



Environmental tax reform: Short-term versus long-term macroeconomic effects



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ABSTRACT

This paper examines the macroeconomic effects of environmental tax reform in a growing economy. A model of endogenous growth based on human capital accumulation is used to simulate numerically the growth effects of different environmental tax reforms and calculate their impact on welfare in the short and the long-term. Our results suggest that the magnitude of these effects depends on the type of tax reform and the presence of a convex adjustment cost for investment. Although, the green tax reform that aims to use the revenue from environmental tax in order to reduce tax on wages is always growth improving, its long term welfare effects depend on the capital adjustment cost. Moreover, regardless of the tax reform scenarios, the short-term welfare effect is always negative.

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1. Introduction

There is a recurring question in relation to green tax revenues recycling: how can environmental tax reform be undertaken without reducing growth and social welfare? This question is central to public debate, not only in countries where environmental tax reform has been introduced, but also in countries where such reform is still under consideration (Heine et al., 2012). Numerous OECD countries such as Sweden, Norway, Finland, Denmark, the Netherlands, Germany, Italy and the United Kingdom have implemented explicit environmental tax reforms. The stake in the fiscal debate is substantial. Revenues raised from green taxes average about 2% of GDP and have exceeded 9% of total tax revenues in some OECD countries. There are several ways in which green tax revenues are utilized. The macroeconomic effects differ from one tax reform to another. The objective of this paper is to examine the short and long-term effects of different environmental tax reforms in a growing economy.

Many prior studies examine the relationship between tighter environmental policy and economic growth. Endogenous growth models were used to analyze the effects of green taxes on the long-term growth rate.¹ A tighter environmental policy

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¹ See Ricci (2007) for a comprehensive survey on impacts of environmental policy on growth.

can potentially operate through different mechanisms such as investment, education and R&D. Overall, to generate a positive growth effect, many studies incorporate environmental quality into firm's production function as an externality by considering that a clean environment would improve the productivity of inputs or the efficiency of the education system (Ligthart and van der Ploeg, 1994; Bovenberg and Smulders, 1995; Hart, 2004; Nakada, 2004; Grimaud, 1999; Chen et al., 2009; among others). Furthermore, it was highlighted that the labor-leisure choice played a role in the transmission of the environmental tax effect in a two-sector model of endogenous growth (Hettich, 1998). In response to an increase in the environment tax firms increase their abatement, which reduces final output leading to households substitute education time for leisure time in order to counteract reduced consumption, and finally improve long-term growth rate.

In addition, the environmental tax reform issue has been extensively investigated in endogenous growth structure (Bovenberg and Smulders, 1995; Bovenberg and Mooij, 1997; Fullerton and Kim, 2008; Greiner, 2005; Nakada, 2010; Fernandez et al., 2011; among others). These papers consider many combinations of tax structures and externalities and give different conditions to achieve a double dividend. The double dividend hypothesis is nicely exposed in Goulder (1998) and Bovenberg (1999): the first dividend is an improvement in the environmental quality, and the second is an increase in welfare from private commodities as the result of a less distortionary tax system.

In a seminal paper, Lucas (1990) finds that shifting capital income taxation completely to labor income taxation has negligible effects on long-run economic growth in a model of endogenous growth which is calibrated to the US economy. According to this Lucas's positive approach, Jorgenson and Wilcoxon (1993) estimate a model for the US economy using post war data. Their simulations suggest that a carbon tax would have qualitatively different impacts on the GDP in the long-run, depending on which preexisting taxes are reduced. In the same way, similar models were mentioned by Koskela and Schob (1999) and Bayindir-Upmann and Raith (2003), who showed that, in a distorted labor market, substituting green taxes for labor taxes would increase employment and output and eventually produce a detrimental effect on the environment. Using a dynamic general equilibrium model calibrated to the US economy, Glomm et al. (2008) find that increasing gasoline taxes and using the revenue to reduce capital income taxes deliver both types of welfare gains: from higher consumption of market goods and to a greater environmental quality, even though in the new steady state environmental quality may worsen.

Our goal in this paper is to identify the short and long-term effects of environmental tax reform within an endogenous growth model. We build our approach on previous work by Gradus and Smulders (1993), who use an Uzawa–Lucas structure augmented with an environmental externality and distortionary taxes. Following Hettich (1998), we assume that labor supply is elastic. This leads us to identify a link between environmental tax and the long-term growth rate even without assuming direct productivity effects of a cleaner environment. In addition, a convex adjustment cost was introduced to help smooth the behavior of aggregate investment.

Whereas most endogenous growth models dealing with environmental concerns restrict their analysis to the steady state, little has been said so far on the short-term effects of environmental tax reform. Bovenberg and Smulders (1996), Vellinga (1999), Hofkes (2001), Oueslati (2002) are the few exceptions in the literature. However, these studies are limited to the effect of a tighter environmental policy and do not explicitly consider the transitional effects of environmental fiscal reform. In this paper, we compute the entire dynamic adjustment path towards a balanced growth path. Furthermore, the analysis of the dynamic adjustment path enables us to perform welfare calculations. In particular, we make explicit the trade-off between the short and long-term welfare costs related to environmental tax reform.

We consider three scenarios of tax reform associated with the implementation of pollution tax. Firstly, we examine the cases in which the government uses the environmental tax revenues to decrease the distorting tax rates keeping the share of public spending in the final product constant (revenue-neutral reform). We next study the case where environmental tax reform involves the use of environmental tax revenue as an additional resource for the government budget, i.e. revenue-positive reform.

Our main results can be summarized as follows. A positive capital adjustment cost does not alter the nature of the growth effect of green tax reforms. Thus, a green tax reform which aims to use the revenue from environmental tax to reduce physical capital tax is growth-reducing. However, tax reform which aim to reduce wage tax has a positive effect on the long-term growth. Otherwise, a positive-revenue tax reform may have a negligible or nil growth effect. Since tax reforms induce a transitional dynamics of the economy, the results in terms of welfare show in some cases, a clear opposition between the short and long term. Although all tax reforms have a relatively high welfare cost in the short term, their welfare effects in the long term depend on the value of the capital adjustment cost.

The remainder of the paper is organized as follows. In Section 2 the general model is presented and market solution is derived. Section 3 proposes a numerical simulation of different tax reforms. We then simulate the transitional dynamics. Section 4 computes welfare costs for each reform in the short and long-term. Section 5, summarizes the main findings.

2. The model

We consider a discrete time economy populated with a continuum of identical, infinitely-lived households. Each household owns the stock of physical capital in the economy, K_t , and is endowed with a (normalized) unit time. The time endowment can be allocated between work (remunerated at the current competitive wage rate), leisure and education. A proportion of the final product produces a flow of pollution that can be reduced by a public effort towards depollution. The net pollution flow is assumed to affect individuals' utility.

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