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Renewable energy subsidies: Second-best policy or fatal aberration for mitigation?

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ABSTRACT

This paper evaluates the consequences of renewable energy policies on welfare and energy prices in a world where carbon pricing is imperfect and the regulator seeks to limit emissions to a (cumulative) target. The imperfectness of the carbon price is motivated by political concerns regarding distributional effects of increased energy prices. Hence, carbon prices are considered to be temporarily or permanently absent or endogenously constrained by their effect on energy prices. We use a global general equilibrium model with an intertemporal fossil resource sector and calculate intertemporally optimal policies from a broad set of policy instruments including carbon taxes, renewable energy subsidies and feed-in-tariffs, among others. If carbon pricing is permanently missing, mitigation costs increase by a multiple (compared to the optimal carbon pricing policy) for a wide range of parameters describing extraction costs, renewable energy costs, substitution possibilities and normative attitudes. Furthermore, we show that small deviations from the second-best subsidy can lead to strong increases in emissions and consumption losses. This confirms the rising concerns about the occurrence of unintended side effects of climate

Abbreviations: ETS, emissions trading scheme; FIT, feed-in-tariff; CES, constant elasticity of substitution; FOC, first-order conditions; BAU, business-as-usual; BGE, balanced growth equivalent; RE, renewable energy.

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policy – a new version of the green paradox. Smart combinations of carbon prices and renewable energy subsidies, however, can achieve ambitious mitigation targets at moderate additional costs without leading to high energy price increases.

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1. Introduction

Policies to promote renewable energy technologies have a long tradition in many OECD countries. Even before carbon pricing instruments (like the EU-ETS in 2005) were implemented to reduce carbon emissions, many countries had used subsidies, feed-in-tariffs (FIT) or public research and development spending to increase the share of renewable energy (IEA, 1997). As concerns about global warming intensify due to new research results such as the latest IPCC (2007b) report and the Stern (2007). Review, politicians and economists are debating about the most effective mitigation policy. Many economists recommend putting a price on carbon in form of taxes or emissions trading schemes (ETS) to mitigate emissions at least costs (e.g. IPCC, 2007a, p. 747).

Basically, there are two strands of argumentations for implementing renewable energy specific policies: one is based on efficiency grounds, the other relies on pragmatic considerations promoting second-best policies that are politically more feasible.[1] The first argumentation claims that the energy sector is subject to multiple externalities like carbon emissions, local air pollution, innovation and learning spillovers, imperfect competition, network effects or energy security concerns (e.g. Fischer and Preonas, 2010; Sorrell and Sijm, 2003; Unruh, 2000). If the regulator implements only Pigouvian carbon taxes, emissions will be higher than under the first-best optimum (Grimaud et al., 2011). Likewise, if the regulator seeks to achieve a certain emission target (by an ETS or by appropriate carbon taxes) without further policy instruments, compliance costs will be higher than socially optimal (Fischer and Newell, 2008; Kalkuhl et al., 2012; Kverndokk and Rosendahl, 2007). The second, pragmatic argumentation stresses that distributional concerns and missing stakeholder support for (efficient) carbon pricing may constitute political constraints which prevent the implementation of the first-best policy: High carbon prices reduce profits and income primarily in the fossil energy industry and lower-income households (Burtraw et al., 2009; Metcalf, 2008; Parry, 2004; Parry and Williams III, 2010). Boeters and Koornneef (2011) give further political arguments for the implementation of the EU renewable energy policy such as increase in energy security (through less imports of fossil resources), job creation and technology leadership, among others. Additionally, unilateral carbon pricing can induce relocation of energy-intensive industries (e.g. Markusen et al., 1993). A uniform global carbon tax or a global ETS could solve the relocation problem, but might be Utopian in the short term as there is no practical experience how to negotiate and distribute rent incomes and cost burdens. Ideological attitudes against carbon pricing policies also play an important role: Carbon taxes face high opposition as taxes in general are unpopular in wide parts of the US society (Newell et al., 2005). The alternative to taxes, emissions trading, is criticized similarly by many environmentalists and developing countries as being institutionally infeasible or unfair. Technology-optimistic considerations about the progress of the learning renewable energy technologies might further lead to the perception that a temporary renewable deployment stimulus could be a more manageable way to foster mitigation.[2]

The importance of a thorough investigation of the welfare effects of second-best policies is known from the more specific literature on ethanol fuel policies in the United States, where first-best policies are most likely not politically feasible but a second-best setting is given due to environmental externalities and energy security concerns. Vedenov and Wetzstein (2008), for example, compute the optimal ethanol subsidy for the United States. They stress that in particular rebound effects (i.e. increased fuel

[1] Bennear and Stavins (2007) provide a general discussion on the use of second-best instruments.

[2] Farmer and Trancik (2007), for example, estimate that the “costs of reaching parity between photovoltaics and current electricity prices are on the order of $200 billion” – which is 1.4% of US GDP in 2009.

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