Does a Government Environmental Procurement Policy Yield a Double Dividend?

Presented at the 2001 ECEEE Summer study – Paper number: 1,014

Philippe Quirion, CIRED

(Centre international de recherches sur l'environnement et le développement, CNRS/EHESS)

45 bis, avenue de la belle Gabrielle, F-94736 Nogent-sur-Marne, France

Tel. 33 1 43 94 73 95, Fax. 33 1 43 94 73 70

quirion@centre-cired.fr

Synopsis

A switch in public spending away from a natural resource increases employment and is likely to raise private consumption and welfare. Workers are better-off while resource-owners are worse off.

Abstract

The largest part of the literature on macroeconomic effects of environmental policies deals with ecological tax reforms – the so-called "double dividend" debate. Taxes, however, are far from being the most common policy instrument for protecting the environment. In particular, an instrument that still needs to be looked at is a switch in government expenditure from fossil fuel consumption to renewable energies, energy-efficiency expenditure, or simply goods and services featuring a low energy-intensity. To quote Borg *et al.* (1998), "Government-related facilities are often the largest energy users in a country and the single most important customers for energy-using products and services."

This paper explores the macroeconomic consequences of such policy by utilising a theoretical general equilibrium model. Its main peculiarity is a mixed industrial structure, with a composite good, produced with constant returns to scale, and a domestic natural resource (energy for instance), extracted with diminishing returns and which yields a differential (Ricardian) rent to its owners. The government purchases natural resources and composite goods from private firms.

We show that such policy increases employment. It also raises private consumption and welfare if the initial share of natural resource in public spending is smaller than that of private consumption, or if the difference is small enough. This is likely to hold in most countries at least for energy. Households earning only rents are worse off while those earning only wage income are better off.

Introduction[*]

The largest part of the literature on macroeconomic effects of environmental policies deals with ecological tax reforms - the so-called "double dividend" debate. Taxes, however, are far from being the most common policy instrument for protecting the environment. Therefore a couple of recent papers, e.g. Goulder *et al.* (1999) also analyse emissions quotas, performance standards and mandated technologies. Another instrument worth looking at is the composition of public spending between environmental-friendly and -unfriendly goods and services. Indeed, approximately one-fifth of GDP is purchased directly by the government in most OECD countries. Admittedly, Bovenberg and van der Ploeg (1994) analyse the optimal composition of public spending between a clean and a dirty good, but both are produced with the same production technology.

In particular, a partial but environmentally-efficient measure to fight global warming would be to switch government expenditure from fossil fuel consumption to renewable energies, energy-efficiency expenditure, or simply goods and services featuring a low energy-intensity. To quote Borg *et al.* (1998), "Government-related facilities are often the largest energy users in a country and the single most important customers for energy-using products and services." However, until recently, very few countries had concerted energy management programs for the government sector (Borg *et al.*, 1998). Since then, the situation has been improving quickly. In the U.S., a recent Executive Order[1] states that each federal agency shall reduce its greenhouse gas emissions attributed to facility energy use by 30 percent by 2010 compared to such emissions levels in 1990. Most European climate change programmes include provisions to reduce CO_2 emissions from the public sector, either with a quantitative target (e.g. Germany) or not (e.g. France).

Furthermore, emissions associated with the production of goods and services purchased by the government could be reduced by introducing environmental criteria in the bidding process. For instance, 48 out of the 50 states in the U.S. have laws directing state agencies to purchase recycled materials (Montague, 2000).

This paper explores the macroeconomic consequences of such policies and shows that not only it reduces the use of the natural resource (the first dividend), but also leads benefits as measured in terms of higher employment and, for the most likely values of the parameters, households' consumption and welfare. However there is no room for a Pareto-improvement: households earning only rents are worse off while those earning only wage income are better off.

To demonstrate these results, we use a theoretical general equilibrium model which is presented in the first section. Its main peculiarity is a mixed industrial structure, with a composite good, produced with constant returns to scale, and a domestic natural resource (energy for instance), extracted with diminishing returns and which yields a differential (Ricardian) rent to its owners. The government purchases natural resources and composite goods from private firms. The present model builds heavily on Dixon and Hansen (1999) and Dixon and Pompermaier (1999), who study the effectiveness of monetary policy in presence of menu costs. It is described in some depth since it differs significantly from those used to assess ecological tax reforms.

Section 2 derives the equilibrium and analyses the consequences of the allocation of government spending on employment, private consumption and households' utility. Section 3 explores the magnitudes for different parameters values.

1. The model

1.1. Households

There is a continuum of households $i \in [0;1]$. They derive utility from leisure and from the consumption of a natural resource, C^R, and a composite good, C^C. The quality of the environment does not enter the utility function, nor does public spending. The former assumption is common in the double dividend debate and the latter in the literature on the effects of fiscal policy; cf. for instance Dixon and Lawler (1996). Formally

---

[*] Comments from two anonymous referees from the ECEEE summer study, Randall Bowie, Pierre Courtois, Minh Ha Duong, Khalil Helioui, Antonio Mele, Tarik Tazdait and participants of the EUREQua seminar on environmental economics (5/10/2000) are gratefully acknowledged. Any errors remain the sole responsibility of the author.

[1] Executive Order 13123 (Greening the Government Through Efficient Energy Management), June 1999.

$$U(C_i^R, C_i^C, l_i) = \frac{(C_i^R)^b (C_i^C)^{1-b}}{b^b (1-b)^{1-b}} - \frac{g}{g+1} l_i^{\left(\frac{g+1}{g}\right)} \qquad \forall i \in [0;1], \tag{1}$$

The second term of the utility function is the disutility of labour (*l*). g represents the real wage elasticity of labour supply.

The consumer price index is given by

$$P\left(P^R, P^C\right) = \left(P^R\right)^b \left(P^C\right)^{1-b} \tag{2}$$

The budget constraint of household *i* is

$$P^R C_i^R + P^C C_i^C \leq W l_i + p_i - f_i \equiv I_i \quad \forall i \tag{3}$$

Where *W* is the nominal wage, which is assumed to be the same in the two sectors, meaning that there is perfect labour mobility between the two sectors. p_i is the nominal rent received by household *i* and f_i is a lump-sum tax. Total nominal net-of-tax income of households is denoted

$$I = \int_{i=0}^{1} I_i di \tag{4}$$

Maximising utility and assuming that all households are identical yields aggregate private consumption and labour supply:

$$C^R = b \frac{I}{P^R} \tag{5}$$

$$C^C = (1-b) \frac{I}{P^C} \tag{6}$$

$$l_i = \left(\frac{W}{P}\right)^g \tag{7}$$

The first two equations state that a constant share of income is spent on the natural resource and on the composite good. The third equation states that the labour supply is a function of the real wage and of the elasticity of labour supply.

1.2. Firms

All firms take the nominal wage *W* and prices P^C and P^R as exogenous. The production function of all firms in the composite sector is characterised by constant returns to scale, which is consistent with empirical estimates (e.g. Crépon et al., 1999). The output is normalised to be equal to employment. Therefore we have

$$X^C = L^C \tag{8}$$

$$P^C = W \tag{9}$$

In the sector producing the natural resource there are constant or diminishing returns with

$$X^R = \frac{\left(L^R\right)^a}{a} \tag{10}$$

Where $a \in (0,1]$. The assumption of diminishing returns, which is crucial for our results, seems fairly obvious: extraction costs of known deposits are highly variable, at least for gas and oil, and deposits that are not discovered yet are likely to be more costly than known ones. From (10), when a <1, the demand for labour in the resource sector is

$$L^R = \left(\frac{W}{P^R} \right)^{\frac{-1}{1-a}} \tag{11}$$

When a =1, output is demand determined, since the labour demand curve is infinitely elastic.

1.3. The state

The government consumes natural resources and composite goods supplied by private firms[2] and financed by lump-sum taxes. The government's budget is always balanced. The share of natural resource in public spending is l . Government's demand functions in real terms are

$$G^R = l \, \frac{f\, I}{P^R} \tag{12}$$

$$G^C = (1 - l)\, \frac{f\, I}{P^C} \tag{13}$$

Where $f = \int_{i=0}^{1} f_i di \Big/ I$ is the ratio of public spending to households' revenue. The two above equations state that the government real spending in each good is an exogenous part of its revenue deflated by the price of the goods.

2. Equilibrium and comparative static

Solving for equilibrium, we find that the relative price of the composite good and the natural resource is given by[3]

$$\frac{P^C}{P^R} = \left[\frac{1 - b + f(1 - l)}{a(b + f\, l)} + 1 \right]^{\frac{1-a}{gb(1-a)+1}} \tag{14}$$

Total employment is

$$l = \left[\frac{1 - b + f(1 - l)}{a(b + f\, l)} + 1 \right]^{\frac{gb(1-a)}{gb(1-a)+1}} \tag{15}$$

with employment in the resource sector

$$L^R = \left[\frac{1 - b + f(1 - l)}{a(b + f\, l)} + 1 \right]^{\frac{-1}{gb(1-a)+1}} \tag{16}$$

A "balanced" variation of the nominal level of public spending, i.e. when $l = b$, is neutral on employment[4]:

---

[2] Direct employment in the public sector would be equivalent to public consumption of composite goods.

[3] All demonstrations of the results below are presented in an appendix available from the author.

[4] This would not hold if public spending or leisure entered households' utility function in a non-additive way, if public spending entered production functions (as in Turnovsky and Fisher, 1995, for instance), or with distortionary taxation (as in Heijdra *et al.*, 1998). We have ruled out these well-known mechanisms in order to disentangle the effects of the *level* of public spending from those of its *composition*.

$$\frac{\partial l}{\partial f} = 0$$ when $l = b$.

More interesting is the employment effect of the share of the natural resource in public spending

$$\frac{\partial l}{\partial l} = -\frac{(1-a)bgf(1+f)\left(1+\frac{1-b+f(1-f)}{a(b+lf)}\right)^{\frac{-1}{gb(1-a)+1}}}{a(bg(1-a)+1)(b+lf)^2} \tag{17}$$

The effect is null in case of constant returns in natural resource production ($a = 1$) or when labour supply is fixed ($g = 0$) and strictly negative in every other case. There is thus what we may label a "public spending employment dividend" from saving (domestically produced) natural resources in the public sector.

The explanation is straightforward: a decrease in public consumption of the natural resource makes the least efficient resource producers exit the market. Hence, the price of the resource, which is set by the least efficient firm in activity, decreases, raising real wage thus employment.

Since the level of public spending is neutral, this result holds irrespective of the financial profitability of such a programme, i.e., would the lessening in natural resource bills exceed the expenditures needed to decrease this bill? This result is interesting since the potential for financially profitable energy-efficient investments is a matter of argument for energy engineers as well as economic theorists[5].

Total private consumption is

$$C = \frac{\left(1+\frac{1-b+f(1-l)}{a(b+lf)}\right)^{-\frac{1-b(1-a)}{1+bg(1-a)}}}{a(b+lf)} \tag{18}$$

The effect of the level of nominal public expenditure is given by

$$\frac{\partial C}{\partial f} = -\frac{\left(b(1-(1-a)b)(1+(1-a)gl)+(1+(1-a)bg)\,l\,(1-(1-a)\,l)f\right)\left(1+\frac{1-b+f(1-l)}{a(b+lf)}\right)^{-\frac{1-(1-a)b}{1+(1-a)bg}}}{\left(a(1+(1-a)bg)(b+lf)^2(1-b(1-a)+f(1-l(1-a)))\right)} \tag{19}$$

which is negative: an increase in public spending crowds out private consumption, as usual in a model without increasing returns or nominal rigidities. The effect on private consumption of the share of natural resource in public expenditure is given by

$$\frac{\partial C}{\partial l} = -\frac{(1-a)f\left(1+\frac{1-b+f(1-l)}{a(b+lf)}\right)^{-\frac{1-b+ab}{1+bg(1-a)}}\left((b-l)f+gb\left((1-b(1-a))+f(1-l(1-a))\right)\right)}{a(1-bg(1-a))(b+lf)^2(1-b(1-a)+f(1-l(1-a)))} \tag{20}$$

which equals zero in case of constant returns in natural resource production ($a = 1$). When $a < 1$, because the denominator and the first term of the numerator are positive, the above expression is strictly negative if and only if

$$l < b + \frac{b(1-(1-a)b)g(1+f)}{(1-(1-a)bg)f} \tag{21}$$

Since the second part of the RHS is positive, this inequality means that if the initial share of natural resource in public expenditure is not greater than that of private consumption ($l \leq b$), then (i) a decrease in l unambiguously increases private consumption; (ii) an increase in l reduces private consumption, up to a

---

[5] Bruce, Lee and Haites (eds.) (1995), Ch. 8 and 9 ; Jaffe and Stavins (1994).

certain point which depends on parameters. This last non-monotonic response proceeds from the combination of two antagonistic effects. First, real wage and employment decrease with l , lessening purchasing power of households. Second, abstracting from the first effect, the consumer price index decreases as soon as the allocation of public spending l departs from that of households b, improving purchasing power of households. Simulations of section 3 indicate that condition 21 is likely to hold for most countries, at least for energy.

However, remember that from (19), public spending crowds out private consumption. Hence, if the energy-saving program is not financially profitable and if the government wants to maintain the supply of public goods, the level of public spending will rise and private consumption may fall.

Let's turn to environmental effectiveness. Formally

$$X^R = \frac{\left(1+\frac{1-b+(1-l)f}{a(b+lf)}\right)^{-\frac{a}{1+(1-a)bg}}}{a} \quad (22)$$

$$\frac{\P X^R}{\P l} = \frac{f(1+f)\left(1+\frac{1-b+f(1-l)}{a(b+lf)}\right)^{-\frac{a}{1+bg(1-a)}}}{(b+lf)(1-bg(1-a))(1-b(1-a)+f(1-l(1-a)))} \quad (23)$$

which is positive. Intuitively, a decrease in public demand for natural resources reduces the relative price of the resource and raises private demand for the resource. However, this ‘rebound’ effect is never sufficient to cancel out the ‘first dividend’, i.e. resource extraction decreases nevertheless. This is easily understandable with a reductio ad absurdum: if the aggregate demand for the resource were to rise, so would its supply hence its price in terms of labour; real wage and employment would then decrease, which we know is false (equation 17).

Results on welfare are less clear-cut. Formally:

$$U = \frac{\left(1+\frac{1-b+f(1-l)}{a(b+lf)}\right)^{-\frac{1-b(1-a)}{1+bg(1-a)}}}{a(b+lf)} - \frac{g}{g+1}\left(1+\frac{1-b+f(1-l)}{a(b+lf)}\right)^{-\frac{gb(1-a)}{1+bg(1-a)}} \quad (24)$$

Since government spending does not enter households' utility function, a "balanced" rise in f , i.e. when $l = b$, reduces households' utility:

$$\frac{\P U}{\P f} = -\frac{\left(1+\frac{1-(1-a)b}{ab}\right)^{-\frac{1-(1-a)b}{1+(1-a)bg}}}{ab(1+f)^2} \text{ when } l = b \quad (25)$$

which is negative. The impact of a decrease in l is ambiguous since consumption rises – as long as condition (21) holds – but leisure declines:

$$\frac{\P U}{\P l} = \frac{\P C}{\P l} + \frac{(1-a)bg^2 f(1+q)\left(1+\frac{1-b+f(1-l)}{a(b+lf)}\right)^{-\frac{1}{1+bg(1-a)}}}{a(1+g)(1+bg(1-a))(b+lq)^2} \quad (26)$$

Simulations laid out in section 3 show that the consumption effect is likely to outweigh the leisure effect, i.e., utility closely mimics consumption and is likely to raise when condition (21) holds.

Interesting analytical results turn up if we distinguish a representative worker (whose utility is denoted U_w) who receives only wage income, and a representative resource-owner (utility U_r) who earns only rents.

$$U_w = \frac{(1-gf)\left(1+\frac{1-b+(1-l)f}{a(b+lf)}\right)^{\frac{(1-a)b(1+g)}{1+(1-a)bg}}}{(1+g)(1+f)} \quad (27)$$

$$\frac{¶U_w}{¶l} = -\frac{(1-a)bf(1-gf)\left(1+\frac{1-b+(1-l)f}{a(b+lf)}\right)^{\frac{(1-a)b(1+g)}{1+(1-a)bg}}}{(1+(1-a)bg)(b+lf)(1-(1-a)b+(1-(1-a))lf)} \qquad (28)$$

which equals zero in case of constant returns in natural resource production ($a=1$). With decreasing returns, this expressions is strictly negative when $f < \frac{1}{g}$. Since f is around 0.2 in most countries and estimates of g are between 0.1 and 0.4 in most econometric studies[6], expression (28) is negative for any credible values of the parameters.

$$U_r = \frac{(1-a)\left(1+\frac{1-b+(1-l)f}{a(b+lf)}\right)^{-\frac{1-(1-a)b}{1+(1-a)bg}}}{a(1+f)} \qquad (29)$$

$$\frac{¶U_r}{¶l} = \frac{(1-a)(1-(1-a)b)f\left(1+\frac{1-b+(1-l)f}{a(b+lf)}\right)^{-\frac{1-(1-a)b}{1+(1-a)bg}}}{a(1+(1-a)bg)(b+lf)(1-(1-a)b+(1-(1-a))l)f} \qquad (30)$$

which is null when $a=1$ and positive otherwise. In other words, following a decrease in l , households who get only wage income are better off while those receiving only rents are worse off. This is obviously because real wage rises while real rents decrease.

3. Results of the simulations

Four scenarios are generated by varying two key parameters: the elasticity of labour supply g and the magnitude of decreasing returns in resource production a :

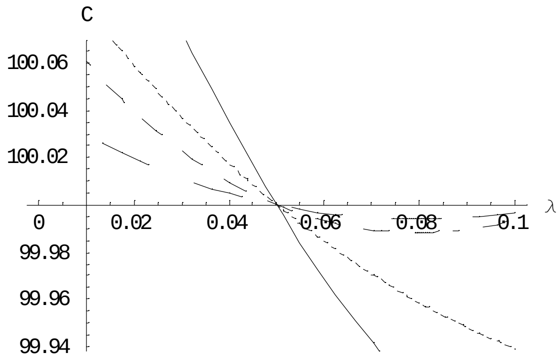
Table 1. Parameters scenarios

Common features: q =0.2, b =0.05		**magnitude of decreasing returns in resource production**	
		High (a =0.5)	Low (a =0.75)
elasticity of labour supply	High (g =0.4)	Solid line	Short dashing
	Low (g =0.1)	Intermediate dashing	Long dashing

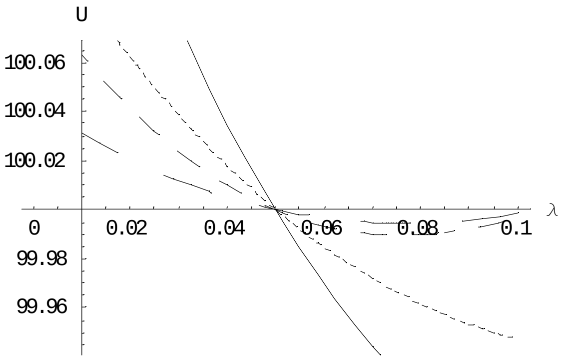
The four graphs below display the values of *C* (private consumption), *U* (welfare), *l* (employment) and *Xr* (natural resource production) for q =0.2, b =0.05 and l ranging from 0.01 to 0.1. The particular value of b reflects the share of fossil fuels (coal, oil and gas) in households' budget in France (INSEE, 1998). To improve the clarity of the presentation, every curve is normalised at 100 for l =0.05, so that variations of the endogenous variables are displayed as a percentage of their initial value.

[6] Killingsworth (1983).

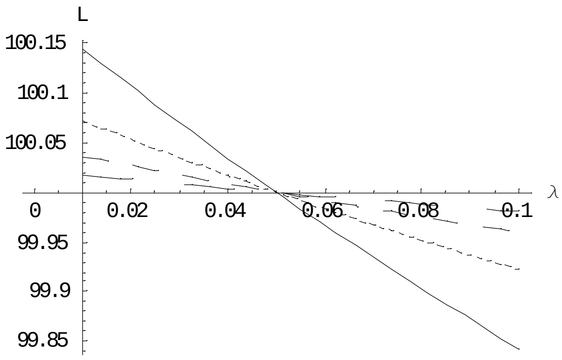
Private consumption



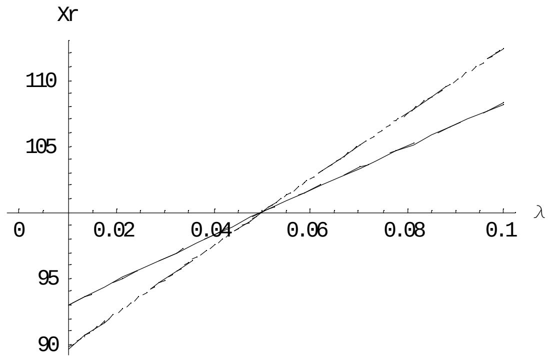
Welfare



Employment



Resource production



Let's first focus on the two variables that respond to a variation in l in a non-monotonic way: *C* and *U*. For the high elasticity of labour supply scenarios, a decrease in l raises both variables even if the initial share of resource in the public sector is twice that of the private sector. In the low elasticity of labour supply scenarios, however, a decrease in l slightly harms consumption and welfare if the initial value of l is at least 50% higher than b, and is beneficial in terms of consumption and welfare otherwise. The "real" values of l and b of course depend on the country and on the resource, but taking as an illustration the final consumption of fossil fuels in France (INSEE, 1998), we have $b \approx 0.05$ and $l \approx 0.047$. This means that according to our model, an energy-saving program in the French public sector would raise consumption and welfare, on top of employment.

Are our results quantitatively significant? U.S. and European public sector energy saving programs generally aim at a 20 to 30% reduction – meaning approximately a change in l from 0.05 to 0.035 or 0.04. At best, it would bring a 0.1% rise in employment and a 0.05% rise in consumption and welfare. This may seem at first sight modest, but one cannot expect a huge side effect from what is only a partial climate change mitigation measure. Macroeconomic evaluations of the more ambitious carbon/energy tax proposals typically predict an employment impact of +0.1% to +0.7% and an unclear effect on welfare (Majocchi, 1996). Furthermore, the environmental effectiveness of the policy, admittedly reduced by the macroeconomic feedbacks, remains significant: a 30% cut in l, which would ex ante lead to a 6% resource saving (30% * 0.2) yields an ex post saving of 3.4% (for a =0.5) or 5% (for a =0.75).

4. Concluding remarks

We have shown that a switch in public spending away from a natural resource (energy for instance) and towards a composite good increases employment, real wage and workers' utility. It also raises private consumption and welfare under two conditions. First, the initial share of energy in public spending must be smaller than that of private consumption, or the difference must be small enough. Simulations show that it is likely to be the case at least for energy. Second, it must not entail too high a rise in the aggregate public spending. This last question is a matter or argument for energy engineers as well as economic theorists and is outside the scope of this paper.

Furthermore, even if the private demand for the resource rises following the switch in public spending, this 'rebound' effect is never sufficient to cancel out the 'first dividend', i.e. resource extraction decreases nevertheless.

Hence, there is always an "employment double dividend" from saving energy in the public sector, and also a "welfare double dividend" if such policy is not too costly. Admittedly modest in quantitative terms, these macroeconomic effects are not trivial when compared to those predicted for ecological tax reforms.

However there is no room for a Pareto-improvement: households earning only rents are worse off while those earning only wage income are better off.

The crucial assumption here is that marginal returns are lower in the natural resource sector than in the composite sector. This seems fairly obvious: extraction costs of known deposits are highly variable, at least for gas and oil, and deposits that are not discovered yet are likely to be more costly than known ones. In the composite sector, the constant returns assumption is in line with empirical estimates.

The mechanisms we have formalised in this paper are best thought of as long term effects. In the short run, various rigidities may hold. On the one hand, labour (and also capital) mobility is obviously not perfect. Hence, a decrease in public demand for the natural resource might harm employment and private consumption in the short term[7]. On the other hand, price rigidities may occur. If prices were sticky, a decrease in the share of energy in public expenditure would also raise real wage and employment, through a different mechanism than in our model. Simply, since all the turnover of the composite sector is used for hiring labour while a part of that of the resource sector is distributed as rents, employment intensity of the former is larger than that of the latter.

Up to now, the bulk of the literature on macroeconomic effects of environmental policies has focused on tax reforms. Furthermore, it has typically neglected the technical heterogeneity between the sectors behind the environmental externalities and the rest of the economy. Our results constitute an invitation to devote more attention to other environmental measures than ecological tax reforms and to the modelling of the specific features of environmental-friendly and unfriendly sectors.

---

[7] However this adverse consequence is not granted. Indeed Ramey and Shapiro (1998) analyse the effects of sector-specific changes in government spending in a model with two symmetric sectors. Following an increase in government spending in one sector, real wage and employment are higher when the reallocation of capital across sectors is costly.

References

Borg, N., E. Mills, N. Martin, and J. Harris, 1998, "Energy Management in the Government Sector: An International Review", *Proceedings of the 1997 ECEEE Summer Study*, Prague, Czech Republic. Panel 4, ID 150, 1-24. (European Council for an Energy-Efficient Economy, Copenhagen, Denmark)

Bovenberg, A.L. and F. van der Ploeg, 1994, "Environmental Policy, Public Finance and the Labour Market in a Second-Best World", *Journal of Public Economics*, 55(3), 349-90

Bruce, J.P., H. Lee and E.F. Haites (eds.), 1995, *IPCC Second Assessment Report: Climate Change 1995 - Working group III: Economic and Social Dimensions of Climate Change* (Cambridge University Press, Cambridge)

Crépon, B., R. Desplatz and J. Mairesse, 1999, *Estimating price cost margins, scale economies and workers' bargaining power at the firm level*, INSEE/DESE working paper G 9917, Malakoff, France

Dixon, H.D. and C.T. Hansen, 1999, "A mixed industrial structure magnifies the importance of menu costs", *European Economic Review*, 43, 1475-1499

Dixon, H.D. and P. Lawler, 1996, "Imperfect Competition and the Fiscal Multiplier", *Scandinavian Journal of Economics*, 98(2), 219-31

Dixon, H.D. and A. Pompermaier, 1999, "A comparison of menu costs in open and closed economies with a mixed industrial structure", *Open Economies Review*, 10, 365-384

Goulder, L.H., I.A.W. Parry, R.C. Williams and D. Burtraw, 1999, "The cost-effectiveness of alternative instruments for environmental protection in a second-best setting", *Journal of Public Economics*, 72, 329-360

Heijdra, B.J., J.E. Ligthart and F. van der Ploeg, 1998, "Fiscal policy, distortionary taxation, and direct crowding out under monopolistic competition", *Oxford Economic Papers*, 50, 79-88

INSEE, 1998, *Comptes et indicateurs économiques – Rapport sur les comptes de la Nation 1997*, Paris, France

Jaffe, A.B. and R.N. Stavins, 1994, "The energy-efficiency gap - What does it mean?", *Energy Policy*, 22(10)

Killingsworth, M., 1983, *Labour supply* (Cambridge University Press, Cambridge)

Majocchi, A., 1996, “Green Fiscal Reform and Employment: A Survey”, *Environmental and Resource Economics*, 8(4), 375-397, December

Montague, P., 2000, "Steps Toward A Corporate State", *Rachel's Environment & Health Weekly*, 694

Ramey, V. and M. Shapiro, 1998, "Costly capital reallocation and the effects of government spending", *Carnegie-Rochester Conference Series on Public Policy*, 48, 145-94

Turnovsky, S.J. and W.H. Fisher, 1995, "The composition of government expenditure and its consequences for macroeconomic performance", *Journal of Economic Dynamics and Control*, 19(4), 747-86