Taxation of a Polluting Non-renewable Resource in the Heterogeneous World

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Abstract This paper extends the literature on the taxation of polluting exhaustible resources by taking international heterogeneities and national tax-setting into account. We propose a two-country Romer model of endogenous growth in which the South is endowed with the stock of an essential polluting non-renewable resource and world economic growth is driven by a northern research sector. We consider the stock of pollution as affecting global welfare. First, we characterize the optimal environmental taxation policies. Second, we examine the impacts of national taxes. Their time profile determines the extraction path, the dynamics of pollution accumulation and that of world output. Their respective levels entail inter-country interactions by altering the efficiency of the world resource allocation, the tax revenues and the resource rents. We study isolatedly the distortional and distributional effects of local taxes. Then, we completely assess the overall impact of a unilateral tax increase. Finally, we find that, even if heterogeneous countries coordinate their taxation policies to correct the global environmental problem, their divergent strategic interests cause another global, non-environmental distortion in the allocation of the resource.

Keywords Non-renewable resources · Stock pollution · Endogenous growth · Environmental taxation · Inter-country effects

1 Introduction

A current challenge for environmental economists is to advocate instruments to reduce the impact of climate change. Due to the global character of this phenomenon, whatever are
the chosen instruments, participation of a large group of countries will be needed to implement an efficient policy. Hence, a particular aspect of economic instruments that deserves major attention is their international impacts. This paper aims at examining these impacts of taxes on the use of polluting non-renewable resources. This issue proves to be of a particular relevance when countries are heterogeneous along one or more dimensions.

A large literature investigates the optimal taxation of these resources. The first studies (in the 1990s) used partial equilibrium models of an exhaustible resource depletion where the flow of resource fills a stock of pollution. The optimal dynamics of depletion in presence of climate change was computed and compared to that in absence of climate change by Withagen (1994). Sinclair (1992), Ulph and Ulph (1994), and Hoel and Kverndokk (1996) analyzed the impacts of a carbon tax on the decentralized equilibrium and characterized the optimal tax schemes correcting the environmental distortion. More recently (in the 2000s), this issue has been addressed in dynamic general equilibrium, still one-country, models of endogenous growth. As a first step, some authors considered the flow of pollution from the resource consumption to be harmful (Schou 2000, 2002 and Grimaud and Rougé 2005). A substantial theoretical improvement has been done by modeling pollution as in the partial equilibrium literature above, i.e. by assuming the stock of atmospheric pollution to have negative effects on the economy. Groth and Schou (2007) and Grimaud and Rougé (2008) represent this new generation of analytical studies. Overall, this literature highlights the requirement of a dynamic framework under perfect anticipations and of the explicit consideration of the resource exhaustibility (On this, see also Belgodere 2009). It then emphasizes the particular role of the time profile of the environmental tax rate. Precisely, extraction under laissez faire is shown to be faster than optimally, this distortion being corrected by a decreasing ad valorem tax on the resource use. This optimal policy fosters growth and slows down resource depletion.

On the one hand, these contributions are particularly relevant to address climate change. Indeed, it is now well known that carbon dioxide is the main anthropogenic greenhouse gas and that a very large part of its emissions is due to combustion of exhaustible fossil fuels.

On the other hand, only aggregated models, representing a homogeneous world, have been used to study taxation of fossil fuels. However, the real world is very heterogeneous with respect to oil endowments, for example. Moreover, taxation of an exhaustible resource whose distribution among countries is heterogeneous entails inter-country transfers and thus conflicting interests.

Indeed, exploitation of a non-renewable resource generates pure rents that, as such, are partly captured through a tax on the resource (e.g. Dasgupta and Heal 1979; Sinn 1982 and Gaudet and Lasserre 1990): independently of the effect of the tax on the extraction path,

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1 Other important papers deal with the related question of environmental taxation in presence of innovation externalities. One could refer to Goulder and Mathai (2000), Hart (2008) and Gerlagh et al. (2009), among others. Although our model features an endogenous growth mechanism for consistency with the recent literature, we focus on the correction of the environmental externality.

2 Carbon dioxide from energy represents 95% of the energy-related greenhouse gas emissions and about 80% of the world anthropogenic greenhouse gas emissions (Quadrelli and Peterson 2007).

3 In 2004, fossil sources accounted for 81% of the global primary energy supply (Quadrelli and Peterson 2007).

4 Combustion of oil products generates 40% of the world carbon dioxide emissions; it is the most important source of carbon dioxide emissions (Quadrelli and Peterson 2007). The 19 countries with the largest crude oil reserves per capita represent more than 80% of the world reserves (source: PennWell Corporation 2004).

5 Other, most-cited, distributional effects of environmental policies are intergenerational transfers or transfers between different categories of residents inside the same country. Our point here is different: environmental taxation benefits some countries at the expense of other countries.