

# How changes in the prices of milk and beef affect deforestation in Brazil

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At first glance, this may seem like a trivial question but in the context of the Brazilian Amazon, heavily deforested over the last half-a-century, understanding the links between commodity prices and deforestation is important given ever-increasing demand for beef and dairy products. Tropical forests host critical biodiversity ‘hotspots’ as well as providing a range of important ecosystem services, in particular, carbon sequestration and storage. Indeed, tropical deforestation is a major source of global greenhouse gas emissions. Deforestation, therefore, carries both a high environmental and economic cost and Brazil is home to one of the largest stocks of tropical forest remaining in the world.

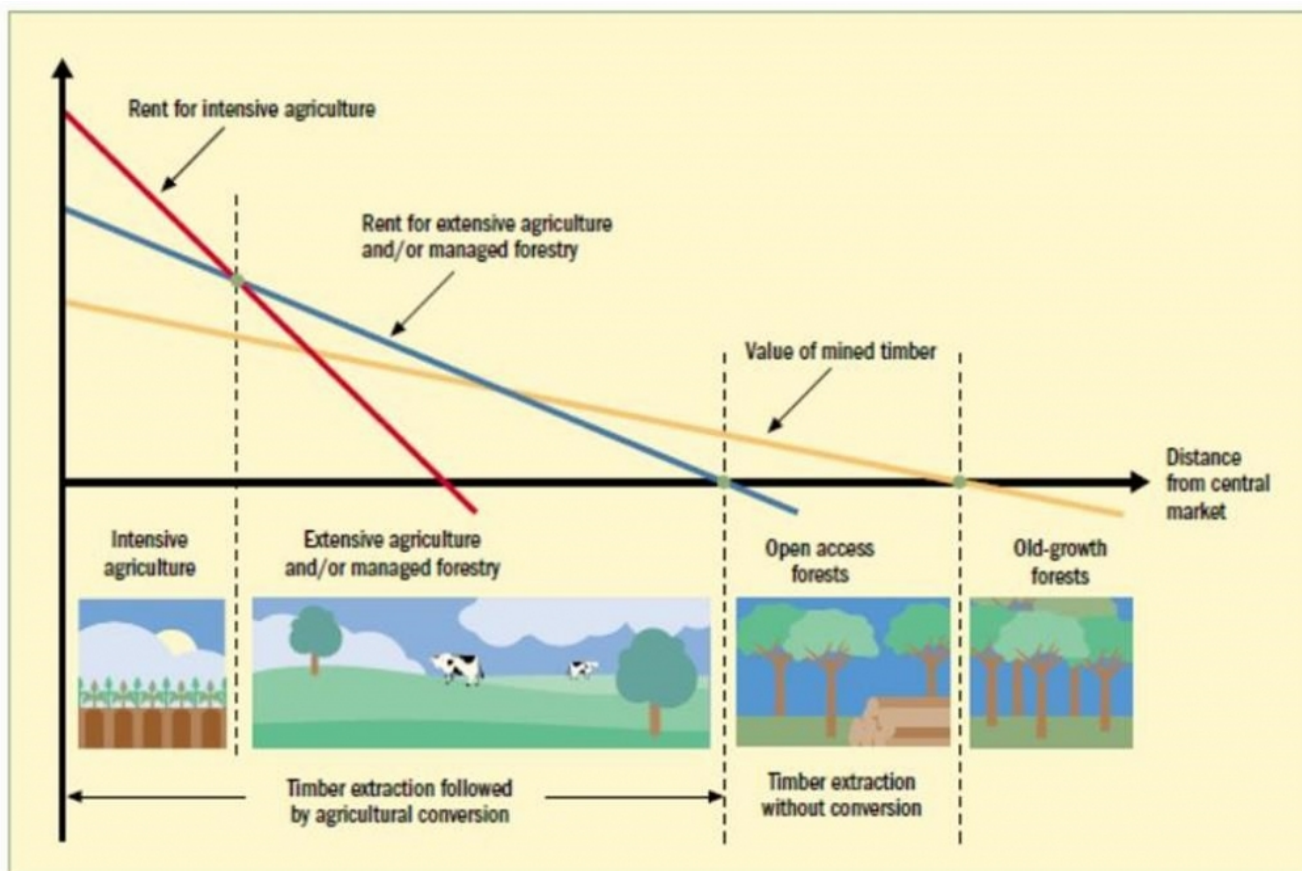
Since the 1960s, widespread colonisation of the Amazon has led to growth of the agricultural sector, including the expansion of cattle herds. Between 1980 and 2008, 80 per cent of the total increase in Brazil’s cattle inventory occurred in the Amazon, and the country is now the world’s largest exporter of beef. ([McAlpine et al., 2009](#)). The setting for our research is the state of Rondônia, in which rapid land transformation alongside a phenomenal increase in the cattle inventory have contributed to high rates of deforestation ([Alves, 2002](#); [Soler et al., 2014](#)). Slowing deforestation rates, a priority of the Brazilian government, requires a better understanding of the links between commodity prices and deforestation. For the targeting of appropriate policies in the most appropriate places, it also requires a deeper knowledge of how patterns of land use are distributed over space.

## What is the expected relationship between location, prices and land use?

Given the establishment of close to 1,000 urban centres in the Brazilian Amazon over the past 50 years ([Browder and Godfrey, 1997](#); [Brondizio, 2016](#)), the land rent framework provides a useful starting point for addressing this question. Originated by Johann Heinrich von Thünen in 1826, it posits that location and distance to markets is a key determinant of rents ([von Thünen, 1966](#)). Closer to market, farmers bear lower costs in getting their products to market and since they make higher profits, rent is higher. Applied to tropical forests, the rent curves for different land

uses, shown in the Figure 1 below, can be mapped out as concentric circles or zones centred on a central market. The frontier of each zone is located where production is no longer profitable.

**Figure 1: Stylised land rent framework**



**Source:** Chomitz et al. (2007)

This framework yields two predictions. First, the intensity of agricultural production will decline with distance to market. Second, higher levels of forest cover are expected when the distance to market too great to allow for profitable farming. However, the way in which changes in prices drive deforestation is unclear. A price increase could lead to more deforestation as producers expand their cattle herds and clear forest for new pasture. On the other hand, higher prices could also increase the profitability of producers thus enabling investments in more productive – ‘intensive’ – technologies, leading to lower rates of deforestation. This is consistent with the so-called ‘land sparing’ effect (Phalan et al., 2011).

Using data from a sample of households with privately owned lots in the state of Rondônia, we empirically examine the links between location, prices, and land uses. More specifically, we test the proposition that the further away a rural household is from the market, the more likely it will expand pasture, and hence deforest rather than intensify cattle production in response to rising demand for beef and milk.

**What do we find?**

The relationship between prices and land use hinges on the following four factors:

**Distance:** households further away from the market tend to clear more forest in response to an increase in commodity prices. This result corroborates the prediction that intensification of production is more likely to occur

closer to the market, whereas more extensive practices become increasingly prevalent further away from the market.

**Commodity:** Rising beef prices tend to reduce forest cover and increase pasture area, unlike milk prices, where we instead find some support for the land-sparing hypothesis.

**Type of forest:** Price increases tend to affect secondary forest (land left fallow after earlier crop cycles) than primary (original) forest cover. This can be explained by the lower levels of labour and capital needed to clear secondary forest.

**Forest endowment:** Changes in prices have a much more pronounced effect in lots with substantial remaining forest. In lots that have already undergone substantial deforestation, this effect is much smaller.

### **What does this mean for policy?**

Our research has direct policy implications as it identifies important characteristics that help determine which households are most likely to clear forest in response to commodity price increases. We find that households with high remaining forest cover, located further away from the market and owning large non-dairy herds are most prone to clear forest following a price increase. Identifying such characteristics potentially allows for more effective targeting of households by policy-makers.

In their efforts to slow deforestation, policy-makers have a number of different options at their disposal. These range from extension services, which could promote more intensive agricultural practices, to a number of market-based instruments, which reduce the incentives to deforest by paying households to keep forest standing. The latter have been widely discussed in both academic and policy circles. In Brazil, two particular market-based schemes are of relevance for our results, namely Environmental Reserve Quotas and payments for environmental services (PES).

The underlying idea behind Environmental Reserve Quotas is that households who deforested more than is legally allowed have to either re-grow forest or purchase quotas from households who retain forest above the legal minimum. In typical PES schemes, households receive pre-specified monetary compensation, which increases with the forest area in their lots. In essence, both of these policy instruments increase the costs of clearing forest since clearing forest implies foregone revenue. As a result, these are likely to reduce rates of deforestation and could also promote more intensive agricultural practices.



#### *Notes:*

- *This blog post is based on the authors' paper [Was von Thünen right? Cattle intensification and deforestation in Brazil](#), LSE's Grantham Research Institute on Climate Change and the Environment Working Paper No. 261 (2017)*
- *The post gives the views of its authors, not the position of LSE Business Review or the London School of Economics.*
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