

DEFORESTATION AND ENVIRONMENTAL POLICY: A DSGE APPROACH

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This paper proposes an environmental Dynamic Stochastic General Equilibrium (DSGE) model with deforestation of a tropical rain forest. The forest can be used to produce goods, but it also affects the well-being of the representative individual. Environmental policy is implemented with the taxation of the deforestation activity. We calibrate the model for the Brazilian economy, and show that it predicts a procyclical deforestation, and that a more stringent policy reduces the volatility of deforestation. Moreover, technological progress decreases the stock of forest, and it does so more intensely with a lenient environmental policy.

The deforestation of tropical rainforests is a major issue in the modern environmental policy debate. They concentrate most of the planet's biodiversity, and unlike other types of forests, their natural rate of regeneration is rather low. That makes a rainforest an almost non-renewable resource, and deforestation an almost irreversible process. In fact, the evidence shows that it may take up to eighty years for a secondary tropical rainforest to accumulate at least as many species as mature forests (Brown and Lugo, 1990; Finegan, 1996). The best way to design policies that preserve these forests would be to understand what causes deforestation. An extensive empirical literature dedicated to answer that question has been developed through the years by virtue of a good availability of satellite deforestation data in places such as the Brazilian Amazon. A lot less attention, however, has been given to analyzing how economic fluctuations may interact with deforestation in particular, and with environmental variables in general. A booming economy going through technological advancements will most certainly demand more deforestation, considering that the forest provides important inputs to the production of goods. As individuals get richer, they demand more goods but also more leisure time, and more environmental quality. Which in this case means less deforestation.

So, it is important to understand how this interaction takes place, and how environmental policy can affect optimal outcomes.

This paper focuses on how business cycles affect the deforestation of tropical rainforests. Essentially, deforestation is carried out in order to enable the productive use of land and/or wood. In both cases, a permanent removal of the trees and bushes gives rise to a production input. We simply name this input as deforestation. It is a flow that, together with a natural regeneration rate of the forest, entails a forest stock loss process. It is similar to capital accumulation through investment, but generally on the opposite direction.

The real business cycle (RBC) modelling approach has been widely used in many areas of economic research since its inception in the early 1980's. More recently a number of studies have introduced environmental issues in RBC models. Fisher and Springborn (2009) compare the effects of productivity shocks under different environmental policies towards emissions within an RBC framework. They conclude that intensity targets maintain higher levels of labor, capital and output, and so are more desirable than emission caps, or taxation. Heutel (2012) also introduces emissions and environmental policy in an RBC model. He finds that the optimal paths for tax or quota policies are procyclical. Heutel shows that a price effect dominates an opposite income effect, rendering procyclical emissions. And this procyclicality would only be higher on an unregulated economy.

This paper differs from all the previous environmental RBC models in one important aspect. The environmental variable is not greenhouse gas emissions, but rather the level of deforestation. Unlike emissions data, that have to rely on complex estimates, deforestation data is rather precise, gathered through satellite technology, and widely available. Besides, deforestation may be a more pressing environmental issue than

emissions in countries endowed with large rain forests. We propose an RBC model with a forest stock, deforestation, and a government that implements environmental policy through taxation. The model is driven by four types of stochastic shocks: Technological, shocks in preferences, and shocks in the taxation of consumption and deforestation. We then show how the model behaves with a stringent environmental policy, and with a more loose one.

The model was calibrated for the Brazilian economy. It predicts a procyclical deforestation. In the presence of continued technological progress the forest stock is repeatedly shortened. Deforestation in this case is higher with a more lenient environmental policy. In the presence of a repeated change in tastes towards more environmental quality, deforestation is reduced and the forest stock converges to a higher level. However, in this case the intensity of the reduction in deforestation and increase in forest stock vary inversely with the degree of policy stringency. So a loose policy would actually do better for the environment. All of these scenarios are based on the finding that a more stringent policy reduces the volatility of deforestation.

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