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Gradual green tax reforms

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ABSTRACT

Green tax reforms have become an important tool not only in protecting the environment but also in bringing about a more efficient tax system. However, reforms often imply accepting sacrifices in the short-run and bring about the risk of potential political opposition. Within this framework, the debate on whether to implement green tax reforms in one-step or gradually becomes of great interest. In this paper, we use a dynamic general equilibrium model, calibrated to the Spanish economy, to evaluate different reforms that consist in increasing energy taxes and adjusting capital taxation in a revenue-neutral framework. Our findings show that, although an environmental dividend is always granted, the existence of an efficiency dividend depends on the type of reform, its size and how gradually it is implemented. Thus, one-step reforms that produce an efficiency dividend would imply large efficiency costs in the short-run. In this case, the reform could only produce efficiency gains in the short-run if it is implemented gradually, although such gains would end up disappearing in the long-run.

1. Introduction

Green tax reforms represent an important advance in the policy struggle against environmental damage caused by modern industrial societies. This is not only due to the fact that these policies are implemented to reduce those damages, but also because they can be used to reassess present tax systems that are often based on taxing factors of production such as labor and capital [see, for example Pearce (1991)]. This makes green tax reforms interesting from an economic as well as an environmental point of view.

From a theoretical perspective, a green tax reform is often associated to the Double Dividend idea [see, Bovenberg and De Mooij, 1994; Oates, 1991], that is, the hypothesis that such a reform would entail not only environmental welfare gains (through pollution reduction), but also economic welfare gains (through efficiency reallocation). This refers to the "strong" double dividend version, according to the Goulder (1995) taxonomy.

In practice, green tax reforms have been of great interest in Europe. As early on as 1996, the European Environmental Agency (EEA) pointed out how introducing environmental tax reforms could achieve a multiple dividend. Yet introducing environmental taxes (particularly energy taxes) may give way to many political barriers. Bassi et al. (2009), in a project for the EEA, point out several barriers and criticisms to implementing green tax reforms such as: potential increase in production costs and inflation, negative impacts on international competitiveness, vested interest of lobby groups and perceived impacts to low income groups. The gradual introduction of environmental taxes is one of the "good practices" that these authors identify to overcome those barriers and to generate public support.

There is extensive literature analyzing the appropriate speed of adjustment of a reform and the main factors behind it [see Nsouli et al. (2005) for a discussion]. The basic idea is to find the optimal adjustment path that maximizes the social welfare subject to a set of structural and financial constraints. The debate between the advocates of a high-speed approach (one-step reform) and those favoring a gradualist approach is based primarily on the weights given to adjustment costs, policy credibility and reform feasibility.

Supporters of the shock approach argue that rapid reforms lead to lower adjustment costs because they increase incentives to relocate resources [see Mussa, 1984]. Under circumstances where product and factor prices adjust immediately and resources can be reallocated without cost, the optimal policy is clear, namely the simultaneous removal of all distortions. Moreover, credibility is an important determinant of the magnitude of the adjustment costs. Thus, if reforms are credible, private agents will align their behavior with the announced policies. In fact, the more credible the reform is, the more quickly it should be implemented. Finally it is difficult to design a detailed sequence of reforms; therefore, reforms should move ahead as rapidly as possible.

Proponents of gradualism point out that, in the real world, resources cannot be reallocated without incurring in costs. Little

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[1] Goulder (1995) also defines a "weak" double dividend that emerges when the welfare improvement of recycling revenues from environmental taxes to cut distorting taxes is greater than the welfare improvement when the revenues of environmental taxes are returned in a lump-sum fashion.

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et al. (1970) introduce the argument that gradualism can minimize adjustment costs, because it generates lower short-term costs and thus less political opposition. Those authors argue that temporary contractions of economic activity can be larger with rapid reforms than they would be with a gradual approach and this rapid approach would engender stiffer political opposition than would a gradual approach. Mehlum (2001) also shows that a gradual approach would produce less severe losses of rent by owners of factors of production during a particular phase of reform. Dewatripont and Roland (1992) provide arguments in favor of a gradual reform when the budgetary cost of reform is an important policy variable.

Furthermore, if announced policies and reforms are not credible, agents will be reluctant to respond to the announcement. This could make for a longer adjustment process or could even trigger failure. By contrast, gradualism may enhance credibility if the short-term results are sufficiently favorable. At the same time, proponents of a gradual approach stress that it simply takes time to implement reforms.

Although it would be theoretically optimal to implement a one-step reform in a world without resource reallocation adjustment cost, from a policy-maker point of view, the short-run effects could be crucial in deciding whether to implement a policy. When the reform implies short-run sacrifices, implementing it gradually could help mitigate the costs which could be the cause of failure, even if the reform proves to be welfare-improving. Thus, it is interesting to analyze different degrees of gradualism when implementing environmental policies. This is what our paper aims to do.

We analyze different green tax reforms by using a dynamic general equilibrium model calibrated to the Spanish economy. A dynamic general equilibrium framework is crucial to assess the effects of a green tax reform, since the distortionary effect of taxes is not only contemporary but also intertemporal. Thus, taxation affects capital accumulation, and a dynamic distortion emerges. Welfare gains associated to fiscal reforms crucially depend on the dynamic response of the economy after the policy change.[2]

We evaluate the effects of changes in fiscal policy in two different energy taxation scenarios. On the one hand, increasing taxes on energy consumption by households and on the other hand increasing taxes on energy used by firms. In both cases, we reduce pre-existing capital taxes in a revenue-neutral framework. We analyze the role of the speed of adjustment of the reform, comparing gradual versus one-step green tax reforms, and we do all of this for different increases in tax rates. In every case, we compute the associated environmental and efficiency dividends.

The results point out that the speed of adjustment in a green tax reform is as crucial in analyzing the economic and environmental impact, as is the size and type of reform.

We find that a one-step green tax reform would be better than a gradual reform when considering the complete transitional dynamics path to compute welfare. This result has to do with the lack of adjustment cost, because one-step reforms increase incentives to reallocate resources quickly.

In the short-run, we find that the more gradual the reform is, the better the results in terms of efficiency are. A gradual reform makes for initially lower costs, given its smoother adjustment which, in turn, delays the costs of the reform. In terms of the environment, the opposite occurs. The reduction of pollution is lower, the longer the energy takes to adjust and therefore, the environmental improvement is smaller.

[2] Although there is an important branch of the literature that addresses the existence of a double dividend in CGE models, transitional dynamics in these models is quite different and this would, in turn, alter the intertemporal effect of the reform (see Gurgel et al., 2011).

In addition, the simulations carried out show that the environmental dividend is always granted and that the existence of an efficiency dividend depends on the type of reform, its size and the gradualism of its implementation.

When we take into account the complete transitional dynamics path to compute welfare (the total effect of the reform), we only find an efficiency dividend when the reform consists in an increase of the energy consumption tax and it is implemented rapidly. When we focus only in the short run, it is possible to find efficiency gains for both reforms implemented gradually.

The paper is organized as follows. In Section 2, we specify the model. In Section 3 we describe the policy experiments and the calibration of the parameter. Section 4 presents the results and, lastly, in Section 5 we summarize the main conclusions.

2. The model

We set a dynamic general equilibrium model consisting in households, firms and a government that finances an exogenous flow of spending through tax collecting. Energy is used in this economy for consumption (eh) and for production (ef). Prices for both types of energy differ based on the fact that the energy mix of a household and that of a firm are different. We assume energy prices p^h and p^f to be exogenous.

Firms produce output by a constant return-to-scale technology that combines labor (n), capital (k) and energy (ef). The production function is given by:

$$F(n_t, k_t, ef_t) = n_t^{\theta}\left[(1-a)k_t^{-\upsilon} + aef_t^{-\upsilon}\right]^{-\frac{1-\theta}{\upsilon}}. \tag{1}$$

The representative firm maximizes profits:

$$\underset{n_t, k_t, ef_t}{Max}\ F(n_t, k_t, ef_t) - w_t n_t - r_t k_t - \left(1 + \tau_t^f\right)p^f ef_t,$$

where w and r denote wages and the interest rate, and τ^f is the tax on energy used in production.

First-order conditions for the firm are:

$$w_t = \frac{\partial F(n_t, k_t, ef_t)}{\partial n_t},$$
$$r_t = \frac{\partial F(n_t, k_t, ef_t)}{\partial k_t},$$
$$\left(1 + \tau_t^f\right)p^f = \frac{\partial F(n_t, k_t, ef_t)}{\partial ef_t}.$$

The representative household derives utility from:

$$U(A_t, n_t, H_t) = \frac{\left[A_t^{1-\mu}(1-n_t)^{\mu}H_t^{\phi}\right]^{\sigma}}{\sigma}, \tag{2}$$

$$A_t(c_t, eh_t) = \left[(1-\gamma)c_t^{\alpha} + \gamma eh_t^{\alpha}\right]^{\frac{1}{\alpha}},$$

where A is the aggregate good that combines non-energy (c) and energy consumption (eh). The elasticity of substitution between energy and non-energy consumption is $1/(1-\alpha)$. H_t is a negative externality (pollution) that represents the negative impact on welfare caused by the use of energy (eh and ef). We assume H will be given by:

$$H_t = eh_t + ef_t. \tag{3}$$