Green Tax Reforms:
Implications for Welfare and Distribution

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1. INTRODUCTION

Environmental tax reforms have attracted increasing attention in recent years. One reason is increasing concern about the quality of the natural environment. Another reason involves the revenues from environmental taxes. These revenues can be used to contribute to non-environmental objectives. In particular, they may be employed to cut other, distortionary taxes. In this way, the government may reap a "double dividend" – not only a cleaner environment but also non-environmental benefits associated with lower distortionary taxes. This paper explores the conditions under which such a double dividend may occur.

The paper is organized as follows. Section 2 develops a small general equilibrium model, which is based on Bovenberg and de Mooij (1994a), to explore the welfare effects of environmental tax reform. Environmental quality enters utility. The non-environmental dividend is defined as an increase in non-environmental welfare. In the simple model, such a non-environmental dividend requires an expansion of employment. Section 3 shows, however, that an environmental reform reduces employment. The reason is twofold. First, labor bears the ultimate incidence of all taxes. Second, the reform raises the overall tax burden – even though the level of public spending remains constant. This so-called tax-level effect originates in the additional abatement costs associated with a cleaner environment. Turning to optimal taxation, section 4 reveals that cutting environmental taxes below their Pigovian levels may raise efficiency by alleviating non-environmental distortions. In particular, by boosting employment, lower environmental taxes alleviate labor-market distortions arising from distortionary taxes. Section 5 discusses the robustness of the result that an environmental tax reform increases the overall tax burden. It demonstrates that three factors determine the tax-level effect: first, the abatement costs associated with a higher supply of the public good of the environment; second, the beneficial effect of a higher level of environmental quality on productivity; and, third, the efficiency effect of making the tax system more or less efficient from a non-environmental point of view.

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In Europe, the interest in environmental tax reform originates primarily in the desire to raise employment. Defining the non-environmental dividend as an expansion of employment, section 6 extends the model introduced in section 2 by allowing for consumption out of non-labor income. It shows that the impact on employment depends on two effects: the tax-level effect (introduced in section 3) and the so-called tax-shifting effect. In particular, for an environmental tax reform to benefit employment by reducing the tax burden on labor, two conditions must be met. First, the overall tax level should be contained. Second, the distribution of the tax burden should be moved away from workers to others, i.e. capital owners, the owners of resources, and the recipients of income transfers.

Section 6 reveals that, in order to determine the employment effects of pollution taxes, an analysis of the ultimate incidence of pollution taxes is called for. Section 7 explores the incidence of pollution taxes. Section 8 turns to the issue of involuntary unemployment. It discusses the crucial role of the process of wage determination in affecting the impact of a green tax reform on unemployment. Political issues involving the distribution of welfare over heterogeneous households are investigated in section 9. This section emphasizes that distributional issues are at the heart of the double dividend debate. In deciding how to use the revenues from green taxes, governments often confront a trade-off between equity and efficiency. Finally, section 10 concludes.

2. THE MODEL

Output $Y$, which is produced with a single production factor labor, can be used for public consumption, $G$, and for private consumption of a «clean» and a «dirty» commodity (per capita consumption of these two commodities is denoted by, respectively, $C$ and $D$). Accordingly, equilibrium on the commodity market is given by

$$ NL = G + NC + ND $$

where $L$ stands for per-capita employment and $N$ represents the number of households. Units are normalized so that the constant rates of transformation between labor and the three produced commodities are unity.

The representative household faces the following budget constraint:

$$ C + (1 + t_D)D = (1 - t_L)L $$

where $t_D$ and $t_L$ represent taxes on dirty consumption and labor, respectively. We assume (without loss of generality) that the clean consumption commodity is untaxed. The combination of (1) and (2) yields the government budget constraint:

$$ G = t_D ND + t_L NL $$

Environmental quality, $E$, deteriorates with dirty consumption, $E = e(ND)$, $e_{ND} > 0$, where a subscript denotes a partial derivative with respect to a particular variable.

Private behavior is described by the households maximizing utility $u(C,D,\,I\,-\,L,\,G,E)$ subject to the budget constraint (2). Households ignore environmental externalities. Private behavior is thus described by

$$u_C = \lambda$$

$$u_D = \lambda(1 + t_D)$$

$$u_{I\,-\,L} = \lambda(1 - t_L)$$

where $\lambda$ denotes marginal utility of income.

Taking the total differential of utility $U(C,D,\,I\,-\,L,\,G,e(ND))$, we arrive at the following expression for the welfare effects of a revenue-neutral change in the tax mix (i.e. a change in taxes such that government consumption is constant):

$$du = u_C dC + u_D dD - u_{I\,-\,L} dL + Nu_D e_{ND} dD$$

Substitution of the expressions for household behavior (4), (5), and (6) into (7) yields:

$$\frac{du}{u_C} = dC + (1 + t_D) dD - (1 - t_L) dL + \frac{Nu_D e_{ND}}{u_C} dD$$

Taking the total differential of goods-market equilibrium (1) and using the result to eliminate $dC$ from (8), we find:

$$\frac{du}{u_C} = t_L dL + \left[ t_D - \frac{Nu_D e_{ND}}{u_C} \right] dD$$

Equation (9) shows the welfare impacts due to changes in employment and dirty consumption. The first term on the right-hand side of (9) represents the distortionary effect in the labor market, which is regulated by the pre-existing tax on labor income $t_L$. If the existing tax rate on labor income is positive, an expansion of employment boosts welfare. Intuitively, at the margin, the social benefits of employment exceed the social opportunity costs because, with the tax on labor, the marginal product of labor exceeds the marginal opportunity cost (i.e. the value of foregone leisure). In particular, the additional production from one additional unit of labor not only compensates the household for giving up leisure, but also yields tax revenue. By strengthening the economic base of the
domestic economy, tax revenue increases, providing additional benefits.

1. The number of hours available for work has been normalized at unity.
public sector, employment thus yields a public benefit to society over and above the compensation for giving up leisure to the private supplier of labor.

The second term on the right-hand side of (9) corresponds to the welfare effects on the environmental margin. The welfare impact of a marginal increase in the demand for the dirty consumption good amounts to the difference between, on the one hand, a tax term (which measures the social benefits of additional tax revenue due to a broader revenue base) and, on the other hand, the marginal social damage from pollution. If the pollution tax \( t_D \) is zero, a marginal reduction in the demand for the dirty consumption commodity enhances welfare by reducing the adverse pollution externalities.

In the «first-best» case, in which there is no need to finance public spending through distortionary taxation (i.e., if \( t_L = 0 \)), the optimal pollution tax amounts to the Pigovian tax. This tax fully internalizes the adverse external effects of pollution:

\[
t_D = \frac{N \cdot e_{ND}}{u_C} \tag{10}
\]

Substituting (10) into (9), we find that in this first-best case, the beneficial environmental effects associated with less dirty consumption (i.e., \( [N \cdot e_{ND}/u_C] dD \)) exactly offset the adverse welfare effects due to an erosion of the tax base (i.e., \( t_D dD \)). In the absence of distortionary labor taxation, incremental changes in employment do not yield any first-order effects on welfare because the social opportunity costs of additional employment exactly offset the social benefits at the margin.

For the more general case in which distortionary taxes are present, we can diagnose the effects of tax changes by rearranging expression (9):

\[
\frac{\partial u}{\partial u_C} = \frac{u_E}{u_C} \left[ N(-e_{ND}) dD \right] + \left[ t_L dL + t_D dD \right] \tag{11}
\]

The first term on the right-hand side of equation (11) corresponds to the welfare effects of changes in environmental quality. The last term in square brackets on the right-hand side of (11) stands for the impact on the tax base. This tax-base effect represents the consequences of a different tax mix for the efficiency of the tax system as an instrument to raise revenue. In particular, an erosion of the tax base indicates that the tax system becomes less efficient as a revenue-raising device, as higher marginal tax rates are required to collect the same amount of revenue.

The tax-base effect can also be written as the change in real private (after-tax) income enjoyed by households, \( dY^D \), by taking the total differential of the government budget constraint (3) (with \( dG = 0 \)):

\[
t_L dL + t_D dD = -L dt_L - D dt_D = dY^D \tag{12}
\]

We can employ expression (11) to examine the double-dividend argument: the two dividends are represented by the two terms in square brackets in equation (11). The tax-base
effect corresponds to the non-environmental dividend of environmental taxes, i.e. the negative of the «gross» distortionary costs (i.e., the costs before netting out the environmental benefits) of the tax-induced changes in the allocation of resources. If the double-dividend hypothesis were to hold, (small) environmental taxes not only would raise environmental quality, but also, by expanding the base of the distortionary labor income tax, would reduce the tax burden on private incomes. In this way, pre-existing distortions in the labor market would make pollution taxes more attractive.

3. AN ENVIRONMENTAL TAX REFORM

In implementing an environmental tax reform, the government raises the pollution taxes on dirty consumption. The policy change is revenue neutral. In particular, the government keeps the public budget in balance by adjusting the tax rate on labor. Utility is given by

\[ u = u(M(Q(C,D),1-L),G,E). \]

Private goods are thus (weakly) separable from public goods \( G \) and \( E \). Hence, environmental quality and public consumption do not directly affect private demands. The subutility function \( Q \), aggregating clean and dirty consumption into a composite consumption good, is homothetic. Accordingly, in the absence of environmental externalities, a uniform tax on clean and dirty consumption is optimal.

To find the general equilibrium effects of the pollution tax on dirty consumption, \( t_D \), on employment, one first derives \( (u_{t_D}/u_C) = (1+t_D) \) from (4) and (5). Taking the total differential, we arrive at:

\[ \Delta C - \Delta D = \sigma_H t_D \]  

(13)

where \( \Delta D = dt_D/(1+t_D) \). For other variables, \( \Delta \) stands for a relative change. \( \sigma_H \) represents the substitution elasticity between clean and dirty consumption in the subutility function \( Q(C,D) \). In deriving (13), we have used the assumption that leisure is weakly separable from the produced commodities \( C \) and \( D \) in private utility. Under these separability assumptions and a linear homogenous subutility function \( Q(C,D) \), the first-order conditions for optimal household behavior can be written as \( u_Q/u_{1-L} = p_Q/w \), where \( p_Q \) is the ideal consumer price index of the consumption basket \( Q \) and \( w = (1-t_L) \) stands for the after-tax wage. Taking the total differential of this first-order condition and using (13) and the total differential of the household budget constraint (2), we find

\[ \Delta L = V(\sigma_v - 1)\tilde{w}_R \]  

(14)

\[ \Delta C = \Delta L + \tilde{w}_R + (1-\alpha_C)\sigma_H t_D \]  

(15)

\[ \Delta D = \Delta L + \tilde{w}_R - \alpha_C\sigma_H t_D \]  

(16)
where \( \sigma_v \) stands for the substitution elasticity between leisure and composite consumption, \( \alpha_c \equiv (1-t_L)L \) is the share of non-polluting consumption in overall household consumption and \( w_R \equiv \hat{\bar{\omega}} - \hat{\bar{\rho}}_Q \) represents the relative change in the real after-tax wage.

We can write goods market equilibrium (1) as

\[
L = (1-t_L) [\alpha_c \hat{\bar{\omega}} + ((1-\alpha_c) / (1+t_D))\hat{\bar{D}}] \tag{17}
\]

Substituting (14), (15), and (16) into (17), we arrive at

\[
\tilde{L} = \frac{\beta L}{\Delta} [\theta_D \alpha_c (1-\alpha_c) (1-t_L)\sigma_H D] \tag{18}
\]

where

\[
\Delta \equiv S - \beta_L T > 0 \tag{19}
\]

\[
S \equiv (1-t_L) (1-\theta_D (1-\alpha_c)) \tag{20}
\]

\[
T \equiv t_L + \theta_D (1-\alpha_c) (1-t_L) \tag{21}
\]

where \( \theta_D = t_D / (1+t_D) \) while \( \beta_L = V\sigma_v - V \) stands for the uncompensated wage elasticity of labor supply. The latter elasticity is positive if the substitution effect dominates the income effect, i.e., if the substitution elasticity between leisure and composite consumption, \( \sigma_v \), exceeds unity. We assume that the labor-supply curve is indeed upward sloping, as most empirical studies yield positive estimates for this elasticity.

Consider the effects of introducing small environment taxes in an equilibrium without any environmental taxes (i.e., \( t_D = 0 \)). This reform does not affect employment (see equation (18)), although the revenues from the pollution taxes allow for lower taxes on labor. The reason is that the incidence not only of the labor tax but also of the pollution tax falls on labor. Substituting a pollution levy for a labor tax thus amounts to substituting an implicit tax on labor for an explicit tax on labor. In particular, the wage rate that affects the incentives to supply labor is the real after-tax wage (i.e., the wage not only after labor taxes but also after consumption taxes). Hence, the wedge between before-tax and real after-tax wages is widened not only by the distortionary tax on labor but also by the pollution tax on consumption. Given the constraint of revenue neutrality, the higher pollution tax exactly offsets the effect of a lower labor tax on the overall wedge between before- and after-tax wages.

We now turn to the case in which environmental taxes are raised from an initial equilibrium in which environmental taxes are positive (i.e., \( t_D > 0 \)). In this case, an increase...
in the pollution tax reduces employment (see expression (18) with $\beta_L > 0$). The negative effect on employment is due to a decline in the real after-tax wage, which reduces the incentive to supply labor. The negative effect on the real after-tax wage comes about because the lower tax rate on labor income does not fully compensate workers for the adverse effect of the pollution levy on their real after-tax wage. This incomplete offset originates in the erosion of the base of the environmental taxes. In particular, the increase in environmental taxes causes private agents to reduce their demands for polluting goods. If the initial pollution tax is positive, these behavioral effects erode the base of the environmental tax. The associated adverse implications for public revenues imply that the government is not able to reduce the tax rate on labor sufficiently in order to offset the adverse effect of a higher pollution levy on the real after-tax wage. The resulting lower income from an additional unit of work reduces labor supply and thus employment.

As an instrument to finance public spending with the least costs to after-tax wages, the environmental tax appears to be less efficient than a broad-based labor tax. In contrast to a labor tax, the pollution tax on dirty consumption «distorts» the composition of the consumption basket. These «distortions» enhance environmental quality but at the same time reduce the real after-tax income from work. Whereas the environmental benefits are public and thus independent of private behavior, the costs depend on the amount of labor supplied. Indeed, by enhancing environmental quality, the pollution tax expands the supply of public goods, thereby raising the overall tax burden as measured by the burden of the provision of public goods on private incomes. This additional tax burden corresponds to the abatement costs. Indeed, a cleaner environment is not a free lunch: just as other public priorities that require public spending, environmental policy imposes costs on the private sector. Hence, the environmental tax reform amounts to replacing explicit labor taxes by higher implicit labor taxes.

The term between square brackets in (18) represents the additional tax burden associated with a cleaner environment. This so-called tax-level effect, which corresponds to the costs of a cleaner environment, depends on two elements: First, the initial pollution levies and, second, the substitution elasticities between clean and dirty commodities.

The initial pollution taxes measure the marginal abatement costs. Without prior pollution taxes, reducing a marginal unit of pollution comes free. However, the higher the initial pollution taxes are, the larger the marginal costs of increasing environmental quality become. Hence, while small environmental taxes impose only small abatement costs, large pollution taxes tend to impose a substantial burden on private incomes. Indeed, the erosion of the base of pollution taxes due to lower pollution yields more serious adverse consequences for tax revenues if initial pollution taxes are higher.

Whereas the initial tax rates determine the costs associated with each unit of reduced pollution, the substitution elasticities between clean and dirty commodities affect the

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2. The word «distort» is in quotes to acknowledge that the change in resource allocation may be efficient if environmental benefits are taken into account.
magnitude of the reduction in pollution. The larger these elasticities are, the larger the improvement in environmental quality, and thus the larger the overall costs associated with the additional supply of this public good. Thus, a fundamental trade-off emerges between, on the one hand, beneficial environmental effects and, on the other hand, favorable employment effects. The more successful environmental policy is in improving the quality of the environment, the higher the overall tax burden and thus the less likely an expansion of employment becomes. Indeed, if a pollution levy is successful in changing behavior, it does not generate much revenue, thereby reducing the scope for cutting distortionary taxes on labor.

Armed with the general equilibrium effects on employment, we now return to expression (9) for the welfare effects of marginal tax changes. By harming employment, pollution taxes narrow, rather than widen, the tax base. Accordingly, the gross distortionary costs of substituting pollution levies for labor taxes are positive and the double dividend hypothesis thus fails. Moreover, by eroding the base of the labor tax, environmental taxes exacerbate pre-existing tax distortions. Hence, the larger the magnitude of pre-existing tax distortions, the higher become the gross distortionary costs of revenue-neutral pollution taxes. In particular, in the presence of a distortionary tax on labor, welfare would rise if the government would marginally reduce the environmental tax below its Pigovian level (and, at the same time, would raise the tax on labor, \( t_L \), to offset the revenue losses).

This is a typical second-best result. The theory of the second best teaches that, in a world with remaining distortions, introducing an additional distortion (i.e., reducing the environmental tax below its Pigovian value) may not necessarily reduce overall efficiency. Intuitively, the introduction of the distortion may alleviate the remaining distortions. This is exactly what happens when environmental taxes are reduced below their Pigovian level in a world with tax distortions. In particular, by raising employment, lower environmental taxes alleviate the distortions due to an excessively low level of employment.

4. THE OPTIMAL ENVIRONMENTAL TAX

This section derives on explicit expression for the optimal environmental tax. The government maximizes household utility subject to the government budget constraint and decentralized optimization by firms and households. Private commodities are separable from public goods. In contrast to section 3, this section does not necessarily assume that leisure is weakly separable from produced consumption goods.
\[ NV((1+t_D), (1-t_L), G, e(ND)) + \mu [t_LNL + t_DND] \]  

where \( V \) represents indirect utility, and \( m \) denotes the marginal disutility of raising one unit of public revenue.

Maximizing with respect to \( t_L \), we find the following first-order condition

\[
(\lambda - \mu) L + \mu \left[ t_D \frac{\partial L}{\partial w} + t_L \frac{\partial L}{\partial w} \right] + Nu_E e_{ND} \frac{\partial D}{\partial w} = 0
\]  

where we have used Roy's identity \( \frac{\partial V}{\partial (1-t_L)} = \lambda L \). Define

\[
t_D^E = \frac{Nu_E (-e_{ND})}{\mu}
\]  

Substitution of (24) into (23) yields

\[
(\lambda - \mu) L + \mu \left[ (t_D - t_D^E) \frac{\partial D}{\partial w} + t_L \frac{\partial L}{\partial w} \right] = 0
\]  

In an analogous way, the first-order condition for \( t_D \) yields

\[
(\lambda - \mu) D - \mu \left[ (t_D - t_D^E) \frac{\partial D}{\partial D} + t_L \frac{\partial L}{\partial D} \right] = 0
\]

where we have used Roy's identity \( \frac{\partial V}{\partial (1+t_D)} = -\lambda D \).

The optimal tax on dirty consumption consists of two parts (see also Sandmo (1975) and Bovenberg and van der Ploeg (1994b)). The first part is the distortionary (or revenue-raising) component of the tax on polluting consumption. Together with the optimal labor tax, the optimal level of this distortionary component is determined on the basis of the familiar Ramsey formulas for raising revenues with the lowest costs to private incomes (see (25) and (26)). To illustrate, if (as assumed in section 3) clean and dirty consumption are weakly separable from leisure and if utility is homothetic, uniform taxation of clean and dirty goods is optimal from the point of view of raising revenues with the smallest burden on private incomes. Here, the optimum involves equal distortionary components of the two taxes on consumption. In this model, uniform distortionary taxes on consumption are equivalent to taxes on labor; the optimum is thus characterized by zero distortionary taxation of dirty consumption (i.e. \( t_D = t_D^E \)). In this particular case the so-called marginal cost of public funds (MCPF) \( \eta = \mu/\lambda \) can be written with the aid of (25) as
The MCPF thus exceeds unity if, first, the uncompensated wage elasticity of labor supply, $\beta_L$, is positive and, second, Pigovian taxes do not suffice to finance public consumption so that the distortionary tax on labor, $t_L$, is positive.

The second part of the optimal tax on dirty consumption, $t^E_D$, corrects for the environmental externality (use (24) with $\lambda = u_C$)

$$t^E_D = \left\{ \frac{N u_E (-e_{ND})}{u_C} \right\} \frac{1}{\eta}$$

The term between square brackets on the right-hand side of (28) corresponds to the Pigovian tax (see (10)). The Pigovian tax is optimal only if the marginal cost of public funds, $\eta \equiv \mu/\lambda$, equals unity. A unitary MCPF indicates that public funds are not scarcer than private funds (as is the case if distortionary taxes are absent or labor supply is completely inelastic). However, in a second-best world without lump-sum taxation, the MCPF typically differs from one. Indeed, the MCPF term in (28) reveals how second-best considerations affect optimal environmental taxation. In particular, the higher the MCPF is, ceteris paribus, the smaller becomes the optimal environmental tax.

The reason for the inverse relationship between the MCPF and the optimal environmental tax is as follows. The government employs the tax system to simultaneously accomplish two objectives: raising revenues and internalizing environmental externalities. If public revenues become scarcer, as indicated by a higher marginal cost of public funds, the optimal tax system focuses more on generating revenues and less on internalizing pollution externalities. The conflict between raising revenues and protecting the environment exists because an environmental levy reduces pollution by encouraging taxpayers to avoid taxes. Tax avoidance not only reduces pollution but also makes it necessary to levy higher distortionary taxes to finance public spending. Accordingly, the larger the government’s revenue needs are (as indicated by a higher MCPF), the less the government can afford tax differentiation aimed at environmental protection. Indeed, the optimal pollution tax balances the social costs of pollution against the social benefits from additional tax revenues. Therefore, the higher the social value attached to tax revenue, the higher the marginal social costs of pollution have to be to justify a given environmental tax.
5. THE TAX BURDEN EFFECT

Section 3 showed that a revenue-neutral environmental tax reform raises the overall tax burden. This section explores how robust this result is with respect to alternative assumptions about the way the environment impacts the economy and about the efficiency of the initial tax system.

5.1 The feedback of environmental benefits

To assess the macro-economic effects of a larger public sector, one should in principle take into account the economic effects of the additional public expenditures. The overall impact of a larger public sector on economic activity and employment may well be favorable if the additional tax revenues finance public investments that substantially boost labor productivity. However, if income transfers rather than public investments are raised, labor supply is likely to fall on account of the positive income effect. In that case, the expenditure side thus exacerbates the adverse employment effects of the higher level of taxation.

Similarly, one should in principle explore the economic consequences of a cleaner environment if pollution taxes succeed in enhancing environmental quality. The simple model introduced in section 2, however, assumes that the natural environment is a public consumption good that enters utility in a weakly separable way. Accordingly, the improved quality of the environment (i.e. the «excess benefit» of an environmental tax reform or the «green dividend») does not directly affect economic decisions.

In principle, however, a cleaner environment could impact the labor market through two channels. First, it affects labor supply if environmental quality enters household utility in a non-separable fashion. In particular, environmental quality may be complementary to leisure, as a cleaner environment is likely to make leisure more enjoyable. In that case, environmental benefits reduce labor supply, thereby strengthening the adverse employment effects associated with higher abatement costs. Intuitively, those who consume most leisure, and thus supply the least labor, benefit most from the cleaner environment. Hence, not only the costs of a cleaner environment rise but also the benefits fall as the amount of labor supplied increases. If environmental quality is a substitute for leisure, in contrast, environmental improvements raise the incentives to supply labor, thereby mitigating the adverse employment effects.

The second channel through which environmental benefits can impact the economy is the feedback of a cleaner environment on production. In particular, the natural environment may act not only as a public consumption good but also as a public input into production. For example, in agriculture, production benefits from a better quality of the soil and the air. Furthermore, less air pollution is likely to improve health and morale, thereby boosting labor productivity. If the environment acts as a public factor of production, a higher level of environmental quality may well raise labor productivity. In that case, households with the highest supply of labor benefit most from the cleaner environment.
Hence, both the costs and the benefits of a cleaner environment rise with the amount of labor supplied. Indeed, if the environment enters production as a public production factor (and does not enter utility), Bovenberg and van der Ploeg (1994a) demonstrate that the optimal environment tax equals the Pigovian tax, even in a second-best world with distortionary labor taxes. Intuitively, marginally reducing the environmental tax below the Pigovian tax does not alleviate the labor-market distortion by raising employment because both the benefits and costs of doing so are directly borne by labor.

These considerations indicate that in principle one should explore the feedback on the economy of a higher supply of the public good of the environment. However, most models investigating the consequences of an environmental tax reform abstract from this feedback. In particular, they ignore the impact of environmental benefits on both labor demand and labor supply. This is a valid assumption only if the environment enters households' utility function as a consumption good in a weakly separable way and does not act as an input into production.

5.2 The efficiency of the initial tax system

If the initial tax structure is not optimal from a non-environmental point of view, an environmental tax reform may be able to reduce the overall burden of taxation. The key requirement is that the tax reform moves the tax system closer to its non-environmental optimum. In that case, the welfare gains associated with moving towards a more efficient tax system from a non-environmental point of view may finance the improvement in environmental quality. This sub-section illustrates this general point with a number of examples. These examples raise the question why governments have not reformed their tax systems to deal with these inefficiencies. Indeed, the case for such a reform is independent of environmental concerns. Section 9 discusses this issue in more detail.

Clean consumption a better substitute for leisure

The utility structure assumed in the tax-reform analysis in section 3 implies that leisure is an equally good substitute for dirty and clean consumption. Accordingly, a uniform tax on clean and dirty consumption (i.e. a labor tax) is optimal from a non-environmental point of view. If, compared to dirty consumption, clean consumption is a better substitute for leisure, however, the optimal (non-environmental) tax on dirty consumption exceeds that on clean consumption. In that case, therefore, an environmental tax reform that starts from a uniform tax on clean and dirty consumption moves the tax system closer to the non-environmental optimum. Intuitively, by shifting the tax burden from clean consumption, which is a relatively good substitute for leisure, to dirty consumption, which is a relatively poor substitute for leisure, the government implicitly taxes leisure. The resulting higher level of labor supply alleviates the initial tax distortions.
Environmental taxes as rent taxes

Environmental taxes may be an implicit way to tax the scarcity rents associated with natural resources. Taxes on the demands for fossil fuels, for example, may be borne largely by the owners of the fossil fuels. The shifting of these taxes to the suppliers contains non-environmental costs because taxing rents involves no efficiency cost. At the same time, this shifting to the supply side limits the environmental improvements, since it reduces the increase in (gross-of-tax) prices to those who demand the fuels.

Inefficient factor taxation

If the initial tax system involves differences in the marginal excess burdens of various taxes, an environmental tax reform can boost private incomes by shifting the tax burden away from factors with high marginal excess burdens to factors with low marginal excess burdens (see BOVENBERG and GOULDER (1997) and GOULDER (1995)).

These considerations may be relevant for the mix between capital and labor taxation. To illustrate, most applied general equilibrium models of the U.S. economy suggest that, compared to taxes on labor income, taxes on capital income tend to produce larger marginal efficiency losses. The most direct way to improve the efficiency of the tax system as a revenue-raising device would be to finance a cut in capital taxes with higher taxes on labor. However, if the government does not want to adopt explicit labor taxes, it can use environmental taxes that are primarily borne by labor (i.e. implicit labor taxes).

The welfare effects associated with a sub-optimal initial tax system do not necessarily make environmental tax reforms more attractive, however, because the burden of the environmental tax could well fall on the factor that is already overtaxed from an efficiency point of view. Indeed, the numerical general equilibrium analysis in BOVENBERG and GOULDER (1997) suggests that inefficiencies in the initial U.S. tax system may make carbon taxes less rather than more attractive.

Environmental taxes as optimal tariffs

In an open economy, governments can employ pollution taxes to improve the terms of trade. For example, a large oil-importing country may improve its terms of trade if it reduces the demand for oil by raising the tax burden on fossil fuels. Similarly, a large exporting country can boost the prices of its exports by imposing pollution taxes that reduce the supply of its export commodities. If the terms-of-trade gains are sufficiently large, domestic non-environmental welfare may rise. In that case, foreigners, in effect, pay for the cleaner environment.
Pre-existing subsidies on polluting activities

The overall burden on polluting activities may be too low initially – even from the point of view of maximizing private income – because these activities are subsidized initially. The tax reform analysis in section 3 illustrates this. If the dirty consumption good is subsidized in the initial equilibrium (i.e. \( t_D < 0 \)), employment (and hence private income) expands if this subsidy is reduced.

6. EMPLOYMENT EFFECTS

The previous section explored the efficiency implications of an environmental tax reform. Indeed, the double dividend was defined in terms of a gain in both environmental quality and non-environmental welfare. In Europe, however, the interest in environmental tax reform originates primarily in the desire to raise employment. This section shows that the impact on employment depends on two effects: the tax-level effect (discussed in section 3) and the so-called tax-shifting effect. To that end, it extends the model introduced in section 2 by allowing for consumption out of non-labor income.

In particular, it is assumed that there are two types of households. The first type, the «active» household, relies entirely on labor income. The second type, the «inactive» household, finances its consumption exclusively out of transfer incomes provided by the government. Higher taxes on consumption reduce the purchasing power of the inactive households because transfers are fixed in terms of the producer prices of the consumption goods. Transfers are not subject to the tax on labor income. The relative changes in the demands for the two commodities (15) and (16) become

\[
\tilde{C} = (1-\phi)(\bar{w}_R + \bar{L}) - \phi(1-\alpha_C) \bar{t}_D + (1-\alpha_C) \sigma_H \bar{t}_D \\
\tilde{D} = (1-\phi)(\bar{w}_R + \bar{L}) - \phi(1-\alpha_C) \bar{t}_D - \alpha_C \sigma_H \bar{t}_D
\]

(29)

(30)

where \( \phi \) denotes the share of non-labor income in aggregate household income (after labor taxes). Substitution of (14), (29) and (30) into (17) yields the following expression for employment:

\[
\tilde{L} = \frac{-\beta_L}{\Delta} \left[ -\theta_D \alpha_C (1-\alpha_C) (1-t_L) \alpha_H + \phi S (1-\alpha_C) \bar{t}_D \right]
\]

(31)

where

\[
\Delta \equiv (1-\phi) S - \beta_L T_T \]

(32)

\[
T_T \equiv t_L + \phi(1-t_L) + \theta_D (1-\alpha_C) (1-t_L)(1-\phi)
\]

(33)
In the absence of transfer income, expression (18) reveals that an environmental tax reform does not affect employment if the initial pollution tax is zero. If transfers are positive, in contrast, such a reform boosts employment (see (31) with $\theta_D = 0$). The reason is that, unlike the case without non-labor income, the government is able to more than compensate workers for the real income loss due to a higher environmental tax. Intuitively, contrary to the labor tax, the environmental tax is borne not only by labor but also by non-labor incomes. Hence, the tax reform redistributes income from those receiving non-labor income (who pay the higher tax on dirty consumption but are not compensated by either lower labor income taxes or higher nominal transfers) towards those collecting labor income. As a direct consequence, real wages – and thus labor supply – rise. Thus better environmental quality is accompanied by a higher level of employment.

With positive initial pollution taxes (i.e., $\theta_D > 0$), the overall impact on employment occurs through two channels. The first channel, represented by the first term in square brackets in (31), is the tax-level effect discussed in section 3. This effect reduces employment. It operates if the initial pollution tax is positive: only in that case does a cleaner environment require real resources at the margin.

The second channel through which an ecological tax reform impacts employment is what we call the tax-shifting effect. This channel, represented by the second term in square brackets in expression (31), involves redistribution of income between labor and non-labor incomes. Through this channel, an environmental tax reform can raise employment if it redistributes income away from non-labor incomes to labor income.

In terms of our model, the government can raise employment only if it cuts the real value of transfers. If the government would raise transfers to maintain the real purchasing power of these transfers after the introduction of a pollution tax, the employment impact of the higher labor taxes required to finance the additional transfers would exactly offset the positive employment effect of the tax-shifting effect (see BOVENBERG and de Mooij (1994b)).

The overall effect on employment depends on the balance between, on the one hand, the tax-level effect, and, on the other hand, the tax-shifting effect. Employment increases only if the tax-shifting effect dominates the tax-level effect. In that case, the cleaner environment is entirely paid for by the inactive household.

7. THE INCIDENCE OF POLLUTION TAXES

Section 6 showed that pollution taxes on consumption do not need to be implicit taxes on labor income if households consume out of non-labor income. More generally, in order to determine the employment effects of pollution taxes, an analysis of the ultimate incidence of pollution taxes is called for. Indeed, the slogan «shifting the tax burden away from labor towards pollution» can be misleading because it suggests that pollution can bear taxes. However, only people can bear taxes. Therefore, the key question becomes which people bear the incidence of the pollution taxes. In particular, the tax burden can
be shifted to others besides those collecting transfer incomes, for example to capitalists or foreigners. This section explores the incidence of pollution taxes. In doing so, it distinguishes between pollution taxes on production (sub-section 7.1) and those on consumption (sub-section 7.2).

7.1 Taxes on production

Pollution taxes can be levied on production in various ways. To illustrate, emissions of pollutants by industry can be subject to charges. Alternatively, the government may tax certain polluting inputs into production (e.g., various forms of energy or fertilizers). These taxes are typically not refunded when the outputs of the production process are exported. Furthermore, imports of similar commodities do not face an equivalent tax. Consequently, if a small country imposes a tax on the production process of a tradable commodity, domestic consumers escape the tax burden and the factors engaged in production suffer the incidence of the tax.

Which one of the factors actually bears the brunt of the tax incidence depends on both the production structure and the supply elasticities of the various production factors. A major determinant of the supply elasticities is the degree to which the various factors are mobile internationally. If all non-labor inputs (e.g., capital and energy) are fully mobile internationally, these inputs can escape the tax burden by moving abroad. Accordingly, non-mobile labor bears the full incidence of the tax (see Boovenberg and van der Ploeg (1994a)).

Other non-labor inputs share some of the incidence of pollution taxes in a small open economy if these inputs cannot move costlessly abroad. Indeed, in the short run, physical capital is likely to be rather immobile internationally. As a result, not only human capital but also the owners of physical capital suffer capital losses. In that case, the production structure becomes relevant. With a tax on the input of energy into production, capital bears a relatively large part of the tax burden if, compared to labor, capital is a poorer substitute for energy (see Boovenberg and van der Ploeg (1998a)).

In the long run, however, capital is likely to be mobile internationally. Accordingly, it is able to escape the burden of environmental taxes – at least in open economies. Capital can be taxed on a sustainable basis by reducing the after-tax return only if countries coordinate their tax policies. Even then, elastic saving behavior can shift the burden to labor – as lower saving reduces capital formation, thereby hurting labor productivity. Also the producers of the taxed input can bear part of the burden of environmental policy. To illustrate, if OECD countries would raise taxes on fossil fuels, the oil price could fall substantially. Accordingly, the terms of trade of the oil-importing countries would improve. The OPEC countries, in contrast, would suffer terms-of-trade losses. In this way, oil-producing countries, rather than consumers in OECD countries, would bear the brunt of the tax.
The terms of trade of a country pursuing ambitious environmental policies could improve also if that country exerts market power in its export markets. In particular, by reducing the supply of its export commodities, environmental policy may raise the world-market price of these goods. In this way, part of the incidence of pollution taxes can be shifted to foreign consumers.

7.2 Taxes on consumption

Destination-based taxes are borne by consumers if they are imposed by a small open economy on tradable commodities. Producers can continue to sell their commodities abroad at fixed world-market prices. Hence, they escape the tax burden. The tax is paid not only by those who consume out of labor income, but also by those who consume out of transfer and capital incomes.

In some cases, consumers may share the burden of indirect taxes with other economic agents. In particular, a tax on non-tradable consumption commodities may in part be borne by the production factors that produce the taxed commodity. Depending on relative demand and supply elasticities, the burden is shared between consumers and the suppliers of production factors. Hence, workers are likely to suffer if the tax is imposed on a non-tradable labor-intensive commodity. The burden of an indirect tax would also fall on producers if a large country or a group of countries with a dominant position in the world market were to increase a destination-based tax on a tradable commodity. In that case, the world market price for the taxed commodity would decline, thereby imposing a burden on producers.

8. INVOLUNTARY UNEMPLOYMENT

The previous sections assumed a competitive, well-functioning labor market with market-clearing wages. However, in Europe, the interest in the double-dividend issue springs mainly from the existence of widespread involuntary unemployment. Bovenberg and van der Ploeg (1998b) analyze the consequences of an environmental tax reform in a model with involuntary unemployment due to hiring and search costs. These latter costs imply a rent on job matches. Wages are the outcome of a bargaining process between workers and employers about the distribution of these rents. Just as in section 6, the tax burden can be shifted to those collecting transfer incomes. In the context of the search model, the transfer recipients are those who receive unemployment benefits. As in section 6, lower unemployment benefits boost labor demand by reducing the need to raise labor taxes to finance these benefits. However, in the search model, lower unemployment benefits raise employment also through another channel, namely the process of wage determination. In particular, less generous unemployment compensation induces workers to moderate wages, as a less attractive outside option weakens the bargaining position of workers.
Section 6 showed how higher pollution taxes on consumption can redistribute income away from transfer recipients to workers. Bovenberg and van der Ploeg (1998b) argue that pollution taxes on intermediate inputs may generate the same distributional effects if those not employed in the formal sector collect not only unemployment benefits but also incomes from activities in the informal sector. These latter activities are not subject to the labor tax, so that the unemployed escape the burden of the labor tax. However, they may bear some of the burden of the pollution tax. In particular, a pollution tax on intermediate goods, by reducing labor productivity in the formal sector, also hurts incomes in the informal sector. An environmental reform thus substitutes a tax that is in part borne by the unemployed (i.e., the pollution tax) for a tax that does not affect the unemployed (i.e., the labor tax). The resulting shift in the tax burden away from the employed in the formal sector towards those who are not employed in the formal sector corresponds to yet another form of the tax-shifting effect. This tax-shifting effect, which makes the outside option of workers in the formal sector less attractive, induces these workers to moderate wages, thereby benefiting employment in the formal sector.

This tax-shifting effect is consistent with wage equations in which labor productivity is fully shifted towards employees in terms of higher after-tax wages, while labor taxes are only in part absorbed by workers, so that these labor taxes are in part borne by employers in terms of higher wage costs (see Graafland and Huizinga (1996)). In the presence of such a wage equation, a green tax reform moderates wages, thereby boosting labor demand. On the one hand, the pollution taxes do not affect labor costs per unit of output because the fall in labor productivity is offset by lower after-tax wages. On the other hand, the lower labor taxes reduce labor costs because the cuts in labor taxes are shared between employees in terms of higher after-tax wages and employers in terms of lower (before-tax) wage costs.

The tax-level effect, representing the abatement costs associated with a cleaner environment, typically hurts employment. The overall effect on employment depends on the net impact of the tax-burden effect and the tax-shifting effect. Even if the increase in the tax burden is large, employment may rise if workers accept a large drop in their disposable income. An environmental tax reform succeeds in moderating wages if it makes work in the formal sector more attractive compared to being unemployed. With endogenous wage determination, therefore, a higher tax burden associated with a cleaner environment does not necessarily result in a higher level of unemployment. Intuitively, workers and the unemployed absorb the costs of the cleaner environment in terms of lower after-tax wages and lower incomes in unemployment rather than an increased risk of becoming (or staying) unemployed.

Another channel through which an environmental tax reform may reduce unemployment is a shift in the tax burden away from low-skilled towards high-skilled labor. Lower tax rates on low-skilled labor can facilitate the transition from unemployment to work in the official labor market (alleviating the so-called «unemployment trap»). The replacement rates for unemployment benefits tend to be the highest for low-income earners because the earnings of these workers are closest to the social minimum. Fur-
thermore, the effective tax rates on work faced by low-income workers are particularly high due to the interaction of the tax system, social security contributions, means-tested social security benefits, and income-related prices.

In view of these concerns, the case for a cut in the average tax burden on low-income workers is quite strong. However, a substantial reduction in average tax rates facing low incomes is rather costly in terms of lost tax revenue. To mitigate the budgetary costs, governments may restrict the tax cuts to the lowest incomes only. This implies that marginal tax rates rise. The resulting more progressive tax system may actually reduce unemployment through its effect on wage-setting behavior in non-competitive labor markets. In particular, a more progressive tax reduces the incentive for unions to bargain for higher wages. Moreover, firms find it less attractive to pay efficiency wages. Intuitively, marginal taxes moderate wages because they act like a tax on wage increases (see e.g. Pissarides, (1998)).

Whereas lower taxes on low-skilled labor and higher marginal tax rates can reduce unemployment, they are likely to harm the incentives to supply labor and to acquire more skills. Moreover, price signals in the form of wage differentials are distorted by high marginal tax rates. This harms the flexibility of the labor market in responding to shocks, and reduces the efficiency with which labor is allocated across sectors and regions. Accordingly, governments face a trade-off between cutting unemployment and raising the quality and quantity of labor supply.

9. POLITICAL ECONOMY AND THE INCOME DISTRIBUTION

Section 6 found that the tax-shifting effect allows an environmental tax reform to boost employment by shifting the tax burden away from workers to those outside the labor force. In particular, green taxes may succeed in shifting the tax burden to recipients of transfer incomes. Whereas this tax shifting may boost employment, it may well be unattractive from a distributional point of view.

Sub-section 5.2 showed that an environmental tax reform may raise non-environmental welfare by reducing non-environmental distortions. This raises the question why governments have not reformed their tax systems to address these inefficiencies. Indeed, in these circumstances, the efficiency case for tax reform is independent of environmental concerns. However, political and distributional considerations may have prevented the government from enhancing the efficiency of the tax system. Indeed, distributional issues are at the heart of the double dividend issue: without distributional concerns, taxes would not need to be distortionary – as governments could freely use uniform lump-sum taxation to meet their revenue needs. In designing environmental tax reforms, governments typically face a trade-off between equity and efficiency. In particular, the revenues from pollution taxes can be used only once: either to compensate the poor or to reduce distortionary taxes. This section explores political issues involving the distribution of welfare over heterogeneous households with differing interests.
9.1 The case for linking environmental and non-environmental objectives

If the government aims for two objectives, it should in principle employ two instruments. Conceptually, therefore, one can view a green tax reform aimed at reaping a double dividend as consisting of two separate policies. One policy is aimed at improving the quality of the environment (i.e. the pollution tax). The other policy is targeted at stimulating employment (i.e. shifting the tax burden away from workers towards those outside the labor force) or at making the tax system more efficient from a non-environmental point of view.

There may be a political case for linking two issues because such a linkage increases the number of instruments that can be used to compensate losers from separate reforms. In this way, the scope for arriving at Pareto-improving reforms in political bargaining is increased. To illustrate, an efficiency-enhancing tax reform that stimulates employment may not be politically acceptable because inactive households that rely on non-labor income lose from such a reform. If these latter households attach a high value to environmental quality, however, they may favor an environmental tax reform that shifts the tax burden away from labor. Indeed, for inactive households, the environmental benefits offset the non-environmental costs of such a reform. Hence, the government may be able to introduce a policy that reduces the real value of non-labor incomes while still satisfying the distributional constraint that the overall welfare of households relying on non-labor incomes must be maintained. Indeed, the taxes borne by the inactive households act as benefit taxes for benefits associated with the better quality of the environment: the households that benefit from the cleaner environment also pay for it.

This points to a key feature of environmental taxes that distinguishes these taxes from other taxes. In particular, environmental taxes not only finance ordinary public goods but also increase the supply of the environmental public good. The distribution of these environmental benefits can be such as to create more opportunities for political bargaining concerning an efficiency-enhancing reform. In this way, environmental taxes can «grease the wheels» of tax reform.

In a similar fashion, the literature on the optimal provision of public goods in the presence of heterogeneous households suggests that there may be cases in which distributional concerns should result in «overproviding» environmental quality (as measured by the relationship between, on the one hand, the optimal environmental tax and, on the other hand, the Pigovian tax defined as the sum of the marginal rates of substitution between the environmental public good and private goods). In particular, for environmental quality to be overprovided, environmental quality should be less complementary with leisure than with private goods. In this case, the marginal willingness to pay for the environment (i.e. the marginal rate of substitution between environmental quality and private goods) declines with the amount of leisure. This relaxes the self-selection constraint that restricts the amount of redistribution (see BOADWAY and KEEN (1993)). In particular, if high-ability households mimic the low-ability households, the high-ability households enjoy more leisure. Their marginal willingness to pay for the environment is lower than that of the low-ability households because this willingness to pay declines with leisure.
Accordingly, raising the ratio of environmental quality to private commodities increases the utility of the low-ability households compared to that of the mimicking high-ability households. By relaxing the self-selection constraint, a higher environmental tax allows for a less progressive tax system – i.e. a lower (distortionary) marginal labor tax for the low-ability households. In this way, distributional concerns cause the environment to be «overprovided».

In this case, environmental tax reforms enhance non-environmental efficiency not just by moving along the efficiency-equity trade-off, but by moving the efficiency-equity trade-off itself. Hence, a green tax reform enhances both equity, non-environmental efficiency, and environmental quality. Intuitively, environmental quality is used as an instrument to distribute resources to the low-ability households, which feature a higher marginal willingness to pay for the environment than the mimicking high-ability households. In this way, the provision of environmental quality is employed as a redistributive instrument. A similar argument holds if preferences are correlated with unobservable ability. In particular, the environment should be «overprovided» if low-ability households feature high preferences for the environment.

9.2 The case against linking environmental and non-environmental objectives

Distributional concerns, however, may also complicate environmental tax reforms. In particular, the distribution of the environmental benefits may tighten rather than relax second-best constraints. The literature on the optimal provision of public goods suggests that this is the case if, compared to private goods, leisure is more complementary with environmental quality – so that the marginal willingness to pay for the environment rises with the consumption of leisure. In that case, underproviding the natural environment is an implicit way to tax leisure, thereby relaxing the second-best constraint. Indeed, environmental quality and leisure may well be complementary because a cleaner environment is likely to make leisure more enjoyable.

In a similar way, political considerations may make an employment-generating environmental tax reform difficult to attain if those who bear the incidence of the pollution taxes (i.e. the victims of the tax-shifting effect) do not attach much value to the cleaner environment. In that case, these victims pay twice: not only for the cleaner environment (through the tax-burden effect), but also for ordinary public goods (through the tax-shifting effect, which implies that they pay a larger share of ordinary public spending). Simultaneously raising employment and environmental quality thus implies that costs and benefits accrue to rather different groups in society. This complicates the processes of building political consensus on environmental policy.

More fundamentally, requiring environmental policy to serve not only environmental objectives but also other, non-environmental, goals may complicate the implementation of environmental policy by intensifying the distributional struggle about the property rights of the natural environment. In deciding on environmental policy instruments, the
government implicitly determines the distribution of property rights of the environment. To illustrate, if the government imposes environmental taxes, the government, as representative of the victims of the pollution, in effect owns the property rights. Hence, in order to be able to pollute, pollutors have to compensate the victims by paying the government. If the pollutors own the property rights, in contrast, the victims have to bribe the pollutors to cut pollution, for example by providing subsidies for cleaner technologies. In view of the rather different distributional outcomes of the various policy instruments, it is not surprising that political discussions about environmental policy are often dominated by distributional issues rather than efficiency considerations.

If pollutors have historically (i.e. before environmental concerns became important) enjoyed the right to freely pollute, the government imposing environmental taxes amounts to nationalizing the pollution rights. Pollutors often perceive these changes in the rules of the game as inequitable. In their view, by imposing unanticipated pollution taxes, the government breaks implicit promises about stable property rights. In this way, the government taxes away quasi-rents that originate in specific investments made in anticipation of free pollution rights. This government behavior may thus raise uncertainty about the stability of property rights, thereby negatively affecting long-term investment decisions.

To avoid these adverse equity and efficiency effects, the government may use the revenues from environmental taxes to compensate pollutors for the nationalization of property rights. Using revenues to compensate pollutors, however, typically conflicts with the desire to boost employment and reduce non-environmental distortions in tax systems. Whereas reaping a double dividend requires tax shifting, political considerations (i.e. respecting property rights and creating political consensus) argue in favor of minimizing tax shifting so as to contain the distributional effects of environmental policy. Indeed, taxing away the quasi-rents from existing pollution rights creates the potential for a double dividend, but violates the desire to respect historical property rights. It confirms the fear of pollutors that the government uses environmental taxes primarily to redistribute rents rather than to protect the environment. In their view, a redistributive operation is conducted under the banner of environmental protection. The government talking about a double dividend convinces pollutors that their rents will indeed be taken away from them.

This discussion points to the crucial distinction between reforming an existing tax system and designing a tax system from scratch. However, governments often lack sufficient instruments to fully neutralize the distributional effects. Accordingly, they may grandfather the existing property rights by granting tax-free allowances to existing pollutors. This can be viewed as an earmarked tax, which employs its revenues to compensate existing pollutors. Another reason why green taxes may be unattractive from a political point of view is that the nationalization of pollution rights may expand public spending. In particular, it may be feared that revenues from green taxes are not recycled to the private sector but rather are spent by the political process on wasteful public spending. This would further increase the tax-burden effect discussed in section 3.
in order to be used for non-environmental objectives. Linking environmental policy to redistribution intensifies the distributional struggle associated with environmental policy and may result in rent-seeking behavior. In this way, linking environmental policy to other objectives (such as employment creation) raises the political transaction costs of implementing environmental policy.

10. CONCLUSIONS

The overall message of this paper is rather disappointing for those who expect substantial non-environmental benefits from green tax reform. The analysis shows that stringent conditions need to be met in order for an environmental tax reform to yield a double dividend. Moreover, such a double dividend often yields negative political or distributional dividends. Indeed, an environmental tax reform is not a free lunch.

A failure of the double-dividend argument does not imply that environmental taxes should not be employed. It does suggest, however, that the case for environmental taxes should be made primarily on environmental grounds. The attention for the double-dividend argument stems in part from the desire to justify environmental taxes despite the uncertainties about the size of the environmental dividend. In the presence of a non-environmental dividend, green tax reforms are worthwhile as long as the environmental benefits are non-negative. The discussion in this paper indicates that the attempt to argue in favor of environmental taxes on non-environmental grounds is likely to fail. Indeed, the analysis suggests that environmental benefits not only determine the environmental dividend but may also impact the non-environmental dividend. In particular, sub-section 5.1 reveals that the feedback of environmental benefits on the economy is an important determinant of the tax-level effect. Moreover, section 9 shows that the distribution of the environmental benefits is an important determinant of the effect of a green tax reform on political and second-best constraints. Accordingly, a high priority should be given to identifying and measuring environmental benefits.
REFERENCES


ZUSAMMENFASSUNG

Dieser Aufsatz zeigt auf, wie eine ökologische Steuerreform Wohlfahrt, Beschäftigung und die Einkommensverteilung beeinflusst. Es werden die Bedingungen untersucht, unter welchen eine ökologische Steuerreform eine doppelte Dividende hervorruft, d.h. nicht nur eine sauberere Umwelt, sondern auch nicht-ökologische Vorteile generiert. Im weiteren wird untersucht, ob eine solche doppelte Dividende andere nicht-ökologische Kosten nach sich zieht, wie beispielsweise bei der Einkommensverteilung. Abschließend werden die Auswirkungen einer Umweltbesteuerung auf die politische Ebene besprochen.

RÉSUMÉ

Cet article décrit les effets d'une reforme fiscale écologique sur le bien-être social, l'emploi et la distribution des revenus. Il analyse les conditions sous lesquelles une réforme fiscale écologique génère un double dividende, c'est-à-dire non seulement un environnement plus propre, mais aussi des avantages non-écologiques. Il est également examiné si un tel double dividende entraîne d'autres coûts non-écologiques, par exemple en ce qui concerne la distribution des revenus. Finalement, les conséquences d'une taxation écologique au niveau politique sont discutées.

SUMMARY

This paper explores how environmental tax reforms impact welfare, employment and the distribution of income. It investigates the conditions under which a green tax reform generates a double dividend, i.e. not only a cleaner environment but also non-environmental benefits. It investigates also whether such a double dividend implies some other non-environmental costs, e.g. in terms of the income distribution. Finally, the political economy of environmental taxation is discussed.