Time-consistent carbon pricing

Olga Chiappinelli, DIW Berlin, ++49 30 89789 425, ochiappinelli@diw.de
Karsten Neuhoff, DIW Berlin, ++49 30 89789 471 kneuhoff@diw.de

Overview

Production of basic materials like steel and cement are responsible for 30% of global greenhouse gas emissions. In order to meet the de-carbonization targets agreen in Paris climate agreements, radical low-carbon innovation in production and use of these materials is needed.

To induce the private sector to invest in radical green innovation of products and processes, it is often argued governments should set a carbon price sufficiently high to ensure the profitability of such transition. However, carbon pricing is prone to time inconsistency and credibility problems. These arise for mainly two reasons. First, there are multiple and conflicting objectives in the political and regulatory agendas: long-term aimed carbon-reduction policies conflict with short-term social and economic objectives, such as distributional implications of higher carbon price, and public finance constraints. This multi-objective nature of the government social welfare function creates a trade-off between climate and redistributive goals and governments are typically biased towards the short-term side of this trade-off, both because of electoral concerns and political alternation.

The second reason is that the firm and the government take sequential moves, and low-carbon investments are irreversible and specific in nature. The two arguments lead to an ex-post opportunism problem: the former creates motivation for ex-post opportunism, while the latter creates the scope. The government has an incentive to create expectations of a relatively high carbon price (e.g., announce the emission of a small number of permits or of a high carbon tax) in order to induce the firm to invest in radical green innovation (hence achieving the goal of reducing emissions); then, after the firm has sunk the investment costs, the government has an incentive to ex-post lower the carbon price in order to avoid the negative impact on consumer surplus.

However, as rational agents, potential innovators anticipate the risk of such ex-post opportunistic behavior on the side of the government, and do not invest in the first place, so that no emission reduction is realized. This time inconsistency problem is not new to the economic literature and not specific to climate policy, but common to many regulatory settings, such as monetary policy (Barro:1983 and Kydland 1977) and rate-of-return regulation (see e.g, Laffont:1993). Some past research has studied the problem in the specific context of climate policy, suggesting a number of solutions: tax earmarking (e.g., Marsiliani:2000, delegation of environmental regulation to an independent environmental agency (e.g., Helm:2003), investment subsidies (e.g., Abrego:2002, Golombeck:2010, Montero:2011, pollution taxes (e.g., Biglaiser:1995), options to pollute and procurement (e.g., Laffont:1996).

Methods

Differently from the above mentioned literature, which takes the time-inonsistency problem for granted, we assume that policy makers are not totally present-biased and have some degree of forward lookingness. In this context, allowing for reputation effects (which can emerge in a repeated relationship) can bring some improvements. This exercise was done in the regulatory context (see e.g., Salant:1991, Salant:1992), Gilbert:1994 and Martimort:2006 but never specific to the climate policy case.

We assume a setting of pricing regulation similar to Laffont:1996. There is a continuum of agents/potential polluters with demand for a polluting good where p is the carbon price as reflected in the good price (we assume full carbon pass through). The carbon price is "set" by the government at the beginning of a trading periods, in the sense that the governemnt can influence the carbon price via setting the number of allowances or a carbon tax. The government is Nash leader in this setting and the firm Nash follower. Given the sequentiality of the moves between the government and the firm, there is scope for ex-post opportunism on the side of the government: the government can ex-post change the price by manipulating the number of allowances or change the tax rate.

Results

We investigate whether a repeated relationship between the private sector and the government can alleviate the problem of time-inconsistency and hold up underlying carbon pricing policies. We represent the time-inconsistency problem in a simple model of carbon pricing and we find that reputational forces can bring some improvement on the committment problem in the long run and partially restore the incentive for the private sector to invest. We furthermore investigate whether integrating the carbon price with additional policies can improve on the time-inconsistency problem in the short term. In particular we consider the role of project-based carbon-price guarantees, where a carbon price is guaranteed for a share of the project.

Conclusions

We have shown the time-inconsistency problem in a simple model of carbon pricing and found that reputational forces can bring some improvement on the committment problem and partially restore the incentive for the private sector to invest. The equilibrium carbon price and the level of investment are distorted downward with respect to the commitment benchmark, so to ensure that the benefits of investment (in terms of reduced emissions) are spread over time, therefore increasing the opportunity cost for the goverment of forgoing the relationship with the firm.

Furthermore, we have investigated how additional policies can improve on the time-inconsistency problem in the short term. In particular we considerd the role of project-based carbon-price guarantees. where a carbon price is guaranteed for a share of the project. In this case the time-inconsistency problem is expected to be less severe since the government can renege on the announced price only on part of the project. As far as we know we are the first in providing a formal modelization of carbon contracts. We found that carbon contracts alleviate the time-inconsistency problem and partially restore the incentive for the firm to invest.

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