

# Double dividend hypothesis, golden rule and welfare distribution

Mireille Chiroleu-Assouline<sup>a,\*</sup>, Mouez Fodha<sup>b</sup>

<sup>a</sup>Centre d'Economie de la Sorbonne, Université Paris 1 Panthéon-Sorbonne, CNRS, Maison des Sciences Economiques,  
106-112 Bd de l'Hôpital, F75647 Paris cedex 13, France

<sup>b</sup>Centre d'Economie de la Sorbonne, Université Paris 1 Panthéon-Sorbonne, CNRS, and ERASME, France

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## Abstract

This paper analyzes the double dividend issues within the framework of overlapping generations models. We characterize the necessary conditions for obtaining a double dividend, i.e. an improvement of environmental and non-environmental welfare when the revenue from the pollution tax is recycled into a change in the labor tax rate. We show that, depending on the initial capital stock and on the intertemporal elasticity of substitution, conditions may be defined to simultaneously allow (i) the obtaining of a long-term double dividend, (ii) the economy to move closer to the modified golden rule and (iii) in the short term, an improvement in the welfare of the two present generations.

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## 1. Introduction

One of the advantages of the environmental tax is that it provides public revenue which can be recycled. This is the reason why it is often preferred to subsidies or emission quotas. Several authors such as Terkla [31], Parry [27], or Poterba [29] have argued that this *revenue recycling* could reduce or even annihilate the gross cost of the implementation of an environmental tax. As governments use the revenues from pollution taxes to decrease other distortionary taxes, environmental taxes may lead to a *double dividend*, according to Goulder's definition, by both improving the environmental quality and achieving a less distortionary tax system [16]. Baumol and Oates [1], Pearce [28] and Oates [26] have suggested that these efficiency gains could be a powerful argument in favor of environmental taxation. But a great number of theoretical and empirical works refute the double dividend hypothesis [5–9, 11, 17, 3] and, on the contrary, consider, that environmental taxes exacerbate, rather than alleviate, pre-existing tax distortions.

As well as these potential efficiency properties, environmental decisions have an impact on the welfare of both current and future generations, since environmental quality is a public good shared by different

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\*Corresponding author. Fax: +33 1 44 07 82 31.

E-mail address: [assoulin@univ-paris1.fr](mailto:assoulin@univ-paris1.fr) (M. Chiroleu-Assouline).

generations. These intergenerational issues on environmental externalities<sup>1</sup> or on taxation<sup>2</sup> have been quite widely studied in the economic literature. In an overlapping generations framework, John et al. [22] examine the effect of an environmental tax whose revenue finances a public pollution abatement activity. Fisher and van Marrewijk [15], using an endogenous growth model with pollution, derive the conditions under which a pollution tax does not slow economic growth. Bovenberg and Heijdra [4] examine the effects of a green tax on polluting capital when the tax revenue is redistributed by lump-sum intergenerational transfers and find that this tax benefits the younger generation but harms the older ones. Without studying the double dividend issue, all these papers conclude that environmental taxation implies such a welfare loss for older generations that its implementation is not desirable: one of the generation which would decide it would also bear the heaviest burden. The potential contradiction between efficiency and distributional concern has been already emphasized by some works in other frameworks. While the double dividend hypothesis is rejected when the economy consists of one productive sector, using only one productive factor (labor), and one representative consumer [2], when instead there are several productive factors and/or several consumer groups, the double dividend can be obtained but at the expense of distributive equity [10,30].

Our analysis of the double dividend and welfare distribution issues takes place within a framework of overlapping generations models, which seems more convenient for analyzing such environmental problems. In the absence of altruism, the behavior of private agents is responsible for an intergenerational environmental externality. The consumption activity of present generations causes emissions of pollutants which degrade the environmental quality, harming the welfare of all future generations. The solution which is usually advocated in order to internalize this kind of externality is the implementation of environmental taxation (pigovian taxes). But such taxes imply non-environmental welfare losses for the generations bearing them.

The conditions for a double dividend have not yet been explicitly derived in a dynamic model which encompasses intergenerational externalities because balanced environmental fiscal reforms have never been considered (in [21,22] for example, the environmental reform increases the fiscal revenues). It is the reason why generally in these papers the generation which has to implement the reform is the one which mainly bears its costs. The main contribution of our paper is then to examine, within an appropriate demographic framework, whether a revenue-neutral increase in the pollution tax compensated for by a change in the labor tax can yield a long-term double dividend, by (i) achieving the long-term environmental objective and (ii) improving long-term non-environmental welfare.

The intertemporal double dividend could be defined as an improvement of the discounted sum of non-environmental and environmental welfares of all generations. It takes into account the welfare of the generations alive during the transition between initial and final steady states. Such a social welfare criterion leads to the modified golden rule which is preferred to the golden rule criterion because of both ethical and practical problems: the first generations would be sacrificed to the future generations while only these will fully benefit from the environmental policy; moreover, decisions about future environmental improvements are to be made by present generations which support their economic costs. The arguments given by Goulder and Stavins [18], for instance, in order to justify discounting apply here to justify the use of the modified golden rule.

Our results for the long-term double dividend are then linked to the general discounting debate and contribute to the research of the conditions for an intertemporal double dividend. Even if some generations are made worse off along the transition path, any increase in the social discount factor increases the weight of the welfare of the infinite number of generations alive in the final steady-state equilibrium and (in case of a long-term double dividend) increases the occurrence probability of an intertemporal double dividend. We focus then on the comparison of long-term steady-state equilibria because a necessary condition to obtain an intertemporal double dividend is that the generations on the new steady-state equilibrium are made better off with respect to both environmental and non-environmental welfare. We show that, according to the discounted social welfare criterion, a double dividend can occur.

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<sup>1</sup>cf. Howarth and Norgaard [19], Marini and Scaramozzino [25].

<sup>2</sup>cf. Kotlikoff and Summers [24], Ihuri [20].

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