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Comparing policies to confront permit over-allocation☆

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ABSTRACT

Instability in cap-and-trade markets, particularly with respect to permit price collapses, has been an area of concern for regulators. To that end, several policies, including hybrid price-quantity mechanisms and the newly introduced "market stability reserve" (MSR) systems, have been introduced and even implemented in some cases. I develop a stochastic dynamic model of a cap-and-trade system, parameterized to values relevant to the European Union's Emission Trading System (EU ETS) to analyze the performance of these policies aimed at adding stability to the system or at least at reducing perceived over-allocations of permits. Results suggest that adaptive-allocation mechanisms such as a price collar or MSR can reduce permit over-allocations and permit price volatility in a more cost-effective manner than simply reducing scheduled permit allocations. However, it is also found that the performance of these adaptive allocation policies, and in particular the MSR, are greatly affected by assumed discount rates and policy parameters.

Introduction

Cap-and-trade policies have been used for decades as a means to control emissions from stationary sources and they appear to be the policy of choice in several recent efforts to control greenhouse gas (GHG) emissions.[1] The virtues and negative aspects of cap-and-trade policies have been well documented in the economics literature. However, in recent policy debates and in the popular press, price variability and in particular price collapses have garnered much attention.[2] The idea of price variability in cap-and-trade programs is, of course, not a new revelation. Analysis of quantity-based programs, such as a cap-and-trade policy, with uncertainty in marginal benefits and/or marginal abatement costs can be found in such classic works as Weitzman (1974); Roberts and Spence (1976), and Stavins (1996). Building on this work, several studies have also explored the impact of uncertainty on cap-and-trade systems and possible mechanisms to deal with it, such as banking and borrowing or price-quantity hybrid systems, in dynamic settings (e.g. Schennach, 2000; Unold and Requate, 2001; Fell and Morgenstern, 2010; Fell et al., 2012b, 2012a).

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[1] Recent cap-and-trade programs to regulate GHG emissions include the EU Emissions Trading Scheme (EU ETS), the Regional Greenhouse Gas Initiative in the Northeastern U.S., California's AB 32 regulation, and New Zealand's ETS. Several other regions have also applied carbon taxes, but the majority of regulated sources of GHG's fall under a cap-and-trade program.

[2] An article in the Economist (2013) declared, "The ETS has long been a mess. …Partly because recession has reduced industrial demand for the permits, and partly because the EU gave away too many allowances in the first place, there is massive overcapacity in the carbon market. The surplus is 1.5 billion–2 billion tonnes, or about a year's emissions. Prices had already fallen from €20 ($30) a tonne in 2011 to €5 a tonne in early 2013."

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These aforementioned studies and others like it describe the relative trade-offs of various policy designs in an uncertainty modeling context and prescribe program features that could be applied from the program's inception. However, recently, a more subtle debate has developed – how do we alter existing programs to deal with a situation in which there is an unexpected “over-supply” of emission allowances?

Several practical examples of this concern can be found in the SO_2 emissions trading program in the U.S., the Regional Greenhouse Gas Initiative (RGGI) in the Northeastern U.S., and the EU's emission trading scheme for carbon (EU ETS). In the SO_2 trading program, U.S. Environmental Protection Agency (EPA) regulators determined there was a relative over-supply of permits given information about relatively high benefits from SO_2 abatement and the environmental problems created by interstate air pollution. The EPA regulators sought to effectively reduce the supply of permits through the issuing of the Clean Air Interstate Rule (CAIR). Under the CAIR, which was set to begin in 2015, banked permits of vintage 2009 or earlier could be exchanged at a one-to-one ratio for compliance purposes, but firms would have to exchange two banked permits of vintage 2010–2014 for a unit of emissions. Furthermore, for permits of vintage 2015 and beyond, CAIR would have required firms to turn over 2.86 permits per unit of emissions.[3] CAIR was eventually struck down by U.S. federal courts, but it does provide a possible policy, change the trading ratio of a permit, for dealing with a perceived over-supply.

The RGGI program, a CO_2 emissions trading system among power plants in the Northeastern U.S. that began in 2009, also contains mechanisms to prevent over-allocation. First, RGGI has a price-floor in their permit auctions, which can serve to reduce the number permits entering the market. Second, given the permit banks acquired by the regulated entities over the first few years of the program, RGGI-participating states agreed to a considerable reduction in the planned cap in 2014 and beyond, reducing the planned 2014 cap by about 45% (165 million permits to 91 million) and having it decrease by 2.5% from 2014 through 2020.

Rather than being motivated by higher-than-expected benefits, EU regulators are concerned that permit prices are too low and therefore do not provide an adequate incentive for firms to undertake long-run investments needed to move to a low-carbon economy. EU regulators have thus proposed several plans to reduce, at least temporarily, the supply of allocated permits in an effort to prop-up EU ETS permit prices. There are two main ways that the European Commission (EC) regulators are proposing to reduce supply. The first method is known as “backloading”. Under backloading, regulators will reduce the number of permits that will be available for auction in the next few auctions relative to what was initially planned. However, these permits that were removed from the near-term auctions will be offered several years later in subsequent auctions. Thus, this policy only temporarily removes permits from the market.

The other policy EC regulators are considering is a so-called “market stability reserve” (MSR) system. Under the MSR policy, a rules-based policy will be implemented such that if the total number of outstanding allowances (i.e. the cumulative bank of allowances held by firms) exceeds some threshold, then allocations in subsequent auctions will be reduced relative to the planned allocation. Likewise if the total number of outstanding allowances falls below some limit, additional permits beyond what was planned will be made available for sale in future auctions. The goal of the MSR is thus to reduce perceived permit “surplus” conditions and likewise to protect against system-wide permit shortages. Though not a stated goal of the EC regulators, such an adaptive permit supply system could also increase permit price stability.

In this paper, I develop a stochastic dynamic model of abatement cost to analyze various methods of dealing with over-supplies of permits These methods include altering trading ratios, MSR policies, permit price collars, and policies aimed at completely vacating allocations in later years of the program are also considered. Using a model that is parameterized to the EU ETS, the relative effectiveness of these various policies in terms of expected abatement costs, permit price variability, and emissions variability are examined. These results are then used to make policy recommendations to the EC with regards to their efforts to increase permit market stability.

The results indicate that the MSR policy as proposed by the EC will likely reduce allocation primarily in the beginning years, leading to a near-term increase in permit prices, and does reduce permit price variation relative to the EU ETS in its current form. However, the price collar mechanisms modeled are found to achieve the same expected emission levels as the MSR but with less price variation and lower expected abatement costs than the MSR, albeit with higher volatility in cumulative emissions. The permit reduction policies, on the other hand, achieve the same expected cumulative emissions level as the MSR at a slightly higher expected abatement cost and larger variation in permit prices, but with virtually no uncertainty in achieved cumulative emissions.

Importantly, it is also shown that the effectiveness of the MSR in terms of removing perceived excess permits and promoting greater price supports is diminished as the regulated firms' discount rate increases. In contrast, price collar mechanisms with a strict price-floor actually further reduce allocations with increasing discount rates and by definition prevent price collapses. Finally, in exploring parameterization sensitivity of the MSR it is found that the MSR designs that withdraw about as many permits in high-bank states as they inject in low-bank states do little to increase permit prices or decrease permit price variation relative to the EU ETS system as is.

The remainder of the paper is organized as follows. Section “Basic model description” describes the basic theoretic model that underlies the numeric modeling efforts and describes the various policy provisions. Section “Numeric model description” describes the numeric modeling technique. In Section “Simulation results”, I describe the results from the simulation experiments under various parameterizations. Concluding remarks are given in the final Section “Conclusions”.

[3] For more information on CAIR, see Fraas and Richardson (2010).

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