Are there Carbon Savings from US Biofuel Policies? The Critical Importance of Accounting for Leakage in Land and Fuel Markets

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Although the costs of comprehensive U.S. federal climate legislation, such as a cap-and-trade program, have been shown to be small, a variety of political obstacles continue to block its passage. Policymakers have instead relied on sectoral and regional approaches to reduce greenhouse gas (GHG) emissions. A major concern associated with sectoral and regional approaches to climate policy relates to their effectiveness in reducing GHG emissions. Such approaches are *incomplete*, in that only a subset of polluting sectors or regions are regulated. As a consequence they are likely to generate *carbon leakage*. Carbon leakage occurs as sectors or regions not covered by the regulation respond to the regulation (directly or indirectly). When it comes to sectoral approaches to climate policy, policies that call for the expansion of liquid biofuels have been especially scrutinized by environmental groups and the popular press. Yet, to date the very few studies that have examined carbon leakage from biofuel policies typically only consider a single source of leakage.

In this paper we provide comprehensive estimates of carbon leakage from the Renewable Fuel Standard (RFS) for conventional biofuels. The RFS mandates quantities of conventional and advanced biofuels, with each biofuel class defined according to its lifecycle emissions savings relative to gasoline. The current RFS was established in 2007 when the Volumetric Ethanol Excise Tax Credit (VEETC)–the long-standing federal biofuel subsidy–was in place. However, the VEETC was allowed to expire at the end of 2011, leaving the RFS as the primary biofuel support program in the U.S. Our analysis of the RFS explicitly accounts for these changes in policy regime, and reviews the impact of current proposals to eliminate the RFS for conventional biofuels altogether.

This paper addresses three related questions. First, what are the effects of the RFS on land and fuel markets? Second, what is the impact of the RFS on overall GHG emissions, and how does carbon leakage in land and fuel markets cause overall emissions to deviate from the intended emissions savings anticipated by legislators at the time the RFS was passed in 2007? Third, what is the impact of the change in policy regimes and current proposals to eliminate the RFS on overall GHG emissions and leakage due to the RFS?

Our central finding is that the expansion of biofuels mandated by the RFS can increase or decrease GHG emissions depending on the policy regime being evaluated. Relative to a baseline that includes the VEETC, which was in place when the current RFS was established, the RFS causes emissions to increase by 4.5 $TgCO_2e$ in 2015. However, swapping the RFS for the VEETC implies fewer GHG emissions than those that result from the VEETC itself, causing emissions to fall by 2.0 $TgCO_2e$

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in 2015. Thus, the decision to allow the VEETC to expire at the end of 2011 will result in cumulative emissions savings of 25.5 $TgCO_2e$ between 2012 and 2015, while increasing ethanol production considerably. Finally, the RFS causes emissions to increase by 6.7 $TgCO_2e$ in 2015 when evaluated relative to a baseline without the VEETC. Given that the VEETC has expired, this is also the amount by which emissions could be reduced if the RFS for conventional biofuels was eliminated.

While the overall impact on emissions of the policy regimes we consider are modest, our numerical analysis uncovers two surprising results that could not be inferred from a theoretical exercise, an analysis of a single market alone, or a multi-market analysis that uses constant emissions factors in one of the markets. First, both baselines and policy context matter when determining the change in overall GHG emissions and the contributions of each leakage channel. We find that leakage channels are co-determined with emissions from other leakage channel through linked markets. Second, we show that there is an implicit tension between land and fuel market leakage channels. Policy regimes that result in less land market leakage tend to result in more domestic fuel market leakage per liter of ethanol added. This relationship between land and fuel market leakage has important implications for policy since it suggests that different policy instruments may lead to different leakage magnitudes.