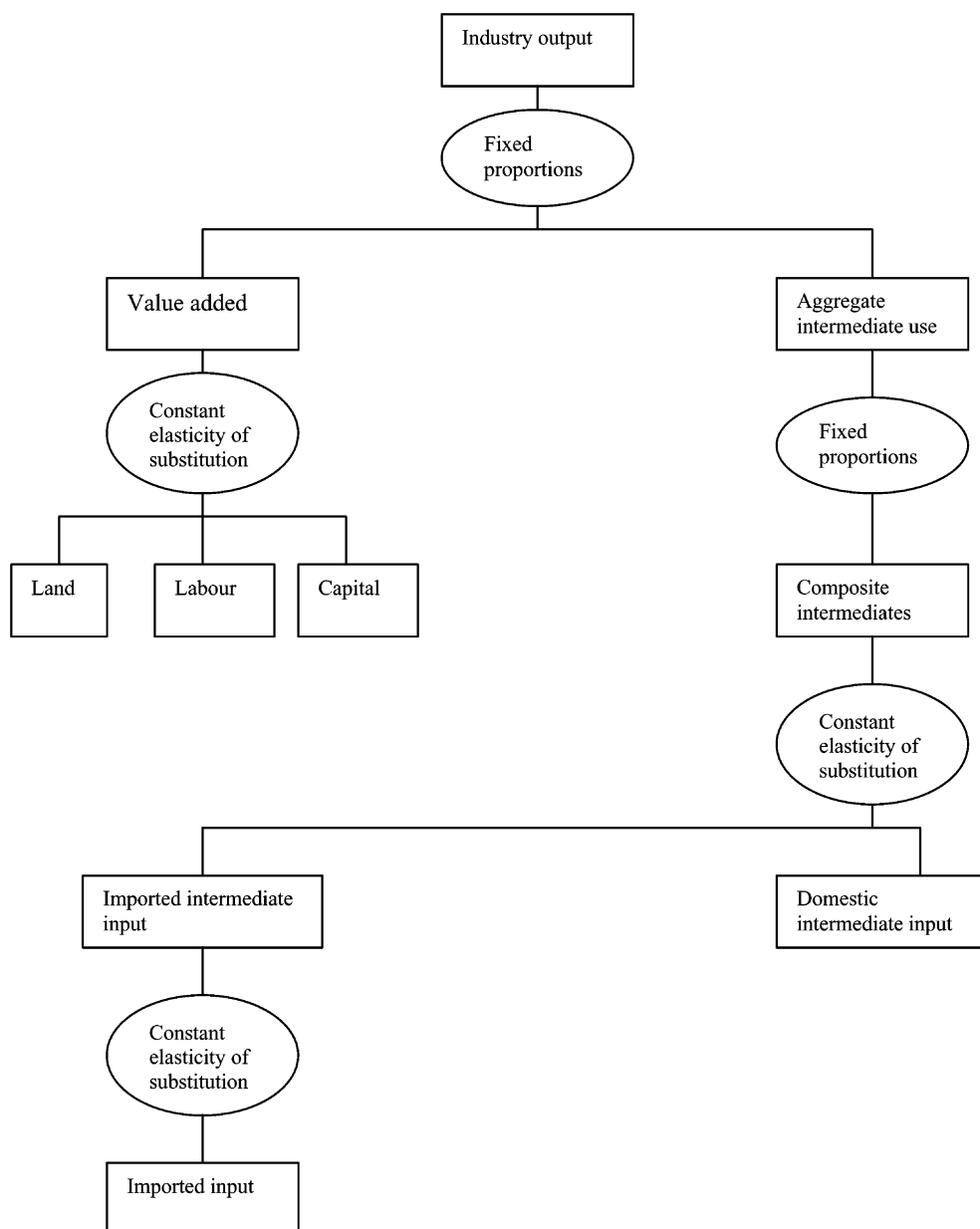


Fig. 2. The production structure of a single-output industry.

levels of commodities, export and import taxes in each policy scenario used in the simulations.

In the GTAP model, input–output data from each of the regions were taken, to fit the input–output and trade concordances mapped out for the

region, in order to arrive at a homogeneous database for the region, and adjusted for a common base year (1988) and a common currency (US\$). The regional data, including that of the Philippines, were adjusted for consistency with industry assis-

Table 1
Levels of commodity, export and import taxes used in the simulations

Description	Tax level (%)			
	Policy climate	Output tax (Logs)	Export tax (Logs)	Import (Pulp)
(a) Existing policies				
Base year set of policies implemented ^a	PC1	– 4.40	– 210.00	– 4.00
(b) Alternative policies				
Proposed set of policies ^b	PC2	– 20.00	– 20.00	– 4.00
Import subsidy (pulp)	PC3			– 40.00
Export subsidies (logs and lumber)	PC4		20.0	4.00

The impacts of these policies were measured relative to a scenario, where no restrictions are in place.

^a The existing set of policies consists of a 4.4% commodity tax on logs, export taxes of 20% on logs, 4% on lumber and a 40% tax on pulp imports.

^b In the proposed set of taxes (1992 Master Plan for Forestry Development) only the commodity tax differs from the base year set of policies implemented and is increased to 20%.

tance, and macroeconomic and fiscal data as well as international trade data. Industry assistance refers to estimates of taxes on commodity, export and import taxes and subsidies.

Estimates of policy impacts, relative to an absence of restrictions, were derived for four different sets of policies. The first category (PC1) represented the existing policies in 1988, the base year. The output tax used was based on estimates of Power and Tumaneng (1983), who found that prevailing charges in 1983 comprised only 4.4% of the value of the raw logs in the world market (Power and Tumaneng, 1983).

Other experiments were based on simulations of different policy scenarios (Table 1). PC2 is similar to existing policies, but with the commodity tax set to 20%, as proposed in the 1992 Master Plan for Forestry Development, and was intended to simulate capture of rent from forest lands. PC3 was an alternative scenario of imposing an import subsidy on pulp and paper, instead of an import tax. PC4 simulates the effects of only an export subsidy on logs and lumber.

5. Results and discussions

5.1. Effects on production

Fig. 3 shows that log and lumber production only increased with the use of export subsidies (PC4). Other policy scenarios yielded the opposite effect.

This implies that export subsidies help the country achieve its goal in supporting the development of the wood industry through an increase in log and lumber production. With an increase in log production, there is also a corresponding increase in lumber production, which implies that the industry took advantage of the 4% lumber export subsidy. On the other hand, an increase in commodity tax (PC2) was a disincentive to harvest logs, hence achieving the country's goal of controlling log production.

Reducing log production not only mitigates loss from deforestation, but also reduces the country's loss, in terms of rent, collected from log harvest. Rent generated from log production has been very low, compared to potential rent. Thus, a reduction in log production means that missing out on potential rent is also reduced. For example, the estimated potential rent from log harvest in 1987 was approximately US\$256 million, but the government only collected 15.3% of that value. This was low, compared with that of the neighbouring tropical log producers, Malaysia and Indonesia, which obtained approximately 33 and 77%, respectively, from the potential rents from log harvests (Barbier et al., 1994). The low forest charges, collected on harvested logs, meant that the Philippines missed out on much-needed rent from the use of its forest resources. A commodity tax, especially one, whose impact is determined by market forces of supply and demand, may be a policy option in promoting conservation and in capturing greater economic rents. It may also

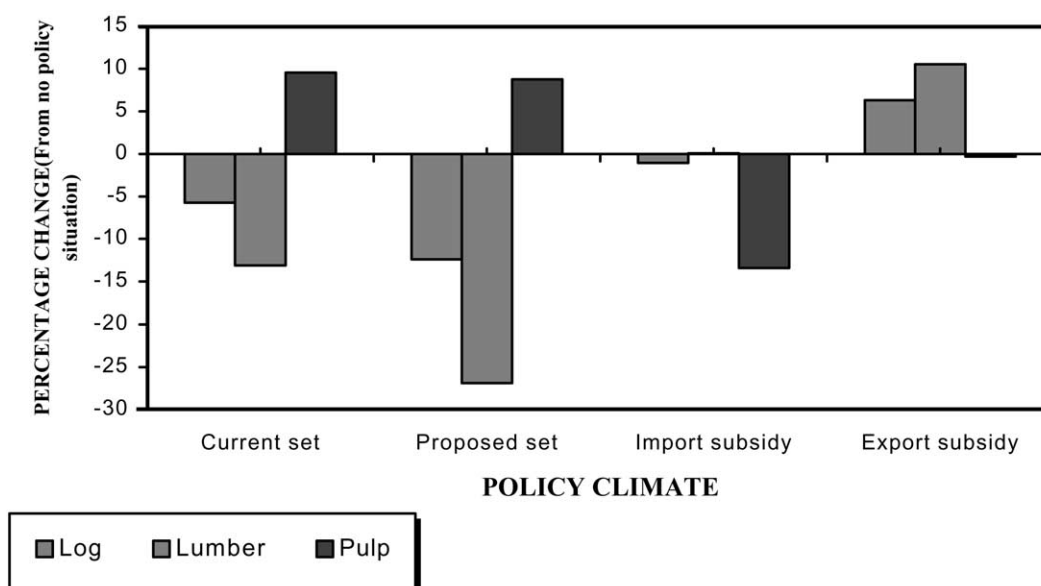


Fig. 3. Effects of current and alternative sets of forest and trade policies on production of wood products in the Philippines (%).

remove excess profits, and discourage the entry of inefficient firms. This could be beneficial to the country in the long-term, as it would encourage more efficient use of forest resources.

The simulation results also indicate that the export taxes on logs and lumber, ostensibly, meet the conservation goal, but not the one, of increasing export earnings. Foreign exchange earnings did not increase owing to a decline in log production and to lower export supply. The efforts to export processed wood products, instead of raw logs, could have been untimely, too, for the prices of wood products were plummeting at this time (Barbier et al., 1994). Hence, the cost of the potential switch, from raw log exports to export of processed wood products, was high.

If curtailing deforestation is the only goal of forest policies, then the existing set of policies helped achieve this goal by reducing log production. This is assuming that the opening of forest lands, through logging, does not attract illegal users such as upland farmers. However, there may have been better alternatives to restrict deforestation than the policies in place. The result that forest and trade policies can enhance conservation, runs contrary to popular consensus. Qualitative investigations also

suggest the opposite. Repetto and Gillis (1988) point out that policy-enhanced deforestation holds true, only when the users of the forest resource are motivated by short-term profits. Loopholes (especially corruption and illegal logging), in exclusive reliance of forest and trade policies, normally enhance such motives.

5.2. Effects on export earnings

One of the outcomes of SFM is the provision of economic benefits. In this study, these benefits are measured, in terms of export earnings, generated from the sale of the wood products and from revenues from the commodity tax. Such much-needed export earnings are vital, in servicing foreign debts and in financing industrialization, especially when external debt servicing comprises approximately 25% of export earnings (United States Department of State, 1992). Revenues from the commodity tax are also invaluable to the country's development programs.

The results of the study show that economic benefits were greatly reduced, when using a commodity tax, export tax and import tax, either as single

policies (Fig. 4) or in combination (Fig. 3). The export subsidy was an exception, with export earnings increasing by approximately US\$39 million (Fig. 3). It appears that the export taxes on logs and lumber, served as disincentives to export, as would be expected, and, thus, export volume and export earnings decreased (Fig. 2). The greatest decline occurred under the proposed set of policies (PC2) with a total loss of approximately US\$353 million dollars for all wood products. This result is consistent with the findings of Constantino (1988) and Vincent (1992), who found that log export restrictions reduced export earnings and value-added in Indonesia and Malaysia, respectively. Similarly, log export restrictions in Nigeria lowered foreign exchange earnings (Igbodipe, 1988). The Philippine's government obviously did not benefit, in terms of increasing foreign exchange earnings, from implementing trade and forest policies involving export taxes. Thus, the country can benefit more, from an assessment and redirection of forest and trade policies, and by recognising the changes in comparative advantage emanating from the dynamic structure of the forest resource (Sedjo and Lyon, 1983).

5.3. Welfare and terms of trade effects

Although government policies are directed towards the attainment of economic and conservation objectives, these policies may or may not increase welfare. This outcome is shown in Table 2. The table shows the effects of the policies on terms of trade or the relative prices of goods and services traded in the international market. The percentage decrease or increase from the updated database was less than 1%. In theory, welfare should increase in a small, open economy when tariffs are reduced owing to improved terms of trade.

Under the existing set of policies (PC1), terms of trade decreased from the updated database by 0.02%. This translates to a national welfare loss to the equivalent of US\$31 million, as indicated by equivalent variation (EV). EV is a function, of aggregate per capita utility and total expenditure, in a region:

$$EV = \left[\frac{vU_n - U_o}{U_o} \right] I_o \quad (1)$$

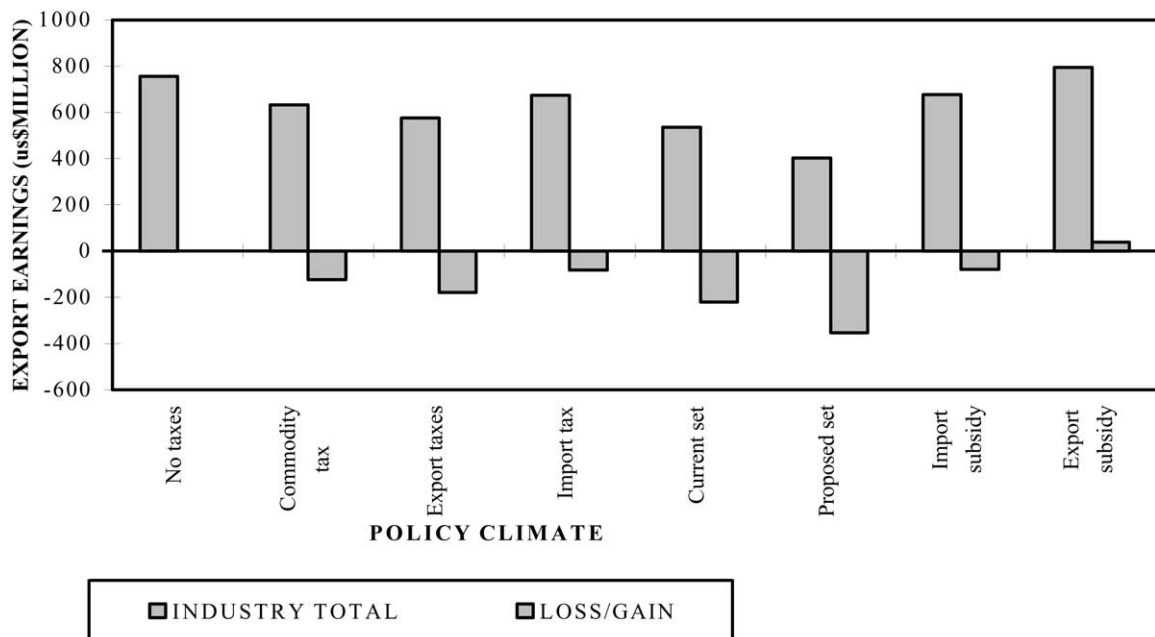


Fig. 4. Effects of Current and Alternative Policies on Export Earnings of the Wood-Based Industry in the Philippines.

Table 2

Effects of current and alternative policy scenarios on terms of trade and welfare in the Philippine wood-based industry (%)

	Policy climate			
	Current policy set ^a PC1	Proposed set of taxes PC2	40% Import subsidy on pulp PC3	Export subsidy (20% logs, 4% lumber) PC4
Terms of trade ^b	– 0.02	– 0.03	– 0.15	0.07
EV ^c (US\$m.)	– 30.68	– 91.77	– 214.81	0.00

^a The same with current set of policies but with the commodity tax on logs set to – 20% as proposed in the 1992 Master Plan for Forestry Development.

^b Terms of trade mean the relative prices of goods and services traded in the international market.

^c $EV = [u(r)/100\%] \text{ INCOME}$, where INCOME is total expenditure in the initial equilibrium in US million.

where U_n and U_o , and I_n and I_o are new and initial levels of utility and income, respectively. A positive EV denotes a welfare-improving change, whereas a negative EV indicates a welfare loss.

Increasing the commodity tax on logs, to 20%, under the proposed set of taxes scenario (PC2), decreased welfare more, by approximately US\$92 million. Increasing the commodity tax, allowed the government to collect a higher percentage from the price of logs, coming from public forests, but in doing so welfare-declined. On the other hand, an import subsidy on pulp of 40% (PC3), caused a US\$214-million loss in national welfare, while an export subsidy (PC4), did not affect welfare. Therefore, the government did not achieve its goal of increasing welfare, through the use of policies, in the wood-based industry.

6. Conclusions

The results indicate that it is difficult for forest-related policies in the Philippines, directed towards goals such as conservation and maximisation of economic and social benefits, to attain such goals simultaneously. Forest policies such as the partial log export ban, the commodity tax on logs, the taxes on the exports of logs and lumber, and on the importation of pulp, all serve various socio-economic and/or environmental purposes. While the log export ban policy was aimed at controlling production, others such as the export taxes on logs and lumber and the import tax on pulp, were aimed at generating or saving foreign exchange. As shown in the study, the existing set of policies affecting the wood-based

industry, in the Philippines, were not giving incentives for the industry to maximise its contribution to the country's economic goals such as generation of foreign exchange earnings. Instead, these policies penalised production, and trade and aggregate welfare. However, these policies enhanced the forest conservation goal of the country. But, even such a positive impact must be treated with caution, since this can be a short-term phenomenon, when the processing industry is not fully developed. Subsequent growth, in the wood industry, will drive demand for wood materials and, consequently, a greater pressure on the forest resource, unless sustainable management is in place. If illegal logging and exporting, and the present population problem are not addressed, depletion of the forest resource may also continue.

These recommendations assume that restrictive policies are the only causes of economic distortions and that there are no prevalent institutional inefficiencies and social constraints. Policies, which are empirically proven to restrict the economic performance of an industry, ought to be removed on the grounds of economic efficiency. This study has shown that only the import tax is worth retaining. This may not be feasible in the longer term, since there is an overriding goal of more open trade in the Asia and Pacific Region. Past economic growth of the country also depended heavily on exports and investments. The government may need to focus on policies, regarding forest use and trade such as a subsidy on forest product exports, to ensure greater value-adding. The inability to control corruption and illegal logging, makes a ban on exports necessary, even though it is an inefficient

instrument, in terms of economic welfare, relative to less restrictive forest and trade policies. Continuing policies that promote security of domestic wood supply, such as the log export ban, may also provide the required incentives for the revival of the wood-based industry.

The results of the study depended on the aggregation of sectors, hence, the effects of trade and forest policies were confined to the three broad groups chosen—forestry, lumber and pulp. Future studies, which include all forest products, market and non-market based, could highlight the economic, social and environmental benefits emanating from the forestry sector. Although an analysis of the intervention from government policies is important, fiscal aspects of policies and institutional constraints should also be taken into account in policy analysis.

This study has been confined to a single region. Multi-region studies need to be pursued, so that inter-regional linkages can be established. In addition, the comparative static nature adopted by this model, only allowed comparisons of a policy change with that of an existing policy, and could not determine the time needed to change from the initial equilibrium to the post-policy situation. Such time factors may be very important in forest-related policies involving long periods of production.

Overall, the study demonstrates the importance and usefulness of computable GE models as tools for policy analysis. In the past, the Philippine's resource policies were responses to social pressures, resource constraints and vested interests. They were, therefore, remedial measures instead of being carefully planned policies, to achieve long-term targets for the economy. This need not be so, when there are economic tools available to help predict the outcomes of certain policies. The resulting structural changes in the economy can provide a basis for policy makers from which, to evaluate a wide range of policies and, possibly, to choose an optimal set of policies, when objectives are conflicting. The Philippines may also benefit more, if policy changes are not based on ad hoc policies. Careful planning and management is required, if the plethora of goals, regarding the use of forest resources, such as maintaining ecological, social and economic sustainability, is to be most efficiently met.

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References

- Adams, F.G., Blackwell, J., 1973. An econometric model of the United States forest products industry. *Forest Science* 19 (2), 82–96.
- Asia-Pacific Forestry Commission, 2001. Forests out of bounds: impacts and effectiveness of logging bans in natural forests in Asia-Pacific. FAO RAP Publications 2001/08.
- Barbier, E.B., Burgess, J.C., Bishop, J., Aylward, B., 1994. *The Economics of the Tropical Timber Trade*. Earthscan Publications Ltd, London.
- Bautista, G.M., 1990. The forestry crisis in the Philippines: nature, causes, and issues. *Developing Economics* 27 (1).
- Boado, E.L., 1988. Incentive policies and forest use in the Philippines. In: Repetto, R., Gillis, M. (Eds.), *Public Policies and the Misuse of Forest Resources*. Cambridge University Press, pp. 165–203.
- Bonita, M.L., Revilla, A.V., 1977. *The Philippine Forest Resources. Population, Resources, Environment and the Philippine Future: Scenarios for the Year 2000 (PREPF) Technical Report. Vol. II*. Development Academy of the Philippines. September 1977.
- Canonizado, J.A., 1986. *A Policy Model for Philippine Timber Products Exports*. Unpublished Ph. D. Dissertation. Oregon State University.
- Constantino, L.F., 1988. Analysis of the international and domestic demand for Indonesian wood products. In: Barbier, E.B., Burgess, J.C., Bishop, J., Aylward, B. (Eds.), 1994. *The Economics of the Tropical Timber Trade*. London: Earthscan Publications Ltd.
- Cororaton, C.B., 1989. *A General Equilibrium Approach to the Analysis of the Short-Run Effects of Tariff Restructuring and Foreign Exchange Rate Devaluation in the Philippines*. Unpublished Ph. D. Thesis. Clark University, Massachusetts, p. 183.
- Department of Environment and Natural Resources (DENR), 1992. *Master Plan for Forest Development*. Manila.
- Executive Order 263, 1995. Adopting community-based forest management as the national strategy to ensure the sustainable development of the country's forestlands resources and providing mechanisms for its implementation. Malacanang, Manila, Philippines.
- Floro, M.S., 1978. *Export Processing in the Philippine Wood Industries*. M.S. Thesis. Monash University.
- Goldin, I., Knudsen, O. (Eds.), 1990. *Agricultural Trade Liberalization. Implications for Developing Countries*. Organization for Economic Co-operation and Development, Paris.
- Goldin, I., Knudsen, O., Brandao, A.S., 1994. *Modelling Economy-wide Reforms*. Organization for Economic co-operation and Development, Paris.

- Habito, C.F., Manasan, R.G., 1992. Agricultural Taxation in the Philippines. A Report Prepared for the Analysis Division of the FAO Economic and Social Policy Planning. FAO, Rome.
- Haltia, O., Simula, M., 1988. Linkages of forestry and forest industry in the Finnish economy. *Silva Fennica* 22 (4), 257–272.
- Harrison, J., Pearson, K., 1993. An Introduction to GEMPACK. GPD-1.
- Harrison, J., Pearson, K., 1994. User's Guide to TABLO, GEMSIM and TABLO-Generated Programs. GPD-2.
- Hertel, T.W., Tsigas, M., 1997. Structure of GTAP. In: Hertel, T.W. (Ed.), *Trade Trade Analysis: Modeling and Applications*. Cambridge University Press, New York.
- Hjortso, C.N., Straede, S., 2001. Strategic multiple-use forest planning in Lithuania—applying multi-criteria decision-making and scenario analysis for decision support in an economy in transition. *Forest Policy and Economics* 3, 175–188.
- Igbodipe, A.B., 1988. Price and Foreign Exchange Effects of Log Export Policies: a Simulation Approach Applied to Nigeria. Ph. D. Dissertation. University of California, Berkeley.
- Koljonen, K., 1983. Inter-industry linkages of forestry and forest industry sectors in the Tanzanian economy. *Silva Fennica* 17 (3), 273–278.
- Krittanon, B., 1974. Demand for and Supply of Lumber in the Philippines. Unpublished Masters Thesis. University of the Philippines at Los Banos.
- Lonndstedt, L., 1986. A dynamic forest sector model with a Swedish case. *Forest Science* 32 (2), 377–397.
- Mcgahey, S.E., 1990. Forest Sector and Natural Resource Policy Linkages: Issues for Research. 19th IUFRO World Congress. 5–11 August, 1990. Montreal, Canada. Division 4:200–209.
- National Statistical Coordination Board, 1992. *Philippine Statistical Yearbook*. Manila, Philippines.
- Power, J.H., Tumaneng, T.D., 1983. Comparative Advantage and Government Policies in Forestry. Philippine Institute of Development Studies. Working Paper No. 83-05.
- Reed, D. (Ed.), 1992. *Structural Adjustment and the Environment*. Westview Press, Inc, Colorado.
- Repetto, R., Gillis, M., 1988. *Public Policies and the Misuse of Forest Resources*. Cambridge University Press, Cambridge.
- Republic Act 7586, 1992. The national integrated protected areas system (NIPAS) law. Congress of the Philippines, Quezon City.
- Scarf, H.E., Shoven, J.B. (Eds.), 1984. *Applied General Equilibrium Analysis*. Cambridge University Press, New York.
- Sedjo, R.A., Lyon, K.S., 1983. Long-term forest resources trade, global timber supply and intertemporal comparative advantage. *American Journal of Agricultural Economics* 65, 1010–1016.
- Segura, M., 1977. Demand for Philippine Timber Products in the Year 2000. Population, Resources, Environment and the Philippine Future: Scenarios for the Year 2000 (PREPF) Technical Report. Vol. II. Development Academy of the Philippines. p. 39.
- Sibal, P.V., 1978. An Econometric Analysis of Supply and Demand for Forest Products in the Philippines. Unpublished Masters Thesis. University of the Philippines at Los Banos. p. 229.
- United States Department of State, 1992. *The Philippines Economic Policy and Trade Practices*. Country Reports on Economic Policy and Trade Practices. University Microfilms. St. Louis University.
- Uusivouri, J., Boungiorno, J., 1991. Pass-through of exchange rates on prices of forest products exports from the United States to Europe and Japan. *Forest Science* 37 (3), 931–948.
- Vincent, J.R., 1992. A simple, nonspatial modelling approach for analysing a country's forest-products trade policies. In: Barbier, E.B., Burgess, J.C., Bishop, J., Aylward, B. (Eds.), 1994. *The Economics of the Tropical Timber Trade*. London: Earthscan Publications Ltd. p. 179.
- Winrock International, 1991. *African Development: Lessons from Asia*. Arlington, Va.: Winrock International Institute for Agricultural Development.
- Zhu, S., Buongiorno, J., Brooks, D.J., 2001. Effects of accelerated tariff liberalization on the forest products sector: a global modeling approach. *Forest Policy and Economics* 2 (1), 57–78.