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Population Growth and Trade Policies in the Philippines: A General Equilibrium Analysis

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Abstract

The paper attempts to show using a computable general equilibrium (CGE) framework the relative effects of population growth and trade policies on economic growth, employment and deforestation in the Philippines. A static CGE model based on ORANI with an appended sub-forestry model is employed in the analysis. The results show that (domestic) population per se would not significantly increase deforestation. Whilst, export taxes are ineffective tools in reducing deforestation, trade liberalisation policies are beneficial to the economy as a whole.

Keywords: CGE modelling, Deforestation, Population, Trade, and Philippines

JEL Classification: C68

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I. Introduction

The Philippines has experienced deforestation all throughout the 19th and 20th centuries. Some scholars attribute it to excessive timber trade others to population growth. The population argument, which is in the centre of most environment-related issue, is valid from 1980s onwards in the case of the Philippines. Population was not an issue in the first half of the 20th century neither in the years before that, however, timber trade was. The Philippines became the single biggest exporter of logs in 1969, when the population was around 36.7 million.

The Philippine population stood at 1.5 million in 1799 and at 7.6 million in 1903. It grew to 19.2 million by 1948 and by 1960 it stood at 27 million. The Philippines' average annual population growth rate was around 2 per cent from 1918 to 1948. From 1960 to 1980, the average annual growth rate was around 2.8 per cent. The period where the growth rate of the population started to reach almost 3 per cent was in 1960. This is the same period when log exports rose to 57.5 per cent, indicating that factors other than an increase in (domestic) population were affecting forest cover.

This study aims to test some issues surrounding Philippine deforestation [2] particularly, population and trade issues. It examines the general equilibrium effects of population growth, export taxes on forestry and trade liberalisation. The paper is organised as follows: Section II discusses the policy simulations while Section III briefly describes the CGE model used in this study. Section IV presents the simulation results while Section V concludes the study.

[2] Deforestation issues in the Philippines are discussed in Stenberg and Siriwardana (2002).

II. Population and Trade Practices Simulations

Although the deforestation that occurred in the Philippines in the 20th century coincided with the growth in log exports, with rising population pressure, land use decisions in the Philippines are becoming more important. The simulations implemented in the model are discussed below.

Population Growth

To simulate population growth, the household population variable in the model is increased by 3 per cent. This is consistent with the annual population growth rate in the Philippines. The purpose of this simulation is to examine the probable effects of population growth on the forestry sector, in particular and on the whole economy, in general. It is anticipated that there would be a reduction in the volume of timber in forested areas when population increases.

Export Tax

An export tax has the effect of reducing the domestic price as producers expand domestic sales. In the case of the Philippines, there is no export tax on log exports per se but there is a log ban imposed on the forestry sector particularly to the export of logs harvested from old growth forests. It is assumed that an export log ban is equivalent to an infinite export tax. Hence, in order to examine the general equilibrium effects of an export ban on log products, the value of the tax is increased by 100 per cent from an initial value of zero per cent.

Removal of Assistance to Industries

There is enough evidence in the literature to suggest that export taxes on logs are ineffective in reducing deforestation in timber producing countries. The inefficiencies

associated with trade restriction support a more liberalised trade among nations. As world globalisation is embraced by most nations, the push for trade liberalisation is attracting more support. The interaction between trade liberalisation and deforestation has been renewed and given emphasis in recent times. There are three simulations in the model concerning the removal of assistance to industries. The effects on the economy of a removal of assistance in (a) the agricultural sector; (b) the forestry sector; and (c) the uniform reduction in tariffs across all sectors are examined. The level of tariffs on these sectors is reduced by 10 per cent.[3]

All the simulations are carried out within two land mobility scenarios. On the one hand, it is assumed that land is immobile between agriculture and forestry and on the other hand, that land is completely mobile between the four land-using sectors (i.e. agriculture, forestry, mining and real-estate sectors).

It is worth noting that in this study, non-timber values of forestlands are not accounted for explicitly. It is has been recognised that forest areas have multiple uses, which are not confined to timber production. Forestlands offer services such as recreation, carbon sequestration and biodiversity. Unfortunately, environmental services, in this study, are crudely represented by the volume of timber left standing after each harvest, which is determined by the minimum age at which trees can be harvested.

III. The Model

The model adopted in this paper is a static CGE model of a small open economy with a forestry sub-model appended adopted from Dee (1991). It is based on ORANI, the multisectoral CGE model for Australia (Dixon et al, 1982). The steady-state assumption

[3] The target set by the Philippine government was to reduce overall tariff rates to 8.16 per cent by year 2000 (Tariff Commission 1995 Annual Report).

embedded in the forestry sub-model is extensively discussed in Stenberg and Siriwardana (2006) and the full model can be found in Stenberg and Siriwardana (forthcoming).

This study incorporates two usages for land (i.e. agricultural and forestry) and the indirect relationship between forestland and non-agricultural land, in particular land devoted to mining and real estate. The pressure of non-agricultural land usage on agricultural land results in additional conversion (or destruction) of forestland to sustain agricultural production. For simplicity, when comparing different land usages, it is assumed that non-agricultural use pertains to real estate, forestry and mining. The land requirements of, say, households for residential purposes are provided by the real estate sector. The model assumes that there are four producing sectors that use land intensively namely, agriculture, forestry, mining and real estate.

IV. Results of Policy Simulations

The results reported in this paper are divided into four sections: (a) real GDP and balance of payments; (b) sectoral employment and production; (c) income distribution and; (d) land use. Only selected tables are shown in this section.

Macroeconomic Results

The share of the forestry sector in the gross domestic product (GDP) in 1990, which is the base year in this study, was just about one per cent. Table 1 shows the simulation results of nominal and real gross domestic product (GDP) for both land mobility scenarios. In the case of land use fixed between agriculture and forestry, the imposition of an export tax on logs results in a slight rise in GDP (i.e. 0.02 per cent). Regardless of land mobility, the removal of assistance across all producing sectors in the economy appears to be the most beneficial in terms of national income improvement.

Table 1: Nominal GDP and Real GDP given land mobility conditions

Simulations	Mobile	Immobile	Mobile	Immobile
	NGDP	NGDP	RGDP	RGDP
Population Growth	-0.0356	-0.0339	-0.0287	-0.0262
Export Tax on Logs	-0.0519	-0.0296	-0.0307	0.0151
Uniform Reduction of Tariffs (all sectors)	-0.8005	-0.7955	1.6956	1.7032
Tariff Reduction in Agriculture	-0.0059	-0.0032	0.1271	0.1231
Tariff Reduction in Forestry	-0.0080	-0.0008	0.0023	0.0151

Notes: Mobile = sectoral land is mobile; Immobile = agricultural land and forestland are fixed.
The results are percentage changes.

Table 2: Uniform reduction of tariffs across all sectors: Macro results

Variable	Description	Projection when land is Mobile	Immobile
L	Aggregate Employment		
	Employment by Occupation :		
l_1	Officials of the Gov't, Corp. Executives, Mgrs.	1.0701	1.0691
l_2	Professionals	1.2455	1.2451
l_3	Technicians and Associated Professionals	0.3978	0.3981
l_4	Clerks	0.7798	0.7799
l_5	Service and Shop Market Sales Workers	1.1478	1.1473
l_6	Farmers, Forestry Workers and Fishermen	-1.2873	-1.2859
l_7	Craft and Related Workers	-0.8112	-0.8110
l_8	Plant and Machine Operators and Assemblers	-1.1128	-1.1153
l_9	Elementary Occupations	0.1599	0.1594
l_{10}	Other Occupations	0.3430	0.3417
x4tot	Export Volume Index	12.3493	11.9532
x0imp	Import Volume Index	8.7193	8.7180
p3toth	Index of Consumer Prices	-1.6927	-1.6930
x1cap	Aggregate Capital Stock	4.4231	4.4358
Realwage	Real Wage	6.8745	6.8896
p0realdev	Real exchange rate	2.5111	2.5136

Notes: Mobile = sectoral land is mobile; Immobile = agricultural land and forestland are fixed.
The results are percentage changes.

In terms of employment and regardless of the land mobility condition, however, the uniform reduction in tariffs across all sectors in the economy has a negative effect on the employment level of farmers, forestry workers and fishermen (l_6), craft and related workers (l_7), and plant and machine operators and assemblers (l_8) (and has a positive effect on the other occupational groups) as shown in Table 2. In theory, tariff cuts would reduce the price of imported commodities. Since the industries (i.e. agriculture and manufacturing) where these labour groups would most probably be employed have to compete with cheaper imports, resulted in employment reduction in these industries. The removal of assistance across all sectors results in the highest increase in export volume index coupled with the real exchange rate depreciating by 2.5 per cent.

Sectoral employment and production

The effect of population growth on the forestry sector is minimal, although negative. As expected, the increase in the export tax on logs results in the decline in the employment level in forestry as the price of timber declines. The removal of assistance in all sectors and in forestry results in a negative effect on forestry employment however, when tariffs in agriculture are reduced by 10 per cent, forestry employment increases by 0.25 per cent. The removal of industry assistance as a whole only benefits the non-tradable sectors (i.e. construction and services) except for the real estate sector.

An increase in population levels favours the agricultural sector both in terms of sectoral employment and production. The reason might be that almost 30 per cent of the labour force are employed by this sector. The export tax on logs tends to reduce the level of forestry output but increases wood and paper manufactures. This is consistent with the findings in the economic literature that export taxes tend to encourage more value-added in log production (Barbier et al. 1995; Manurung and Buongiorno 1997; Repetto and

Gillis 1988). The uniform reduction in the import tariffs across all industries results in the decline in output for all the land-using sectors in the model. Moreover, the removal of assistance in the agricultural and in the forestry sectors tends to have negative effects on these sectors. This suggests that these sectors benefit from the import tariffs.

Income Distribution

The export tax tends to be more effective when land is fixed between agriculture and forestry, although, the increase in household income is in general very small. The export tax on logs can be avoided when land between the two land uses is allowed to move.

Regardless of the land mobility condition, the uniform reduction in tariffs produces very similar results. The lowering of tariff rates in the agricultural sector and in the forestry sector are also not affected by the land mobility condition. Nonetheless, the uniform reduction of assistance across sectors results in an increase in household income for all household groups with the eighth, ninth and tenth deciles benefiting the most. The highest income decile also experiences a positive effect on income levels when tariffs on agricultural imports are reduced. The reduction in import tariffs for the forestry sector has a minimal effect on all income groups with a negative effect on the income of the highest decile. It follows that the highest income decile receives favourable concessions when the forest sector is protected. The increase in household population reduces the income received by the ninth and tenth income deciles.

Table 3: Selected Forestry Variables

	Land Mobile	Land Immobile

	Timber Volume	Harvest per Rotation	Rotation Period	Timber Volume	Harvest per Rotation	Rotation Period
Population growth	-0.0141	-0.0306	-0.1002	0.0700	0.0152	0.0499
Export tax on logs	0.0483	0.1050	0.3439	0.9077	1.9766	6.4930
10% Tariff reduction in:						
Uniform all sectors	-0.0209	-0.0455	-0.1492	0.0529	0.1152	0.3780
Agriculture	0.0179	0.0390	0.1328	-0.0291	-0.0633	-0.2073
Forestry	0.0135	0.0295	0.0966	0.2156	0.4698	1.5459

Notes: Selected results generated by the sub-forestry model in percentage-change.
Mobile = sectoral land is mobile; Immobile = agricultural land and forestland are fixed

Table 4: Percentage Change in Use of Land when Land is Mobile

SECTORS	Population	Export Tax	Tariff reduction in		
	Growth	on logs	All Sectors	Agriculture	Forestry
Agriculture	0.1272	1.2997	0.3647	-0.1739	0.4247
Forestry	-0.2033	-6.2665	-0.7180	0.4553	-1.9806
Mining	-0.2738	1.3948	-4.5178	1.0588	0.4512
Real Estate	-1.5075	1.2665	-0.3510	0.5987	0.4348

Note: There are four land-using sectors in the model.

Land Use

With population growth, the demand for agricultural land increases. This is not surprising since a higher population level requires higher production in agriculture in order to satisfy food requirements. Hence, timber volume is reduced with population growth given that sectoral land is mobile as shown in Table 3. The opposite is true when land is immobile. This suggests that provided the Philippine government can implement its land use policies, which entails forest conservation, the effect of population growth on forest resources could be minimal. The reduction in the forestland devoted to log production brought about by the export tax has increased timber volume, harvest per hectare per rotation and the rotation period for both land mobility scenarios. The removal of assistance (in forestry and in agriculture) results in a reduction in the demand for land in each sector as shown in Table 4.

The uniform removal of tariff barriers across sectors results in more land devoted to agricultural production. Nonetheless, the trade liberalisation policies implemented in this study do not significantly affect the timber volume in the Philippine forests.

V. Conclusion

There are four major findings in the study. Firstly, the uniform removal of tariffs has a negative effect on the employment of farmers, forestry workers and fishermen but has a positive effect on real GDP. Secondly, sectoral production and employment in agriculture benefits from population increase. Thirdly, the uniform removal of tariffs benefits sectoral employment in the non-tradable sectors (except real estate) but reduces sectoral production in all land-using sectors in the model. Lastly, the increase in household population reduces the income received by the ninth and tenth income deciles, while the uniform removal of tariffs results in an increase in the household income for all income groups with the eight, ninth and tenth deciles benefiting the most.

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