

Deforestation and the real exchange rate [☆]

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Abstract

Deforestation is a phenomenon that has largely been concentrated in the developing world. We construct a theoretical model of deforestation that focuses on the factors affecting the incentives to transform forested land into agricultural land. We show that: (i) lower discount rates and stronger institutions decrease deforestation; (ii) a depreciation in the real exchange rate increases deforestation in developing countries whereas the opposite obtains in developed countries; (iii) paradoxically, better institutions may exacerbate the deleterious impact of a depreciation in developing countries. These hypotheses are tested on an annual sample of 101 countries over the 1961–1988 period, and are not rejected by the data. Our results suggest that short-term macroeconomic policy, institutional factors, and the interaction between the two, are potentially important determinants of environmental outcomes. © 2007 Elsevier B.V. All rights reserved.

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“La forêt ici manque et là s’est agrandie,” Victor Hugo, *Les Rayons et les Ombres*

“Fear not till Birnam wood do come to Dunsinane,” William Shakespeare, *Macbeth*

1. Introduction

In recent years, deforestation, particularly in developing countries, has been of increasing concern, mainly

because of widespread fears of global warming and declining biodiversity. The 2003 *World Development Report* states that “one-fifth of all tropical forests have been cleared since 1960. According to the Food and Agriculture Organization of the United Nations (FAO), deforestation has been concentrated in the developing world. At the same time, forest cover in industrial countries is stable or even increasing slightly.”¹

The aim of this paper is to understand why forest cover is decreasing in developing countries while it is increasing in developed areas.² Our line of reasoning is based on a simple theoretical model which revolves around the choice facing an individual endowed with a

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¹ *World Development Report 2003*, p. 3.

² In the data used in this paper, the annual rate of deforestation in the poorest quartile of observations is equal to 0.1 percent, whereas the corresponding figure for the richest quartile of observations is equal to –0.2%.

unit of forested land, and who has to decide whether to keep it as forest or clear it and turn it into agricultural land. We then test the hypotheses that flow from our theoretical model using aggregate country-level data.

Since land has several alternative uses, economic analysis can contribute to our understanding of the process of deforestation. On the one hand, forests allow for wood production for domestic and export markets: wood may be used domestically for industrial and firewood purposes, and timber products may be exported. On the other, forest land is subject to encroachment by agricultural activities and grazing. The choice between forest and agriculture use of the land depends, *ceteris paribus*, on the time preference of individuals since wood production implies a long-term investment in the forest. Since it is often believed that discount rates are higher in poor countries than in rich countries, a bias in favor of deforestation may exist in the former. Moreover, important institutional issues arise because of the common property resource aspect of forests, as well as because of poorly defined property rights. These forms of market failure are usually held to be more likely in developing countries. To wit, forest resources are often over-utilized in developing countries because individual property rights are neither established nor enforced. The example of collective land resulting from forest clearing, and used for grazing, is a case in point.

The alternative uses of forest land also lie behind the importance accorded to population growth and agricultural development in the analysis of deforestation. These factors have been the subject of a good deal of empirical microeconomic analysis (for a survey see [Angelsen and Kaimowitz, 1999](#)). However, simple economic models, such as the three good, two factor general equilibrium model sketched by [Foster and Rosenzweig \(2003\)](#), suggest that the impact of economic development on forest cover will depend upon the relative rates of return to the forest and to alternative uses of the land in question. The normal focus on factors which are associated with readily available data and amenable to direct quantitative treatment explains why there has been relatively little work dealing explicitly with the impact of relative prices on forestation. In most microeconomic datasets, there is little, if any, variation across households in the price of wood or in the price of factor inputs, especially at the local level.³ Even if data on several regions dispersed geographically do allow one to address the lack of variation in prices using microeconomic analysis, such data are rare.⁴ Even in

this case, however, though the prices of factor inputs (notably wages) are likely to vary, the price of wood is likely to be determined internationally, and is therefore unlikely to display much variability on a regional basis.

The forest, though immobile (Macbeth and Birnam wood notwithstanding...), is in fact an internationally tradable good whose price is determined largely on international markets. This is obvious for exported timber, but it is also true for timber consumed by local industry producing internationally traded goods such as paper or furniture, as it is for firewood, which has ready substitutes in the form of imported petroleum products.

It is therefore clear that there is room for useful macroeconomic analyses of deforestation. Indeed, the numerous microeconomic studies of the factors that determine forest area have dealt with a relatively limited number of countries and run the usual risks inherent in using microeconomic studies to generalize concerning global processes. Most importantly, a macroeconomic approach has less difficulty in accounting for the relative return to the forest. This observation yields what we hold to be the most important contribution of our paper: using macro panel data on deforestation allows us to take the relative rate of return to the forest into account through macro-price indices such as the relative price of wood to agricultural goods and the real exchange rate of each country.

Intuitively, it is clear that an increase in the relative price of wood should have a positive effect on land under forest cover, though different responses are possible depending on whether this change is perceived as being permanent or temporary. The consequence of a change in the real exchange rate is less obvious. The real exchange rate represents the price of tradables relative to non-tradables and is a proxy for the price of wood (an internationally tradable good) relative to the price of labor (wages), which is domestically determined. But it is also a proxy for the price of agricultural goods relative to wages, provided that the agricultural sector is not overly protected vis-à-vis the outside world.

It is striking how sharp currency devaluations in developing countries, leading to real exchange rate depreciation, have resulted in deforestation. For instance, following the 50% devaluation of the CFA franc in 1994, heavy timber traffic on roads in Gabon increased, domestic furniture production boomed in Abidjan and Dakar, carts carrying firewood proliferated in rural Burkina Faso, and clearing obtained almost everywhere in the CFA franc area. Similarly, after the collapse of the Indonesian rupiah in 1997, timber exports increased and wood was substituted for petroleum products for domestic use.

³ [Angelsen and Kaimowitz \(1999\)](#), p. 78.

⁴ See, e.g., [Foster and Rosenzweig \(2003\)](#).

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