# Finding the right policy to limit farms' carbon emissions: the case of Brazil and Argentina

*Over 80 per cent of our food's emissions are generated inside the farm, mostly due to land clearing and emissions such as methane released by cattle. However, most governments don't levy carbon taxes on their farmers, and much less so in developing economies.* ***Tomás Domínguez Iino*** *evaluates how effective such environmental tariffs are at reducing emissions, as well as their distributional impact across farmers in the context of Brazilian and Argentinian agricultural supply chains.*

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Agriculture accounts for 26 per cent of the world's greenhouse gas emissions, and an even higher share in developing countries. As the global population is projected to peak at 10 billion by 2050, the challenge of feeding a growing world while remaining within our carbon budget has become a crucial item on the sustainable development agenda (Searchinger et al., 2019).

The first step to reduce the carbon footprint of our food production system is to understand where its emissions come from. Over 80 per cent of our food's emissions are generated before the raw agricultural commodities leave the farm gate, mostly due to land clearing and emissions related to the on-farm production process, such as methane released by cattle (Poore and Nemecek, 2018). These sources dwarf emissions from post-farm stages such as processing and transportation. Furthermore, emissions footprints vary widely across different food products, especially between animal-based and plant-based commodities. Hence, policies hoping to reduce agricultural emissions must change incentives for farmers along two crucial decision margins: how much land

they choose to clear and what they choose to produce on the cleared land.

Because agricultural emissions are generated by the decisions of millions of farmers, direct “command-and-control” regulation is more logistically challenging than in industry, where emissions from the burning of fossil fuels are typically concentrated across a few large firms and are thus easier to regulate directly. Thus, market-based policy instruments such as carbon taxes—which operate by changing incentives through the price mechanism and avoid the enforcement costs of direct regulation—are especially suitable in the agricultural context. However, most governments don’t levy carbon taxes on their farmers, and much less so in developing economies where economic growth is justifiably prioritised over environmental conservation. Instead, because an important driver of agricultural expansion in the developing world is foreign demand, a natural policy lever is environmental trade policy. For example, richer countries often propose carbon tariffs on their imports from poorer countries with laxer environmental standards.

In my Ph.D. thesis I evaluate how effective such environmental tariffs are at reducing emissions, as well as their distributional impact across farmers, in the context of South American agricultural supply chains. The sector’s carbon footprint is mostly attributed to deforestation and on-farm emissions linked to the production of globally traded commodities such as soybeans and cattle. To place this in perspective, South American agricultural emissions exceed those of the entire transportation sector of the United States. Since an important share of the region’s production is shipped overseas, the European Union has considered the use of a carbon tariff on its agricultural imports from South America to correct the environmental externality.

In my paper, I build a quantitative spatial model of agricultural trade, which I estimate by combining various data sources from Argentina and Brazil, and which I use to simulate counterfactual policies such as the proposed EU environmental tariff. The high geographic resolution of my data allows me to capture the wide spatial variation in both agricultural productivity (as reflected by agronomic yield data) and environmental costs (as reflected by the carbon density of land). The model structure allows me to separately quantify farmers decisions along two crucial margins determining emissions: how much land they clear and which commodity they choose to produce. Furthermore, the model incorporates the funnel-like structure of modern agricultural supply chains. Namely, the production of millions of upstream farmers does not reach consumer markets directly but is instead intermediated by a concentrated sector of large agribusiness firms. Thus, the

model allows me to evaluate how a carbon tariff levied downstream at the port on these large firms is passed through to the upstream farmers whose decisions ultimately determine emissions.

My first finding is that an environmental tariff is relatively ineffective if the EU imposes it unilaterally. As the EU demands less from South America, world prices fall, and other buyers pick up the slack. All told, of the emissions reductions achieved by the drop in EU consumption, over 80 per cent is offset by increased trade to non-regulated markets, in particular Asia. The second result is that the tariff has regressive distributional effects across space. Farm-gate prices for South American farmers drop, but they drop twice as much for farmers in the poorest, remotest regions (such as the Amazon) than in the richest regions (such as the south of Brazil). The reason is that supply is less elastic in regions on the agricultural frontier, as farmers face fewer alternative uses for their land and have more difficulty switching across commodities. This inelasticity also implies that quantities respond less, and hence emissions drop less in these frontier regions, which happen to be the ones with the highest carbon densities. Therefore, the tariff is spatially mistargeted because it shifts farmer decisions the least in the areas where the environmental cost is the highest. Finally, given the policy is a market-based instrument, market structure matters for how it is transmitted from downstream agribusiness firms to upstream farmers. I find that the market power of agribusiness firms as buyers makes the policy less effective due to incomplete pass-through as well as more regressive.

To conclude, agriculture presents unique challenges when it comes to emissions regulation. Direct regulation at the externality's source is logistically hard because of how dispersed the sources of the emissions are. Hence, market-based tools such as carbon taxes are attractive but are typically not levied on the farmers who are making the environmentally relevant decisions. Instead, they are implemented where the supply chain becomes more concentrated: downstream on the agribusiness firms. How blunt such policies might be due to their lack of spatial targeting depends on market structure —how agribusiness intermediaries pass through the corrective taxes to farmers. Finally, distributional concerns on producers are especially salient in agriculture compared to other high-emissions industries. Therefore, quantifying the incidence of carbon taxes on the supply side is an important first step to designing transfer mechanisms that would make Pigouvian policies politically feasible in developing countries.

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*Notes:*

- *This blog post is based on Efficiency and Redistribution in Environmental Policy: An Equilibrium Analysis of Agricultural Supply Chains (PDF), presented at LSE's Environment Week (September 2022).*
- *The post represents the views of its author(s), not the position of the Federal Reserve Board, LSE Business Review, or the London School of Economics.*
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