Diffusion of climate technologies in the presence of commitment problems

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Several jurisdictions have announced unilateral climate policy ambitions for the coming decades. The cost of imposing a domestic cap on greenhouse gas emissions will heavily depend on whether the domestic policy design generates the most cost-effective projects within the country. Even though the usual recommendation for optimal abatement is uniform emissions pricing, market failures or other inefficiencies may render emissions pricing insufficient. One such case may arise if policymakers prove unable to credibly commit to future policy. When emission prices are perceived as short-lived, socially cost-effective upfront investment in climate technologies may be hampered by uncertainty about future regulations. Given commitment problems, we compare the costs of different mitigation policies.

A large variety of abatement options

We employ a numerical model for the Norwegian economy with several industries, energy goods and possible climate technology adaptations. It accounts for a large variety of abatement options both within existing technologies by changing consumption, industry, and input compositions, but also beyond today's technologies by investing in new climate-friendly installations and vehicles.

Three policy alternatives

We compare the traditional policy recommendation of introducing an economy-wide emissions pricing system with two other options that specifically target the regulatory uncertainty: One combines the pricing system with a state guarantee scheme that eliminates the regulatory risk. The other combines the pricing system with subsidies for upfront climate technology investments.

In the case with a guarantee scheme, Scenario I, the entire regulatory risk is born by the government. This ensures that agents relate to the announced emission price path and undertake the optimal investments. The other extreme, Scenario II, is the situation with the distrusted emissions pricing system, only. The emission price is not perceived by the population to last and upfront investments in climate technologies will, thus, appear unprofitable. When merely abatement efforts with rather instantaneous emissions effects appear worthwhile, firms will choose to reduce variable costs and scale down output, while households will substitute consumer goods for energy, and leisure for consumption. In Scenario III, technological adaptation takes place in spite of lack of confidence in the pricing system, because they are triggered not by the emission price, but by accompanying upfront subsidies. Contrary to announced future carbon prices, investment subsidies paid out immediately are likely to overcome the commitment problem, as it will be hard to reclaim investment subsidies paid out in the past.

Commitment problems more than triples abatement costs

Two main conclusions can be drawn from our computations. First, if the government fails to give reliable policy signals that match its announced domestic target our estimates suggest more than a tripling of total and marginal abatement costs (see figure below). The reason is that upfront investment in climate technologies will be hampered. Note that comparing these scenarios with (Scenario I) and without (Scenario II) technology adaptations also illustrate the shortcomings of traditional numerical models where abatement beyond existing technologies is not accounted for. Our findings indicate that these traditional numerical models significantly overestimate the costs of the first-best policy – in our case by a factor of 3.

Second, in absence of a first-best guarantee scheme subsidising upfront investment in climate technologies is a feasible policy option (Scenario III). The marginal cost of raising funds is found to be minor, implying that the subsidy scheme performs almost as well as the guarantee scheme. It relies, however, on the strong assumption that the subsidy scheme picks the cost-effective investment projects, a condition that is difficult to meet in practical policy.

Scenarios I and II: Marginal abatement costs. EUR/tonne CO_2-equivalents. 2008–2020