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Understanding overlapping policies: Internal carbon leakage and the punctured waterbed

EPRG Working Paper 1910

Cambridge Working Paper in Economics 1920

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Following reforms finally agreed in 2018, the European Union's emissions trading scheme (EU ETS) has been augmented with a Market Stability Reserve (MSR). The MSR's core feature is that, from 2023 onwards, it will cancel "excess" allowances (EUAs)—and thereby make the EU ETS's long-run emissions cap a function of market outcomes. This transforms a "plain vanilla" cap-and-trade design with a fixed cap into a complex variant of a "hybrid" policy instrument.

At the same time, Europe is seeing increasing unilateral action by individual EU member states wishing to "do more" than what the ETS centrally provides. For example, Great Britain has since 2013 imposed an additional Carbon Price Support on electricity generation to "top up" the EUA price; in December 2018, the Netherlands committed to introducing a similar policy. Other examples include a plethora of support mechanisms for renewables and energy efficiency. These share a common feature: they are policies by an individual country aimed at an individual sector within a multi-country multi- sector ETS.

What is the climate benefit of such overlapping policies? Pre-MSR, the answer was clear. With a binding EU-wide emissions cap, any unilateral emissions reduction is exactly offset by an emissions increase elsewhere: the "waterbed effect" is 100%. The MSR, by canceling a fraction of surplus EUAs, punctures this waterbed. Recent estimates suggest that near-term unilateral action that reduces EU-wide emissions demand by 1 ton of CO_2 in a given year will, over time, translate into an emissions reduction of .5 tCO_2 or more. This enables unilateral action to have a global climate benefit.

Yet the crucial missing link lies in figuring out how large a unilateral action is actually required to achieve this 1 tCO_2 reduction in EU-wide emissions demand. The missing link is what we call "internal carbon leakage" within the EU ETS. Given the degree of European market integration, a unilateral policy that reduces an individual country's emissions will often have knock-on effects on its neighbours.

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Publication March 2019

In this paper, we aim to fill this gap in the literature by providing a simple new integrated framework to understand the climate impacts of such unilateral action. First, we present simple formulae to estimate internal carbon leakage for at the sectoral level for three types of policy: (i) a carbon price floor (perhaps with a border tax adjustment), (ii) an energy efficiency program, and (iii) renewables support. The formulae depend on intuitive characteristics such as the price elasticities of demand and supply and firms' observed market shares. Second, we present a formula to quantify the puncture of the waterbed effect under the reformed EU ETS—and how it varies over time up to 2030. Our approach also nests a "plain vanilla" ETS with a fixed cap (100% waterbed) and a "plain vanilla" carbon-tax system (zero waterbed). Our theory makes clear how the sign and magnitude of the climate benefit from an overlapping policy varies widely depending on its design, location and timing. Punctured waterbeds raise the stakes: well-designed overlapping policies can be much more climate-effective but others now backfire.

On the empirical side, we illustrate how observed policies in Europe and North America fit into our framework and are consistent with our theoretical results. Within the EU ETS, we discuss cost-raising policies such as the Dutch carbon price floor and aviation taxes by individual countries, for which internal carbon leakage is positive and sometimes substantial. We also discuss supply-increasing policies such as renewables support schemes in Germany and Spain, which have negative internal leakage as renewables partially displace imported gas- or coal-fired power.

In North America, several carbon-pricing systems feature a punctured waterbed due to the presence of a price floor and ceiling in allowance auctions with uncertainty over when the system will trade in the "intermediate range" (100% waterbed) vs. at the price floor/ceiling (zero waterbed). We analyze the joint carbon market between California and Quebec and consider a counterfactual Western Climate Initiative (WCI) in which states surrounding California join the market and discuss internal leakage under different market rules. The Regional Greenhouse Gas Initiative (RGGI) for electricity in 10 Northeastern states is similar. New York is currently considering an additional carbon fee, which would also apply to imported electricity from other RGGI states, for which internal leakage is negative due to the border adjustment. Finally, we discuss the new Canadian minimum carbon tax, which has a zero waterbed but the possibility of internal leakage between provinces.

In sum, consistent with our theory, internal carbon leakage for cost-raising policies (e.g., CPFs and flight taxes in Europe) is positive, except when imports are taxed (e.g., carbon fees in California and New York). Supply-increasing policies, such as German and Spanish renewables support, have negative leakage. Nonetheless there is a surprising scarcity in the literature of estimates of internal leakage—and better information could substantially improve future policy-making.

The EU ETS with the MSR and overlapping policies is about as complex as tackling local pollutants with highly heterogenous marginal damages—and the uniform price rule is no longer straightforwardly appropriate.