Taxing international emissions trading

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ABSTRACT

We investigate the efficiency and effectiveness consequences of emissions trading taxation. A theoretical partial equilibrium model is developed, showing that permits taxation distorts the equilibrium price and abatement efforts. Potentially counterintuitive conclusions concerning the tax revenue are also derived. A CGE model complements theoretical results, suggesting that the change in the equilibrium permits price brought about by taxation can be significant. Finally, we conclude that policy design based on cost effectiveness might lead to wrong conclusions: the socially desirable design of emissions trading taxation requires homogenous tax rates applied to net sellers and no rebate rates allowed for net buyers.

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1. Introduction

A seemingly overlooked aspect in the functioning of an international emissions trading scheme (IET) lies in the potential effects of diverging tax treatment of permits revenues and costs across participating countries. For example, the European law establishing the Emission Trading Scheme (EU-ETS) is silent concerning the fiscal treatment of permit related revenues and costs which is then left to the national fiscal systems; as a result, differentiated practices exist in Member Countries participating in the EU-ETS (Copenhagen Economics, 2010).

Though an extensive literature has examined various aspects of permits systems, the fiscal treatment of revenues and costs that arise in emissions trading markets has not yet been fully addressed. Not accounting for such issues may lead to wrong conclusions in terms of the efficiency and cost effectiveness of permits as well as their impact on industry relocation decisions (Bilbao Estrada et al., 2009). The existence of tax differentials also raises relevant design questions in emissions control policies by affecting the allocation of abatement efforts within multinational firms, across countries and across firms (Fischer, 2006).

In this paper we aim to contribute to the literature on cap-and-trade regimes by investigating how differences in the tax treatment of emission

allowances may affect an international permits trading scheme in terms of cost effectiveness, abatement decisions and welfare impacts. These aspects are first analyzed theoretically by a partial equilibrium model and then investigated through numerical simulations performed with a Computable General Equilibrium (CGE) model, which allows us to account for complex features of an IET system and its linkages with the rest of the economy.

In the analytical model, we consider I countries and I representative competitive firms, one in each country. Firms take permits endowment and permits taxation as given and choose their emissions level and their selling or buying behavior accordingly. Our results show that permits taxation involves the violation of cost effectiveness, as distortions both in the equilibrium permits price and in the distribution of the emissions abatement achievements across countries arise. Additionally, the effect on tax revenues depends on the country position in the permits market, (i.e. whether the country is a net buyer or a net seller of permits). The entity of all these effects, as well as their impacts on both single countries and aggregate social welfare, depend in a complex way on countries' specific characteristics, as technology, competitiveness, energy mix as well as domestic taxation. We therefore develop a modified version of the CGE GTAP-E model, where emissions trading is allowed for and permits fiscal treatment is explicitly modeled. Welfare impacts are evaluated on the basis of the overall welfare equivalent variations related to different policy scenarios.

The aim of the paper is neither to mimic actual taxation, nor to provide a full legal analysis of the different forms of accounting and tax

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treatment of permits. Indeed, uncertainties on the tax treatment and accounting procedures related to emission permits are still so large and widespread[1] that it would be particularly complex to try to simulate a realistic scenario. Accordingly, even though we have tried to set tax rates as close as possible to national levels of corporate income taxation, we cannot guarantee that scenarios reflect the actual tax burden in each country. Also, important *caveats* might arise due to the possibility that taxing permit related revenues and costs can conflict with national and international tax laws and regulations.[2]

Though in our model tax revenues are simply redistributed lump sum in regulated countries, our analysis also constitutes a potential starting point for the investigation of the role of emissions trading taxation as part of a more general environmental tax reform (ETR) (Ekins, 2011; Ekins and Salmons, 2010; Ekins et al., 2011a, 2011b). Tax revenues from fiscal treatment of emission permits may be exploited for enhancing investment efforts in green technologies as well as for reducing potential negative distribution effects due to climate change policies.

In this respect, our work is related to a very recent and growing literature on the distributional effects of climate policies. Rive and Rübbelke (2010), for instance, examine the poverty alleviating benefits of the Clean Development Mechanism (CDM) and, focusing on China and the EU, identify conditions under which countries can take advantage of the co-benefits of the CDM through the design of their domestic environmental policies. As pointed out by Altemeyer-Bartscher et al. (forthcoming), when all types of ancillary benefits of climate policies are taken into account (not only improved air pollution, but also a rise in energy security through a higher supply of domestic renewable energy use, for instance), higher environmental taxes financing international side-payments to climate programs can be justified. Finally, another relevant contribution can be found in Fankhauser and Martin (2010), who estimate the potential revenue from a levy on CDM-related transactions as a source of finance for climate change adaptation.[3]

From a theoretical point of view, the bulk of existing contributions considering emissions trading jointly with tax issues deals with the pros and the cons of overlapping regulatory instruments (Böhringer et al., 2008; Borghesi, 2011; Brechet and Peralta, 2007; Eichner and Pethig, 2009; Johnstone, 2003; Sorrell and Sijm, 2003). In a recent paper, Godal and Holtsmark (2011) emphasize that potential efficiency gains from permits trading are neutralized when governments apply taxes or subsidies on domestic emissions; as a result, the instrument mix would only result in a redistribution of income. None of the mentioned papers however assess the direct taxation of permits and its consequences.

To the best of our knowledge only few contributions deal explicitly with emissions trading revenues taxation. Among them, Fischer (2006) investigates the interaction between multinational taxation and abatement in an international emissions trading scenario where the equilibrium permits price is exogenous. Yale (2008) examines under what circumstances income taxation interferes with cap-and-trade environmental regulation. He reaches two opposite conclusions according to the time horizon under scrutiny: within a single tax period, taxing returns from permits does not distort firms' choices at the margin between using and selling permits or between buying permits and abating. On the opposite, when permits are provided for free and their value is excluded from taxable income, taxes may distort firms' decisions regarding whether and to what extent they find permit banking convenient. In this case, the permit price will rise up to the point where tax exemption is capitalized into the price of permits and, accordingly, the relative costs of abatement in present and future periods result to be

distorted.[4] Both Fischer (2006) and Yale (2008), however, deal with a comprehensive corporate income taxation which taxes both profits (net of abatement costs) and permits' revenues/costs. Our theoretical model, instead, aims at isolating the effects of specific permits taxation in an IET scheme that would perform in a cost effective way without this type of taxation, to elicit the specific impact of permits taxation. Then, such impact is tested in a CGE setting, through the use of illustrative cases and focusing on aggregate welfare by countries involved in the emissions trading system.

The potential impact of differentiated tax treatment practices across EU Member States is the focus of the already cited report by Copenhagen Economics (2010); one of its main conclusions is that cost effectiveness of the EU-ETS is not expected to be significantly affected. Departing from Copenhagen Economics (2010) and adopting a framework where market behaviors and permits equilibrium price are endogenously obtained, we show that the price and welfare impacts of permit taxation are, at the opposite, significant.

Finally, we link to recent works by Böhringer et al. (2011) and Carbone et al. (2009) where emissions trading performance and design are assessed using general equilibrium modeling. According to Hoel (2011), structural characteristics, especially from the supply side of the energy sector, as well as differences in taxes, costs and subsidies at the country level, might strongly influence results obtained by simplified models based on a hypothetical world of identical countries. This brings to the necessity to extend and verify the robustness of analytical results with complex models accounting for more realistic assumptions.

The rest of the paper is organized as follows: Section 2 presents the theoretical model whereas Section 3 provides some details on the CGE model used for numerical simulations. Section 4 describes the results from simulations and in Section 5 we provide some specific comments on welfare effects. Section 6 concludes.

2. The theoretical model

We consider a stylized model representing a set of I countries, indexed by $i = 1,...,I$. There is a large number of atomistic identical firms in each country; we can therefore assume that each country features one representative firm i ($i = 1,...,I$). Each firm generates polluting emissions x_i and is assumed to minimize pollution related costs, including abatement costs and permits revenues/expenditures. Firm i's abatement costs are given by the function $c_i(x_i)$, which, as it is standard, is assumed to be decreasing and strictly convex in emissions, i.e. $c_i'(x_i) < 0$ and $c_i''(x_i) > 0$. The shape of $c_i(x_i)$ summarizes specific firm/country's industrial, technological and institutional features.

Each firm i receives an exogenous amount of emission permits, e_i, that can be traded on a perfectly competitive international market.[5] Given the after-trade price p arising in the permit market, each firm chooses the level of emissions x_i^* minimizing compliance costs, defined as:

$$C_i = c_i(x_i) + p(1-t_i)(x_i - e_i),$$

where t_i is the tax rate on revenues (or the tax rebate on costs[6]) generated by $(x_i - e_i)$, i.e. the amount of permits sold (when $x_i < e_i$) or bought (when $x_i > e_i$).

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[1] This is testified, among others, by Copenhagen Economics (2010).

[2] An interesting contribution relative to national laws is Lucas (2010), in which the legal implications of introducing a cap-and-trade system in the US are reviewed, with specific reference to the direct tax treatment of permits.

[3] The redistributive properties of permits taxation, as well as a proper investigation of an ETR linked to permits taxation, are outside the scope of this paper and leave room for future research.

[4] Another paper in this stream of literature is Kane (2009) who provides a descriptive analysis of the fiscal treatments affecting the permits trading markets, claiming that heterogeneous tax regimes among firms or jurisdictions are very likely to affect allocative efficiency in a multi-period context (see also OECD, 2012).

[5] In this context the aggregate permits cap is assumed to be exogenous. It can be noted that tightening the cap would have the same effect on the equilibrium price level as raising tax rates, while it would not affect the cost-effectiveness of the permit system. However, a deep exploration of the effects of an endogenous cap will be a matter for further research.

[6] We consider tax rebate interchangeably as defiscalization or rebate measuring a reduction in the tax debt of firms due to the cost of buying permits.