National CO_2 policy and externalities: some general equilibrium results for Switzerland

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Abstract

Switzerland, following the Kyoto agreement, plans to reduce CO_2 emissions by 10% over the next decade with a tax on the use of fossil fuels. This policy, while having a marginal effect on global CO_2 emission levels, will have a positive effect on local environmental quality. However, since different sources of energy produce different local external effects, a uniform CO_2 tax is ill targeted. This paper shows that a policy setting tax rates equal to the lower bounds of the estimated local marginal external effects would reduce the national CO_2 level by 30%. Using a computable general equilibrium model of the Swiss economy, it also finds substantial efficiency gains of Pigovian taxes as compared to a uniform CO_2 tax. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

Concerns about global warming have elevated environmental policy to the forefront of the political agenda of the international community. Negotiations at several UN conferences have resulted in a multilateral agreement in which the industrialised countries agreed on reducing national CO_2 emissions levels by 5%

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on average from 1990 levels by 2012.[1] However, most national parliaments have not yet ratified the Kyoto Protocol and its implementation has only started in some European countries. With the refusal of the new US administration to ratify the protocol, the process has in fact reached an impasse. There appears to exist two obstacles against an implementation of the protocol. Firstly, interest groups, which will be negatively affected, are opposed and thus lobby against an active CO_2 policy. Secondly, the impact of emission reductions in rather small countries on global CO_2 emission flows is marginal. Thus, for small countries the incentive to free ride on an international CO_2 policy is high. Notwithstanding, the Scandinavian countries, the Netherlands and most recently Germany have introduced energy taxes in order to curb CO_2 emission levels.[2]

This unilateral action may be explained by the fact that local public goods such as clean air, road safety, absence of noise etc. are also affected by energy taxes. An increase in the price of fossil fuels will decrease the amount of polluting activities and thus increase local environmental quality. However, a CO_2 tax is not a well-targeted instrument for a local internalisation policy because different sources of fossil fuels cause varying local external cost. Rather, in order to address external effects efficiently, environmental policy should impose a differentiated tax scheme.

In this paper, we employ a computable general equilibrium model (CGEM) of the Swiss economy and tax system, in which a range of external effects are included explicitly. The focus of our paper is on the consequences of an internalisation of local externalities for CO_2 emissions and national welfare. In particular, the model incorporates Pigovian taxes on the use of gasoline, diesel, heating oil and natural gas based on estimations of the corresponding external effects. One main finding of the paper indicates that the reduction in the use of fossil fuels due to a local internalisation strategy is much higher than the amount Switzerland has agreed on in the international protocol on climate change. The second central result points to a substantial efficiency gain of such an internalisation strategy as compared to a uniform CO_2 tax.

In all scenarios, we follow an 'equal yield' approach and refund the additional revenue to households lump-sum or cut labour income taxes to preserve equal tax yield. Since the existing labour tax is distortionary, the use of the Pigovian tax yield to reduce the labour tax will produce a weak double dividend.[3] In conformity with other studies,[4] our model calculates a substantial second dividend of environmental policy.

CGEM have already been employed to analyse the interaction between the environment and the fiscal system. Closest to the present paper comes Ballard and Medema (1993), who calculate the marginal efficiency effects of environmental taxes in the presence of externalities.

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[1] Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997, Annex B, see http://www.unfccc.de/resource/convkp.html.

[2] Cansier and Krumm (1997), p. 68.

[3] The term goes back to Goulder (1995a).

[4] See, for example, Goulder (1995b, p. 285).