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Analysis

Explaining forest transitions: The role of governance☆

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ABSTRACT

We analyze how governance may influence competing land uses for forests, and thus the occurrence of forest transitions, across different low and middle-income countries. We develop a model of competing land uses that allows for governance to impact the risk of future versus current agricultural and forested land allocations. The resulting hypothesis on the relationship between governance and the likelihood of a forest transition is then tested using cross-country data. The empirical analysis offers strong support for the competing land use framework, and indicates that rule of law, forest policy and regulatory quality influence forest transitions. These findings inform not only the ongoing debate on forest transitions but also policy options for managing such transitions in developing economies.

1. Introduction

Although globally forest conversion still remains pervasive, forest recovery has occurred for decades in developed regions, notably Western Europe and North America, and most recently in some developing countries, such as Bangladesh, China, Costa Rica, Dominican Republic, India, Morocco and Vietnam (Bray, 2010; Hansen et al., 2013; Hosonuma et al., 2012; Mather, 2007; Meyfroidt and Lambin, 2011; Rudel et al., 2005). Mather (1990 and 1992) coined the term *forest transition* to describe this observed turnaround from deforestation to recovery. As shown in Fig. 1, the long-run trend suggests a "U-shaped curve" for forest land with respect to time: a prolonged decline in country's forest cover in the early stages of economic development followed by a partial recovery through conserving remaining primary forest, plantations and reforestation. Thus, an important advantage of the forest transition is that it offers a long-term perspective on land-use management; a country that is deforesting today may not necessarily continue to convert forest land in the future but eventually transition to a stage of forest recovery.

This pattern of forest cover change from deforestation to recovery occurs at different scales across countries or even across regions within a country, which can be explained by changes in the overall allocation of land (Hansen et al., 2013; Mather, 1992; Meyfroidt and Lambin, 2011; Meyfroidt et al. 2010; Pfaff and Walker, 2010; Rudel et al., 2005). Land use in turn depends on the rate of return, or rent, obtained from forest land compared to its competing uses (Angelsen and Rudel, 2013; Barbier et al., 2010). Consequently, the analysis of the forest transition lends itself to the standard competing land use model in economics, which has been used extensively to analyze the conversion of forest land to agriculture and other activities as well as forest recovery (Amacher et al., 2008 and 2009; Angelsen (2007); Barbier and Burgess, 1997; Barbier et al., 2010; Hartwick et al., 2001; Ollivier, 2012; Delacote and Garcia, 2015).

However, governance may also be an important factor affecting forest transition outcomes.[1] There are several ways in which this may occur (Barbier et al., 2010). First, although some evidence suggests that forest recovery is more likely in countries with democratic political institutions, for many low and middle-income countries political

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[1] Throughout this paper, we use the term governance as a short-hand for economy-wide governance, which Kaufmann et al. (2009, p. 5) define as "the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them."

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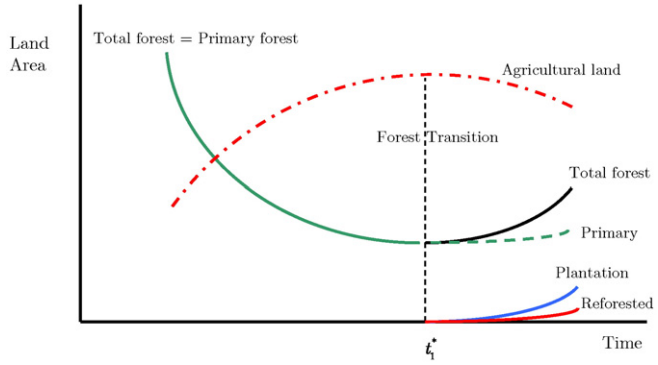

Fig. 1. Land use change and the forest transition. Although timber harvesting and fuelwood consumption may play a role, the initial loss of natural forest cover is mainly the result of rapid loss agricultural area expansion in response to rising demand for food and other commodities as economic development proceeds and populations grow. As agricultural land expansion slows down, so does the decrease in primary forest area. Increased environmental protection of remaining primary forest also stabilizes its size. However, as an economy develops further, the increased demand for wood products and non-market ecosystem services from forested land may lead to recovery in the total forest area, with protection of remaining primary forest, reforestation and plantations all playing a role. The time period when the long-run decline in forest area is superseded by forest recovery is defined as the forest transition (Mather, 1990 and 1992). Source: Adapted from Barbier et al. (2010).

stability may be a more important influence (Grainger, 2004; Grainger and Malayang, 2006; Mather and Needle, 1999). Second, regulatory quality may also matter; for example, countries with very different political regimes, such as China, India and Vietnam, have all developed effective regulatory institutions that have provided incentives to restore degraded forests, promote replanting by landowners and induce afforestation (Mather, 2007). Finally, the rule of law and the protection of property rights could also matter, especially given deforestation in developing countries is caused less by state-funded enterprises and large-scale settlement investments and more through the decentralized decision-making by farmers, land speculators, Agri-business enterprises and ranchers (Chomitz et al., 2007; Gibbs et al., 2010; Lambin and Meyfroidt, 2011; Rudel, 2007).[2]

There is also extensive literature on the impact of institutions on global deforestation, which parallels the concerns about how governance may influence the forest transition of developing countries. Some of this literature focuses on forest governance, notably forest property rights and tenure security (Agrawal, 2007; Agrawal et al., 2008; Alix-Garcia et al., 2004; Alston et al., 1996; Chhatre and Agrawal, 2008; Liscow, 2013).[3] Other studies link deforestation with economy-wide governance, such as political stability, ownership security, corruption and rule of law (Barbier et al., 2005; Barbier and Burgess, 2001; Bhattarai and Hammig, 2004; Bohn and Deacon, 2000; Damatte and Delacote, 2012; Deacon, 1994; Ferreira and Vincent, 2010; Galinato and Galinato, 2012 and Galinato and Galinato, 2013; López and Galinato, 2005; Nguyen-Van and Azomahou, 2007). Most studies find positive correlation between lower governance indices and higher deforestation rates in developing countries, although Damatte and Delacote (2012) suggest that the institutional influences may have been over-estimated in previous studies relative to the impacts of timber harvesting, economic growth, and possibly macroeconomic shocks.

By exploring the impact of governance on forest transitions in developing countries, our paper makes two principal contributions.

[2] Angelsen and Rudel (2013, p. 105) describe the resulting implications for competing forest land uses: As land-use decisions become increasingly enterprise driven, "property right determine the extent to which forest users capture the different forest rents"; in contrast, "in an open access situation, where forest clearing and agricultural uses provide some land rights, there are limited incentive for farmers to factor forest rents into their decisions."

[3] Forest governance refers to how decisions are made about the management, use, and transfer of forest lands and resources (Agrawal, 2007)

First, we develop a competing land use model as our framework for analyzing a forest transition. As Fig. 1 indicates, this transition connects two distinct phases, one in which forest area continuously declines followed by forest recovery. To analyze land use decisions across both phases, we adopt a two-stage optimal control model, which is a standard approach to modeling a dynamic problem with multiple phases (Amit, 1986; Makris, 2001; Tomiyama, 1985). The key proposition to emerge from this model is that worse (better) governance delays (hastens) the time when a forest transition occurs. The result is that the wedge between the returns from agricultural and forested land widens, and the forest transition is postponed. Inadequate governance therefore implies that the likelihood of attaining a forest transition is lower.

In addition, this proposition also suggests a testable hypothesis. Better (worse) governance ceteris paribus increases (decreases) the likelihood of a forest transition occurring. Thus, the second contribution of this paper is to test this hypothesis empirically for 132 developing countries, of which 27 have shown evidence of a forest transition – a shift from net deforestation to net reforestation – by 2010 (Bray, 2010; Food and Agriculture Organization of the United Nations (FAO), 2010; Hosonuma et al., 2012; Meyfroidt and Lambin, 2011; Rudel et al., 2005). Although reliable forest governance indicators across developing countries is generally lacking (Agrawal, 2007; Agrawal et al., 2008; Chhatre and Agrawal, 2008), we employ a wide variety of economy-wide measures in our analysis, including forest policy and ownership variables, governance indicators, economic policy indicators, country risk classifications, and country lending premiums. For nearly all these indicators, the hypothesis that governance influences the probability of a forest transition in developing countries is rejected. The exceptions are the presence of forest policy, rule of law and regulatory quality, which are statistically significant. Whereas forest policy and the rule of law increase the likelihood of a forest transition, regulatory quality reduces this probability. The latter result is surprising, but could be evidence that an improved regulatory climate in the overall economy may actually facilitate enterprise-driven deforestation more than forest recovery (Angelsen and Rudel, 2013; Rudel, 2007; Liscow, 2013).

Because the estimation approach is based on a competing land use model of forest change in developing countries, it differs from other analyses of the possible causes of the forest transition across countries (Hosonuma et al., 2012; Köthke et al., 2013; Rudel et al., 2005). To our knowledge, this is the first paper that develops an economic model of the forest transition, including explicitly the influence of governance, and then uses the analysis to inform an empirical cross-country examination of the resulting hypothesis. We hope that this approach inspires further economic analyses of the forest transition and its most likely causes, including the role of economy-wide and forest governance as well as market and policy failures more generally.

The paper is organized as follows. The next section develops a two-stage optimal control problem of competing land uses for analyzing the forest transition and the potential influence of governance. The following section tests the hypothesis derived from our model that better (worse) governance increases (decreases) the likelihood of a forest transition through empirical analysis across developing countries. We conclude by summarizing our key findings, and identifying the policy implications and issues for further research.

2. A forest transition model.

Assume an initial stock of forest land $F(0) = F_0$ subject to agricultural land conversion. Let $L(0) = L_0$ denote the initial stock of agricultural land. Given the initial stock of land $L_0 + F_0$, at each time t the social planner determines the most valuable land use allocation between agriculture $L(t)$and forest land $F(t)$. We assume that forest land is initially abundant, possibly due to low initial population pressure relative to the amount of agricultural land available. However, as economic development continues and population grows, increased demand for