

RENEWABLE ENERGY POLICIES UNDER UNCERTAINTY: COMMITMENT VS. DISCRETION

Florian Habermacher (PhD in economics and finance), Swiss Institute for International Economics and Applied Economic Research, University of St. Gallen, University of Oxford, Institute for New Economic Thinking (INET), Oxford, UK, florian.habermacher@unisg.ch

Paul Lehmann (PhD in economics), Helmholtz Centre for Environmental Research – UFZ, Department of Economics, Leipzig, Germany, and University of Oxford, Institute for New Economic Thinking (INET), Oxford, UK, paul.lehmann@ufz.de

Overview

To decarbonize the power sector policy-makers need to commit to long-term credible rules for climate and energy policy. Otherwise, time-inconsistent policy-making will impair investments into low-carbon technologies. However, the future benefits and costs of decarbonization are subject to substantial uncertainties. Thus, there may also be societal gains from allowing policy-makers the discretion to adjust the policies as new information becomes available. We examine how this trade-off between policy commitment and discretion affects the optimal intertemporal design of policies to support the deployment of renewable energy sources. Using a dynamic partial equilibrium model of the power sector, we show that commitment to state-contingent renewable subsidies outperforms both unconditional commitment and discretion. The choice between the practically more feasible approaches of unconditional commitment and discretion is analytically ambiguous.

A numerical illustration with naïve assumptions suggests that policy discretion may outperform unconditional commitment in terms of welfare. However, extensions to more realistic cases where only a limited fraction of climate uncertainty resolves, where future policy-makers have own agendas, or with risk-averse investors show commitment as favorable.

The losses we identify from suboptimal choices regarding policy time-commitment in different situations mean policy-makers, when designing the time-structure of renewables support schemes or of indirect support such as carbon taxes, should carefully consider the commitment trade-off. At the same time, our results show that general biases regarding the level of support for renewables can imply even substantially larger losses than a suboptimal policy time-structure. This suggests that discussions about the time-structure of policies ought to be taken seriously, but should not distract from the more basic aim to set the policy support at the right level more generally.

Methods

To analyze the trade-off between renewable electricity sources (RES) policy commitment and discretion, we develop a dynamic equilibrium model for the power sector. Within this framework, we examine the case of direct RES support: A subsidy granted for RES generation in addition to the electricity price. We look at three selected policy scenarios which vary in when and how the social planner decides on a subsidy paid to RES deployment in the future:

- (1) unconditional commitment to a long-run RES subsidy path, i.e. the subsidy level decided upon today is not adjusted in the future, even if knowledge gained in the future suggests it is inefficient,
- (2) rule-based commitment to a set of state-contingent RES subsidy levels, which explicitly relate possible future states of the world (e.g. high and low benefits or costs) to corresponding subsidy levels, and
- (3) discretion to adjust the long-run RES subsidy path, i.e. the subsidy can be freely adapted to the optimal level in the future, which may differ from a level otherwise committed to, because of new knowledge on costs or benefits as well as time-inconsistent policy-making.

We analytically derive the dynamic equilibrium responses of investors and consider subgame-perfect strategies of the policymakers in those cases where commitment is not possible. Numerical calibration for various cases of plausible renewables scenarios for European wind power allows us to derive quantitative insights based on the analytical results.

Results

Our analysis shows that rule-based commitment to future RES support paths outperforms both unconditional commitment as well as discretion. The choice between unconditional commitment and discretion is analytically ambiguous. However, the numerical application for wind power in Europe shows that discretion, in the sense of an optimal, forward-looking adaptation of policies to new information, is superior to unconditional commitment for reasonable parameter values and in realistic frameworks.

While results are numerically ambiguous in a naïve analysis, the slowness with which climate uncertainty resolves over time, idiosyncratic deviations of future policy decisions from current preferences, and risk aversion strengthen the case for commitment under realistic assumptions. If the major source of uncertainty is technology costs rather than climate benefits, the case for or against commitment is influenced by whether the political aim is really to contain climate change or to achieve a fixed renewables deployment target at least cost. In the latter case, we see that discretion appears more favorable if the requirement to achieve a strict target restricts political opportunism. These results are robust to strong variation of the various key parameters.

Conclusions

Adequate levels of private investment demand stable political frameworks, and this is especially important for long-lived infrastructure investments. The corresponding paradigm of long-term political stability and policy commitment can, however, be challenged if benefits and costs of policies are so uncertain ex ante that failure to revise policies when new information becomes available has itself large costs. There is thus a trade-off between policy commitment encouraging investment and discretion allowing to update policies in future in line with new information. Our analysis focuses on a policy domain where this trade-off seems significant: climate change mitigation by RES energy support policies. Large scale RES investments and deployment are only viable with some clarity about the medium-term evolution of policy support. However, uncertainty on the social cost of carbon and RES deployment costs equally mean it cannot be excluded that policies agreed today warrant adjustments in a few years when new information becomes available.

In a dynamic partial equilibrium framework that can account for political opportunism, climate or technology uncertainty, and risk aversion, committing to a policy path with pre-defined adjustments to new information is found to be welfare-maximizing. Politically contracting such contingencies in detail seems implausible for the case of climate policy, and instead a simpler commitment to a fixed policy path, or – on the other extreme – discretion to freely adjust future policy to new information, seem more realistic. Analytically, the choice between the latter two strategies is ambiguous: Depending on parameters, either of the two can yield higher welfare. In a naïve numerical application, calibrated roughly to a case of subsidies for wind turbine deployment, the benefit of adjusting future subsidies to the originally imprecisely estimated real climate damages dominates commitment, so that discretion appears beneficial.

However, this apparent advantage of discretion over commitment disappears under more realistic assumptions. The slowness by which climate uncertainty resolves over time, idiosyncratic deviations of future policy decisions from current preferences, and risk aversion strengthen the case for commitment.

If the major source of uncertainty is technology costs rather than climate benefits, the case for or against commitment is influenced by whether the political aim is really to contain climate change or to achieve a fixed renewables deployment target at least cost. In the latter case, we see that discretion appears more favorable if the requirement to achieve a strict target restricts political opportunism.

The identified situations where welfare achieved under discretion exceeds welfare under policy commitment challenges the traditional wisdom that environmental policy makers should always seek to provide stable framework conditions, even if we do find that in the most realistic cases of our example, commitment seems to indeed increase welfare. Overall, the welfare differences we find are often significant but limited to a few percent of the absolute overall system benefits of the renewables considered. Despite the importance of time-consistency and uncertainty issues, choosing the right order of magnitude of support may thus be more important than the exact way the support is committed to.