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Alternative intertemporal permit trading regimes with stochastic abatement costs

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Abstract

We examine the social efficiency of alternative intertemporal permit trading regimes. The role of uncertainty and information asymmetry is discussed. For banking to be welfare improving, uncertainty itself does not matter, while information asymmetry does. Three effects of banking are identified: externality effect, information effect, and total permit effect. In the absence of total permit effect, banking is welfare improving if information effect is positive and dominates the externality effect. The relative efficiency of banking regimes with different intertemporal trading ratios is affected by the slope of the benefit and damage functions and the covariance of the shocks.

JEL Classification: Q2; Q28

Keywords: Bankable permits; Externality effect; Information effect; Intertemporal trading ratio; Total permit effect

1. Introduction

In recent years, we have witnessed increasing interest in the use of tradable permit systems for pollution control. While most permit systems focus on the gain from trading among the emitting sources, potentially these systems can be made to provide the

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flexibility of trading across time. Temporal permit trading may include banking and borrowing. Banking occurs when permits authorized for the current period are saved for use in subsequent periods, and borrowing occurs when permits authorized for some future period are instead used in the current period. Temporal trading can lower compliance costs by allowing firms to hedge against risks in emissions patterns and smooth out fluctuations in abatement costs over time. Stavins (2003) and Tietenberg (2001) both recognize that the temporal dimension can be a key component of a permit trading system.

In fact, banking has played an important role in some pollution control programs. For example, banking has likely enhanced the performance of the SO_2 allowance trading program (Ellerman et al., 2000), the US lead rights trading program a decade earlier (Kerr and Maré, 1996) and the control of automobile hydrocarbon emissions in California (Rubin and Kling, 1993). Examples of other programs that have made use of bankable permits include the Corporate Average Fuel Economy standards for automobiles and light trucks, which allowed banking and, in some cases, borrowing (Farrell et al., 1999); the ozone transport region NO_x and VOCs emission trading program, which allowed banking; as an example of state-level programs, the Delaware NO_x and VOCs emission trading program, which also allowed banking.[1]

In spite of the potential for application of bankable permits and the extensive studies on permit trading, there is limited research on the efficiency of bankable permits. Much of the literature on tradable permit systems has focused on the cost effectiveness of these pollution control mechanisms. Most economists now agree that permit trading, including bankable permit programs, can be cost effective (Tietenberg, 2001; Cronshaw and Kruse, 1996; Rubin, 1996).

While separating means (cost-effective instruments) from ends (efficiency) highlights a strength of permit trading systems, there are limitations to this wisdom. As Stavins (1998) notes, ''one risks designing a fast train to the wrong station''. Kling and Rubin (1997) demonstrate the risks from focusing on cost effectiveness by showing that, in a bankable permit system, firms will choose suboptimally excessive emissions in early periods and correspondingly too few in later periods. Leiby and Rubin (2001) extend their study to stock pollutants. Neither of these two models considers the consequences of incomplete information of the policymakers.

However, with complete information, there is no real advantage to permit trading, either across time or across firms, since the regulator can set the optimal number of permits for each firm in each period. Thus, it is important to analyze bankable permits in a framework with incomplete information. Yates and Cronshaw (2001) (YC hereafter) provide a careful analysis of bankable permits when polluting firms have better information about their abatement costs than the regulator. They investigate what is the optimal intertemporal trading ratio (ITR) and whether allowing bankable permits is welfare improving given that the bankable permit system is optimally designed.

Our work differs from previous studies, mainly YC, in the following three aspects. First, using a two-period model, we identify the three effects of banking on permit redistribution

[1] For a comprehensive description of permit trading programs, see Stavins (2003).