

Budzinski, Oliver

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**Ecological Tax Reform
and Unemployment**
**Competition and Innovation Issues in the
Double Dividend Debate**

Oliver Budzinski

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Philipps-Universität Marburg
Am Plan 2
D-35032 Marburg
email: budzinski@wiwi.uni-marburg.de
<http://www.wiwi.uni-marburg.de/Lehrstuehle/VWL/WIPOL>

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Abstract

The question of a double dividend from revenue-neutral ecological tax reforms (an ecological advantage plus an economic advantage) has recently become a widely discussed topic both in real-world economic policy and in economic theory. The subject has produced many advocates and opponents in the scientific community. This paper examines potential economic dividends from revenue-neutral ecological tax reforms by systematically distinguishing between an efficiency dividend and an employment dividend. Their occurrence is discussed from the viewpoint of two different theoretical approaches: namely, the optimal taxation view and the market process view. According to the optimal taxation view, which dominates recent economic analysis on this subject, an efficiency dividend seems doubtful whereas an employment dividend is likely to occur under specific circumstances (e.g. involuntary unemployment and sub-optimal initial tax system). However, there is a considerable number of unsuitable assumptions which create doubt when questioning how appropriate the use of optimal taxation theory is when discussing real-world ecological tax reforms. The market process view enlarges the analysis by integrating effects on and from competition and innovation. This strengthens the occurrence of an employment dividend in an imperfect world with involuntary unemployment. In this framework the reduction of involuntary unemployment results from declining wage costs which boost labour demand, a shift in the bias of the innovation process, and an evolution of the consumption basket because of changing relative prices.

1. Potential Dividends from an Ecological Tax Reform

The potential gains and losses resulting from the implementation of ecological tax reforms have recently been a widely discussed topic both in real-world economic politics and in economic theory. Especially the question of which and how many dividends might result has been raised by many advocates and opponents in the scientific community. Although an extensive literature has been published, in the meantime, on the employment effects of ecological tax reforms, the debate is still lacking a thorough analysis of the influence of dynamic and evolutionary competition and innovation effects.¹ To derive real-world policy implications one has to consider that an ecological tax reform in industrialized countries of the so-called Western World takes place within competitive (and therefore evolutionary) market processes that endogenously produce innovation. Switching from the optimal taxation view (summarized in section 2) to a market process view (section 3) changes the probability and extent of the double dividend distinctively. Since the debate of potential second dividends from ecological tax reforms is often confusing due to what is meant by the second dividend, I start with an attempt to clarify this issue by systematically distinguishing different kinds of possible dividends (section 1).

Naturally, the first potential dividend from environmental taxation is the improvement of the environment. As this dividend is widely accepted, this paper focuses around the supposed additional economic dividends from ecological tax reforms – usually called the second dividend (although there are different things mixed together in the meaning of this expression). This second dividend might occur in so-called revenue-neutral tax reforms: the revenues from ecological taxes (e.g. on emissions or on energy inputs) could be used to cut other taxes and public contributions so that an improvement of the economy might result. This, then, would be an additional *economic* reason to implement an ecological tax reform and therefore the hesitance of politicians and interest groups may be removed.

The existence and the sign of the second dividend is discussed controversially among economists, especially since the work of *Bovenberg* and his co-authors in the middle of the 1990s (*Bovenberg and De Mooij* 1994; *Bovenberg and Goulder* 1996; *Bovenberg and van der Ploeg* 1994, 1996). To be precise, however, it becomes necessary to distinguish between different meanings of the second (economic) dividend of revenue-neutral ecological tax reforms:²

- From the perspective of optimal taxation theory the second dividend is an *efficiency dividend*. If ecological taxes cause a smaller excess burden than other distortionary taxes, allocation will improve due to an ecological tax reform and the enhanced efficiency might cause (subsequently) more growth and more employment (section 2).
- Environmental economists argue that an *employment dividend* occurs when ecological taxes are used to finance a cut in labour taxation, so that labour costs fall (sections 2.2 and 3).
- Third, one could discuss the possibility of a *distribution dividend*. Cutting the taxes on low income and, instead, raising ecological taxes may generate a more just income distribution. To be more compact this aspect is left out in this paper.³

¹ This may be due to the phenomenon that this debate predominantly takes place between advocates of optimal taxation theory and environmental economists – both being mainly non-aware or even sceptical concerning (evolutionary) market competition.

² See *Ekins* (1997, pp. 132) and *McCoy* (1997, pp. 203) for similar distinctions.

³ But see e.g. *Bovenberg* (1998, pp. 30; 1999, sec. 4), *DIW* (1995, pp. 196), *Ekins* (1997, pp. 132) and *Park and Pezzey* (1999, pp. 163) on this topic.

2. The Optimal Taxation Viewpoint

Ecological taxes tend to correct negative externalities and therefore reduce distortions of allocation (*Pigou* 1921). Thus, ecological taxes should be less distortionary than other taxes and the tax system might be improved by substituting distortionary taxes with ecological taxes (*Terkla* 1984; *Lee and Misiolek* 1986; *Oates* 1995). The efficiency gain should boost economic growth and thereby lead to more employment, especially when labour taxes are cut in favour of ecological taxes.⁴ This kind of double dividend is challenged by *Bovenberg et al.* from the perspective of optimal taxation theory, in which the excess burden of taxation becomes the decisive aspect when looking at gains in efficiency. Ecological taxes lead to a rise in the prices of polluting goods wherefore a distortion of the consumers' previous pareto-optimum will occur. Perhaps the new indifference curve (that is achieved after the tax reform) will represent a lower individual utility level than the old one, so that the utility loss overcompensates the efficiency gain. The higher price level will cause a decline in real wages and therefore will erode the incentive to supply labour (*Bovenberg* 1999, p. 427).

The second dividend becomes negative (*Bovenberg and De Mooij* 1994, pp. 1085; *Bovenberg and Goulder* 1996; *Christiansen* 1996; *Goulder* 1995), due to an increased excess burden on the whole taxation system: the explicit tax on labour becomes substituted by an implicit one since the incidence of the ecological tax remains on the – assumed⁵ – only immobile production factor labour. This causes a more violent erosion of the tax base than in the case of direct labour taxation so that efficiency losses with a deterioration of real output and employment result.

Altogether, the optimal taxation view leads to a negative economic dividend via the following train of thought: On the one hand real net wages grow because of the cut in labour taxes, but on the other hand they decline because of the higher prices on the polluting goods. The second aspect overshadows the first one because of the higher excess burden due to the more violent erosion of the ecological tax base. According to equilibrium theory, the declining real wages lead to less labour supply and, therefore, employment declines – the second dividend becomes negative (*Bovenberg* 1998, pp. 20; *Bovenberg and De Mooij* 1994, pp. 1087; 1996, pp. 11, 18).⁶

2.1. The Basic Model

Figure 1 shows the basic train of thought in a simple equilibrium model. I concentrate on the labour market since this paper focuses around employment effects: labour supply (L^S) and labour demand (L^D) follow the common assumptions of equilibrium theory, except of the fact that labour demand is a function of gross wages (w^g) whereas labour supply is a function of after-tax or net wages (w^n):

$$(1) \quad L^S = L^S(w^n), \text{ with } \frac{dL^S}{dw^n} > 0.$$

$$(2) \quad L^D = L^D(w^g), \text{ with } \frac{dL^D}{dw^g} < 0.$$

The initial equilibrium ($t = 1$) is defined:

⁴ Most authors discuss a cut in labour or income taxation; only few focus on a cut in social security contributions (see section 2.2.). A cut in profit taxes are analysed by e.g. *Bovenberg and De Mooij* (1996, pp. 23) and *Terkla* (1984, pp. 114).

⁵ See e.g. *Bovenberg and De Mooij* (1994, pp. 1085) and *Bovenberg* (1998, pp. 16).

⁶ For an opposite conclusion drawn from an optimal taxation approach see *Jaeger* (1997).

$$(3) \quad L_1^S(w_1^n) = L_1^D(w_1^g).$$

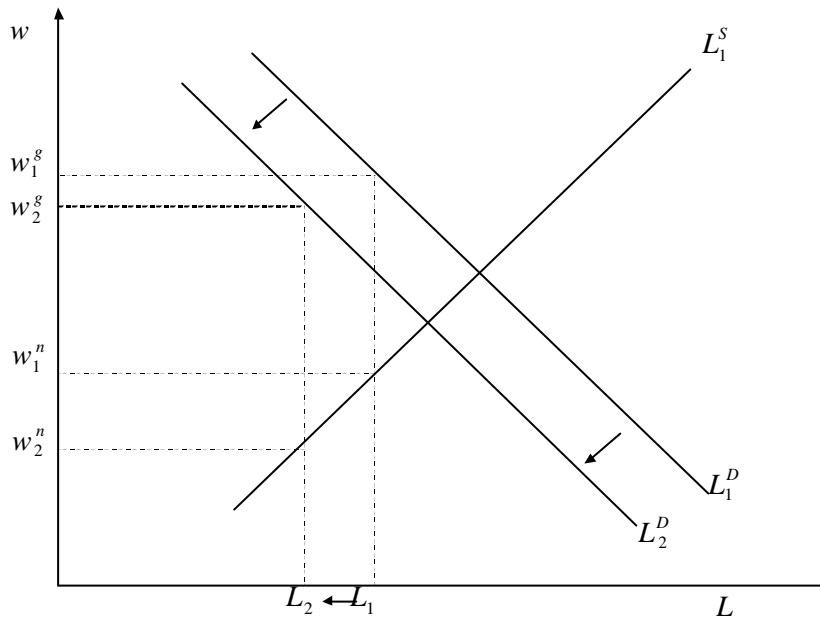


Figure 1: Ecological tax reform and voluntary unemployment; following Kirchgässner (1998a, p. 39)

The basic model of *Bovenberg et al.* allows only for voluntary unemployment and the decisive influence on employment is the individual decision to supply labour. In $t = 2$ a revenue-neutral ecological tax reform with a cut in wage taxes is implemented. Because of the ecotaxation gross wages decline to w_2^g , so that labour demand increases (L_1^D / w_2^g) .⁷ Since at the same time the excess burden of taxation increases, the after-tax wages decline to w_2^n . This causes a decline in labour supply (due to a substitution of labour supply by leisure) (L_1^S / w_2^n) and therefore output declines, too. A lower output level leads to a shift in labour demand (L_2^D / w_2^g) and a new equilibrium with less employment results.

In this basic model the employment effect depends on the supply elasticity of a change in net wages (*Bovenberg and De Mooij* 1994, pp. 1087):

$$(4) \quad h = \frac{dL^S / L^S}{dw^n / w^n}.$$

$$(5) \quad \text{If } h > 0 \text{ and } \frac{dw^n}{w^n} < 0, \text{ then } \frac{dL^S}{L^S} < 0.$$

An increase in employment could only occur if labour supply increases with declining net wages (backward-bending labour-supply curve), maybe because employees try to compensate lower wages by offering more labour.

⁷ It is assumed that the cut in wage taxes is (at least partly) used to reduce gross wages and not only to rise net wages. This might be a heroic assumption if strong unions exist.

2.2. Double Dividend and Involuntary Unemployment

Presently, full employment (or, in other words, the existence of only voluntary unemployment) cannot be observed in most European labour markets. On the contrary, massive involuntary unemployment leads to the assumption that not labour supply but labour demand is the rationing factor on labour markets. Therefore some modifications of the basic model might be useful.

To model involuntary unemployment in fig. 2 it is assumed that actual wages are higher than equilibrium wages and rigid. Due to institutional imperfections and sufficient union power, wage cuts become unlikely to occur. As a second modification labour demand now becomes a function of wage costs (w_1^c) instead of gross wages:

$$(6) \quad L^D = L^D(w_1^c), \text{ with } \frac{dL^D}{dw_1^c} < 0.$$

As a consequence, it becomes possible to consider not only a cut in wage or income taxes but a cut in employer's social security contributions, too. The main difference between these two kinds of compensation is that wage costs decline directly when employer's social security contributions are cut (net wages remain constant) whereas declining wage or income taxes lead to a reduction of employees' tax burden and leave wage costs untouched at that time (net wages increase whereas gross wages remain constant). Only when – and if – employers participate through wage negotiations (which may be prevented because of the unions' influence), a subsequent decline in wage costs may be achieved.⁸

Involuntary unemployment is at U_1 in $t = 1$ (fig. 2) and the labour market is determined by labour demand (dependent on wage costs). In $t = 2$ a revenue-neutral ecological tax reform with a cut in employer's social security contributions is implemented. As a consequence of the declining wage costs labour demand increases to (L^D / w_2^c) . When influences both on the supply-side of the labour market and through a change in the excess burden are excluded, involuntary unemployment would fall to U_2 (fig. 2).

⁸ For empirical and theoretical benefits of substituting employer's social security contributions by ecological taxes in comparison to cutting wage taxes, income taxes, or value-added taxes see also Carraro, Galeotti and Gallo (1996), Ekins (1997, pp. 137), Majocchi (1998, pp. 383), and Park and Pezzey (1999, pp. 174).

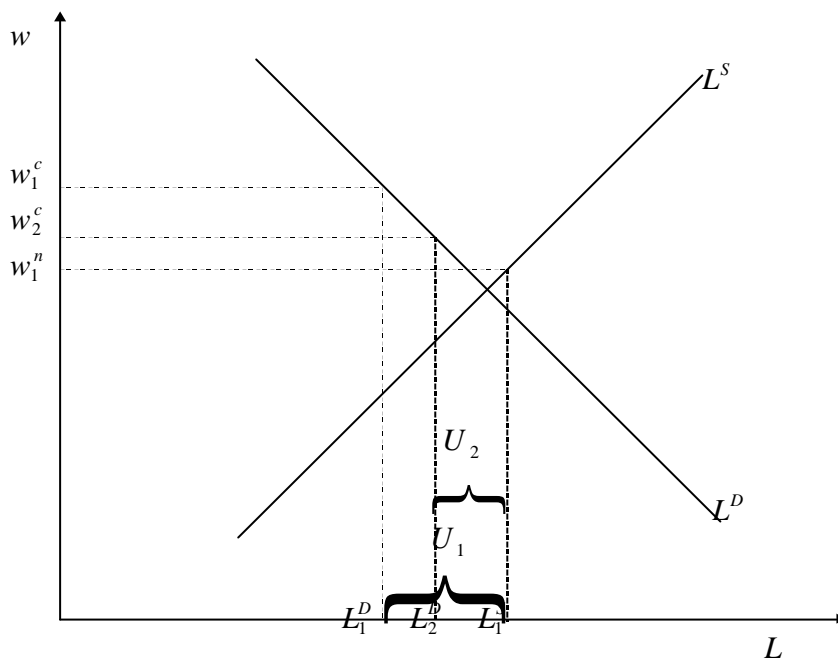


Figure 2: Ecological tax reform and involuntary unemployment

The result does not change by integrating the consequences provided by optimal taxation theory, because the two occurring effects work in opposite directions: An increase in excess burden causes the demand curve to shift to the left which reduces the employment effect. The following decline of net wages leads to a decline in labour supply and thereby strengthens the reduction of involuntary unemployment. However, if the latter effect is excluded due to rigid (net) wages, the increasing deadweight loss of the reformed tax system (causing a general reduction of labour demand because of declining output) might – under specific circumstances – overcompensate the increase of labour demand due to declining wage costs.

Nevertheless, even from the perspective of optimal taxation theory, a double dividend becomes more probable if involuntary unemployment is high and if the revenue-neutral ecological tax reform leads to a decline in wage costs.⁹ However, the economic dividend occurs not necessarily in terms of efficiency gains but in terms of reducing involuntary unemployment. The employment effect is therefore not driven by labour supply as in the case with voluntary unemployment (see section 2.1.) but by labour demand depending on the gap between wage costs and net wages¹⁰:

$$(7) \quad U_2 < U_1, \text{ if: } \frac{w_1^c}{w_1^n} > \frac{w_2^c}{w_2^n}.$$

In conclusion, with involuntary unemployment the case for the double dividend is theoretically more positive than in the case of only voluntary unemployment: while the results concerning an efficiency dividend remain ambiguous, an employment dividend seems to be

⁹ See also Bayindir-Upmann and Raith (1998); Hoel (1998, pp. 91); Koskela, Schöb and Sinn (1998); Nielsen, Pedersen and Sørensen (1995); Schneider (1997).

¹⁰ Koskela and Schöb (1999) developed a double-dividend-model where involuntary unemployment declines (under certain circumstances) because of supply side effects of the labour market. Consequently they (pp. 1728) concentrate on unemployment benefits instead of social security contributions. The latter is more important when – as in this paper – labour demand is considered to be the rationing factor on labour markets.

more probable (*Bovenberg and van der Ploeg* 1994, 1996, 1998). To weigh whether employment or efficiency effects according to optimal taxation theory will dominate in real-world economies, some extensions of the basic view are briefly discussed in the next section: do revenue-neutral ecological tax reforms increase prices and reduce output?

2.3. Efficiency Dividend versus Employment Dividend

Negative employment effects in the optimal taxation view of the double dividend issue crucially depend on declining real wages because of rising prices of polluting goods (thereby eroding labour supply) and on a reduction of output due to an increasing tax burden (substituting direct labour taxation by indirect labour taxation). In the case of involuntary unemployment both effects might exceed the employment dividend so that the resulting economic deficiencies dominate the labour-demand increase due to the decline of wage costs. One can discuss this – according to the differentiation provided in section 1 – in terms of different economic dividends of an ecological tax reform that work in opposite directions: a negative efficiency dividend versus a positive employment dividend.

Let me first address the problem of ecoinflation. In the framework of optimal taxation theory the – inevitable – increase in the prices of polluting goods leads to an increase of the price level, too. This forces consumers to change their (initially optimal) consumption basket so that a lower utility level is realized. With regards to real-world ecological tax reforms, one may object to the first effect that consumers will – indeed – change their demand habitude according to the changing price relations: they will reduce the consumption of the polluting – and therefore more expensive – goods. However, this does not imply that the price level will inevitably increase. Since labour costs decline due to the ecological tax reform, the prices of labour-intensive produced goods will decrease and these goods will become relatively inexpensive. Thus, the purchase power of the consumers income need not decline through a revenue-neutral ecological tax reform as only some prices will rise while others fall – instead of a change of the price level, changes in the price relations will occur (*DIW* 1995). In real-world competitive market processes such changes in relative prices are quite normal and, moreover, basically necessary to face the coordination task of self-organizing markets. Permanently adjusting their individual economic plans to the evolving relative prices represents a distinguishing mark of competitively interacting individual agents. Since agents will adapt to the additional changes in relative prices due to the ecological tax reform, the dynamically changing consumption basket will probably erode any inflationary effect through time.

A distortionary effect of a revenue-neutral ecological tax reform on consumers can only be maintained if the consumers are assumed to possess an optimal pre-reform consumption basket, because, after the ecological tax reform they would then in fact end up with a sub-optimal distribution. This points to the assumption of the basic equilibrium model of optimal taxation theory that the initial equilibrium is optimal in all respects with exception of the environmental problem.¹¹ However, concerning real-world (and, therefore, imperfect) economies it becomes rather improbable and inappropriate to insist on optimal and non-distortionary initial situations. Therefore, it cannot be maintained that the tax reform induced change of the consumption basket leads automatically to a decreasing utility level.¹² If, for

¹¹ For the criticism of drawing (real-world) policy implications on the basis of this assumption see among others *Backhaus* (1996, pp. 121); *Bohm* (1997); *Ekins* (1997, p. 132); *Kahn and Farmer* (1999); *Park and Pezzey* (1999), and rather drastically *Kirchgässner* (1998a, 1998b).

¹² To maintain the utility-reducing effect in an imperfect and distortionary environment implies to judge the status quo distribution to be more valuable than potential future distributions. By this, the interests of the present winners (future potential losers) are favoured above the interests of future potential winners (present

instance, tax-favoured consumption (by tax-exemptions or by taxes that are not neutral concerning the prices of consumer goods) occurs before the implementation of an ecological tax reform (so that the initial consumption basket is distorted), the net utility effect tends to be more positive and there may exist gains from a double dividend (*Parry and Bento 2000*).

The second challenge to the efficiency dividend in the optimal taxation framework is represented by the reduction of output due to the increasing deadweight loss during the shift from direct to indirect labour taxation. In this case, the assumption that labour represents the only immobile factor of production is crucial. Therefore, the incidence of taxes on capital, resources, and energy finally falls on the factor labour again – but with decreasing efficiency (*Bovenberg and De Mooij 1994*). The erosion of the tax base of the assumed totally international mobile factors occurs more violently than of the immobile factor labour. In real-world economies specific kinds of capital (e.g. listed securities) indeed represent an almost perfectly mobile factor. However, all of the other factors are partially mobile and partially immobile and, therefore, tax avoidance will be imperfect in real-world economies. Giving up the assumption of perfect mobility of all factors but labour brightens the case for an efficiency dividend (*Bovenberg 1998; Bovenberg and De Mooij 1996*).

Additionally, different opinions exist concerning the meaning of *distortion* in the scientific discussion between optimal taxation economists and environmental economists. Whereas the optimal taxation view regards the allocation after the ecological tax reform as distortionary, environmental economists insist on the distortion reducing effect of the induced changes both in production structure and in the consumption basket (*Ekins 1997*, p. 135, pp. 147; *Majocchi 1996*, p. 376) and, thereby, claiming the initial tax system to be distortionary. They blame the optimal taxation view for ignoring economic welfare effects and growth potentials resulting from a cleaner environment (with examples *Kahn and Farmer 1999*, pp. 436). Furthermore, the connection between output (or, in a more dynamic sense, economic growth) and employment is challenged, predominantly by environmental economists (see among others *Goulder 1995; Kirchgässner 1998a, 1998b*).

As this section has demonstrated, turning from the first-best world of optimal taxation theory to the imperfect real-world challenges the negative efficiency dividend. Although the conflict between efficiency and employment dividend cannot be solved when starting from an optimal taxation framework, it becomes rather improbable that the negative efficiency dividend in real-world economies is strong enough to dominate the positive employment dividend. This result stands widely in accordance with the findings of *Bovenberg et al.* The employment dividend becomes positive as soon as involuntary unemployment is considered (see section 2.2.). If the assumption that labour is the only immobile factor is additionally dropped, if a shift in the tax burden away from labour towards other at least partly immobile factors (energy, resources, capital) is allowed for instead, and if the initial tax system is sub-optimal and increases wage costs above the full employment level, then – according to *Bovenberg et al.* – even a *triple dividend* may occur: better environmental quality, more employment, and more profits.¹³

losers) – a statement obviously normative in character and, moreover, difficult to justify. See *Vanberg (2001)* for a (general) discussion from the perspective of constitutional economics.

¹³ „This paper has shown that, starting from a sub-optimal tax system, a shift in the tax burden away from labour towards resources may yield a triple dividend in that not only environmental quality improves but also employment expands and after-tax profits rise. (...) With environmental externalities and labour market distortions, the case for a resource tax becomes even stronger in order to internalise pollution externalities and reduce the tax burden on labour, thereby mitigating the gap between the marginal productivity of labour and the reservation wage due to rigid consumer wages.” *Bovenberg and van der Ploeg (1994, p. 18)*. See also *Bovenberg (1998, pp. 24, 29)*.

Competition and innovation issues are generally neglected in the double-dividend debate. Or, respectively, competition is equalled to a specific (static) market structure, predominantly to homogenous polypolies. To derive policy implications that serve as foundations of real-world economic policy decisions, competition has to be understood as a dynamic process. Then, innovation becomes an integral and endogenous part of the competitive market process. Section 3 provides a framework that allows to analyse both competition and innovation effects of a revenue-neutral ecological tax reform from a real-world economics perspective. This will strengthen the case for an employment dividend.

3. The Market Process View

Market process theory provides an adequate framework in order to integrate effects caused by market competition and innovation. First, a brief introduction to the role and meaning of competition and innovation in market process theory is presented (section 3.1.). Thereafter, an analysis is made of the economic dividends resulting from a revenue-neutral ecological tax reform if competition and innovation effects are systematically considered (section 3.2.). In conclusion, some political-economic considerations that entail some importance for the realisation of ecological tax reforms are briefly discussed (section 3.3.).

3.1. Competition and Innovation in Market Process Theory

The foundations of modern market process theory stem from traditional and modern Austrian Economics¹⁴ and evolutionary (new) Institutional Economics¹⁵. Market economies are described as competitive market processes that are permanently evolving, everlasting, endogenously innovation generating and principally open in results (*Langlois 1994; Metcalfe 1998*). Thus, the relative importance of equilibrium analysis (with optimal taxation theory being a specific version of it) changes significantly. Since optimality and equilibria are seen as phenomena that do not represent real-world market economies – the latter being characterized by principal imperfectness and continuously evolving markets – their analysis becomes limited to imperfect equilibrating tendencies within market processes (e.g. *Kirzner 1992*) or may even be completely abandoned and replaced by the analysis of radical subjectivity and ordering principles of evolutionary processes (e.g. *Lachmann 1986; Boettke, Horwitz and Prychitko 1994*). In market processes, innovations are endogenously generated through the competitive interaction of individual agents. By extending the Austrian notion of competition as a discovery procedure (*Hayek 1968*), one can describe the meaning of competition and innovation in market process theory according to the concept of competition as a knowledge-creating process of experimentation (*Kerber 1994, 1997*).

Individual agents develop hypotheses about successful modes of behaviour in competitive interaction that are built on their subjective and fallible knowledge. By performing the modes of individual behaviour that are individually expected to be advantageous, the agents test their hypotheses on reality and thereby processes of mutual learning (creation of situational knowledge) occur. Through competitive interaction, the individual (subjective) expectations become confirmed or disappointed. In the case of disappointment the respective agent has an incentive to change his mode of behaviour, since his previous behavioural repertoire has been endogenously devaluated through market competition (*Wegner 1997*). He can now – principally – react in three different ways that altogether further drive competitive interaction: first, he can react conservatively and imitate specific modes of behaviour that have been more successful so far, according to his (fallible) observations. This adaptive behaviour will erode

¹⁴ See *Hayek (1948, 1967, 1973, 1978)* and for the modern stream *Lachmann (1986)* and *Kirzner (1992, 1997)*.

¹⁵ See among others *Langlois (1986); North (1990, 2002); Buchanan and Vanberg (1991); Kasper and Streit (1999)*.

the advantage of the previously more successful agents and provide an incentive for them to continue to innovate. Second, he can react innovatively himself and create a new mode of behaviour that will represent an innovation for interacting agents. If successful, the innovation will devalue the present modes of behaviour of the interacting agents. Thus, through both types of reaction the endogenously produced incentive to innovate will endure. Third, the agent may refuse to learn and insist on his previous mode of behaviour. However, this may erode his individual competitiveness in the course of time and, thereby, decrease his economic performance. If the agent happens to be a supplier, competitive market selection may consequently drive him out of the respective market.

Competitive interaction of individual agents permanently produces incentives to innovate. Through a process of experimentation, situational and fallible knowledge is created which serves both to coordinate divergent individual plans and to create new divergencies so that the task of coordination does not cease throughout the competitive market process (endogenous and permanent production of innovation). However, the coordinating forces of competitive interaction continuously prevent the innovation-generating market process from becoming a purely random and non-systematic enterprise. Competitive market processes are orderly due to their institutional framework. Codified and informal, external and internal institutions guide the competitive interaction (*Langlois 1986; North 1990*) and exclude or devalue specific kinds of behaviour (*Wegner 1997*), thereby forcing the possible paths of market evolution into an evolutionary corridor that reduces the complexity of interaction and thus enables the individual agents to behave systematically and purposeful (without determining neither the trajectory of evolution nor the performed individual behaviours). Each specific competitive market context depends on the respective institutional arrangements that mould what becomes a profitable opportunity. Therefore, one may call the institutional framework a system of incentives: some (specific) modes of behaviour decrease individual utility because they are negatively sanctioned by public or social authorities while others (neither determined nor finally designed in advance by the institutions) become individually profitable since the institutional conditions allow them to be performed successfully in competition. The evolution of the institutional framework changes the incentives connected to it and induces changes in profitable modes of behaviour: currently performed and previously individually profitable modes of behaviour will become devaluated and new ones will substitute them, thereby increasing individual gains. Thus, the evolution of institutional arrangements offers scope for the creation of new hypotheses and for innovative behaviour.

From the perspective of market process theory, a revenue-neutral ecological tax reform represents such an incentive-changing evolution of the institutional framework of the competitive market economy. Due to the externalisation of ecological costs individual modes of behaviour that lead to ecological damages have been profitable under the previous institutional framework and, therefore, have been performed widespread. After the reform these behavioural modes become devaluated and gain less individual profits (or even individual losses). This influences the behaviour of the individual agents and leads them to create modes of behaviour that avoid ecologically harmful (and therefore taxed) effects. They will, thus, become more successful in competitive interaction and will introduce ecological innovations. This behavioural change is not motivated by individual ecological concerns (preferences for environmental benefits) but by the increase of individual competitiveness and individual profits. The same train of thought applies to a cut in wage-cost-increasing taxation (especially employer's social security contributions). To engage in labour-intensive production, technology and innovation becomes a more profitable mode of behaviour and increases entrepreneurial competitiveness. It belongs to nature of competitive market processes that no political agency prescribes ecological paths of economic development and subsequently dictates the respective path-change. Instead, the evolution of the incentive-

setting institutional framework leads to a competition for ecological innovation, motivated by the individual self-interest of the interacting agents. More ecological trajectories of the market processes are discovered and created through competition as a knowledge-generating process of experimentation and, therefore, this represents an invisible-hand-solution to environmental problems.

This offers a different perspective on the double dividend issue: the second dividend is no longer defined in terms of efficiency, since efficiency becomes a relative term corresponding to the respective institutional arrangements (adaptive efficiency). When the institutional framework changes, different modes of behaviour (comparing to the former situation) must be performed to achieve the “same” efficiency. Thus, it becomes inadequate to discuss institutional evolution (as an ecological tax reform) in terms of changes in efficiency.¹⁶ Instead, the market process view concentrates on the second dividend as an employment dividend. The crucial question is how an ecological tax reform changes the incentive to demand labour on imperfect labour markets (that are characterized by involuntary unemployment) and the rationalization character of the induced innovations. This is explored in the following section.

3.2. Competition, Innovation, and the Employment Dividend

Assuming involuntary unemployment on the labour market (and, therefore, assuming labour demand as the rationing market side) the decision problem of the entrepreneurs can be described in terms of the combination of three production factors: labour (L), capital (K), and (natural) resources (R) including energy.¹⁷

$$(8) \quad Y = f(L, K, R).$$

It is assumed that these factors are partially substitutional. This implies that all factors are only partially international mobile which – in spite of globalisation – does not seem to be too unrealistic even with regards to capital: whereas some kinds of capital (such as tradable securities) are almost perfectly mobile, most are certainly not. This is especially the case with real capital and the financial and real capital of small and medium firms. On the other hand, labour certainly is not perfectly immobile since especially highly qualified specialists, but also some low-skilled workers (e.g. construction workers), are notably international mobile.

$$(9) \quad Y = L^l \cdot K^k \cdot R^s .$$

The main economic variable influencing the factor relations is the relative price (\mathbf{p}) of each factor group (which are assumed to be homogeneous to keep the model simple):

$$(10) \quad \mathbf{p}^L = \frac{p^L}{p^K + p^R}; \quad \mathbf{p}^K = \frac{p^K}{p^L + p^R}; \quad \mathbf{p}^R = \frac{p^R}{p^L + p^K} .$$

To increase profits, entrepreneurs will try to produce a given output with a strong share of the relatively cheap factors and will try to reduce the use of the relatively expensive ones. Thus,

¹⁶ Both the institutional framework before the tax reform and the one after it allow for efficient economic activities. The difference is that different modes of behaviour will prove efficient under different institutional arrangements. Additionally, in an imperfect world, one has to distinguish between the potential efficiency (maximum-achievable efficiency) and the efficiency that imperfect and fallible (inter-) acting agents actually perform.

¹⁷ Following the methodological approach of market process theory it is not intended to build a complete closed mathematical model that pretends that problems of social interaction can be a matter of calculation (see among others *Hayek* 1937 and *Rizzo* 1992). Instead, the competitive market process is assumed to be open in result and principally indetermined. Thus, the formal presentation serves as a didactic heuristic to clarify the line of thought.

the amount of factor input depends on the relative price of the respective factor group, whereby (9) can be written as follows:

$$(11) \quad Y = L(\mathbf{p}^L)^l \cdot K(\mathbf{p}^K)^k \cdot R(\mathbf{p}^R)^r,$$

with:

$$(12) \quad \frac{dL}{d\mathbf{p}^L} < 0, \quad \frac{dK}{d\mathbf{p}^K} < 0, \quad \text{and} \quad \frac{dR}{d\mathbf{p}^R} < 0.$$

The higher the relative factor price the more economically this factor will be used. A change in one absolute factor price causes changes in all relative factor prices (10) and initiates substitution processes: factors with rising relative prices are replaced by other factors as far as the technological conditions will allow for.

In a competitive market process, the technological conditions which shape the substitution processes are not given but depend on the type and rate of innovation (\mathbf{t}). The rationalisation effects of innovations are normally not neutral concerning the different groups of production factors. Competitive entrepreneurs demand special kinds of innovation depending on their decision problem (combination of production factors). They prefer innovations that reduce the use of the relative expensive factors in relation to the other factors. Therefore the innovation process is biased and tends to concentrate on rationalising the relative expensive factor under the prevailing institutional setting.¹⁸

$$(13) \quad \mathbf{t} = f(\bar{\mathbf{p}}^L, \bar{\mathbf{p}}^K, \bar{\mathbf{p}}^R).$$

Since the entrepreneurial decision about new production processes points into future, the expected future price relations play as an important role as the actual price relations do. The respective weight (\mathbf{a}) depends on the individual investment context (e.g. the time of amortization, the expected lifetime of the investment, pre-existing machines etc.).

$$(14) \quad \bar{\mathbf{p}} = \frac{\sum_{t=t_0-n}^{t_0+m} \mathbf{a}_t \mathbf{p}_t}{t}, \quad \text{with} \quad \sum_{t=t_0-n}^{t_0+m} \mathbf{a}_t = 1.$$

So expression (11) can be written as follows:

$$(15) \quad Y = \mathbf{t}(\bar{\mathbf{p}}^L, \bar{\mathbf{p}}^K, \bar{\mathbf{p}}^R) \cdot L(\mathbf{p}^L)^l \cdot K(\mathbf{p}^K)^k \cdot R(\mathbf{p}^R)^r.$$

From the perspective of evolutionary market process theory, the following path-dependencies arise: employer's social security contributions cause the relative price of labour to rise (without rising net wages) and, thereby, induce substitution processes in which labour is replaced by capital and/or resources. This effect is dynamically strengthened through the occurring innovation process: Entrepreneurs demand innovations which reduce labour input (labour saving technical progress) in order to gain individual competitive advantages. To be successful on the innovation markets, the suppliers of innovation concentrate on such labour saving technical solutions and so a trajectory arises which dynamically minimizes labour inputs. This is especially the case if wage costs keep rising because the resulting unemployment causes higher social costs and, therefore, the social security contributions increase as well. Without a change in the institutional arrangements the incentive to save

¹⁸ Of course, factor price relations are not the only influence on the innovation process. For example, it also depends on the available inventions. They might be described in economic terms only to a lesser extent.

labour persists and leads to a dynamically declining labour demand.¹⁹ The institutional framework sets incentives to save labour and relative efficient competitive market processes lead to output growth without an equivalent growth in labour input.

A double dividend in terms of evolutionary market process theory consists of a change of the path of innovation by an evolution of the institutional framework, thereby, altering the incentive system. The path-dependency discussed above might be called a lock-in under constant institutional conditions. However, a change in the institutional arrangements seems to be appropriate to break up the lock-in and to change the trajectory of development. If taxes on the factor resources are implemented and (to be revenue-neutral) if contributions on labour (which directly raise wage costs) are cut, the relative prices of the factor groups change (10): p^L declines and p^R rises. The effect on p^K is ambivalent and a differentiation between different kinds of capital (i.e. removing the assumption of homogenous factor groups), e.g. in energy intensive capital and energy saving capital, would probably reveal substitution processes within the factor group capital, e.g. energy intensive real capital is replaced by more labour intensive real capital. C.p., after the ecological tax reform, in accordance with (15), a constant gross product (Y) – or, in other words, a constant amount of material welfare – is produced with more labour and less resources.

This process of factor substitution becomes more dynamic and, therefore, stronger, because it induces a change in the direction of the innovation process (13, 15). Now, not labour saving but resource (energy) saving technical progress is demanded by the entrepreneurs to gain individual competitive advantages. As a result, a path-change from labour saving to resource saving market processes is initiated. This path-change produces a double dividend by dynamically reducing resource and energy use as well as involuntary unemployment. The dividends are low in the first periods but will rise through time because of the self-enforcing character of the new path-dependency. As in reality, the tax shift will be gradual at first with rising ecological tax rates in the following periods (and, of course, parallel declining contributions on labour). The dynamic effect will be strengthened since entrepreneurs have to calculate with further changing factor price relations in the future and will anticipate this in their investment plans. They will then favour ecological technologies instead of labour saving technologies especially in long-run investments. The probability of a reduction of involuntary

¹⁹ As a result the statistical labour productivity increases due to the substitution of labour by capital and according to standard theory this should cause more employment. However, real-world labour markets are usually characterized by considerable imperfections, one being the gap between the demanders' price (wage costs) and the suppliers' price (gross or net wages). On such imperfect labour markets, increasing labour productivity might be the result of labour-saving technological progress induced by high and increasing wage costs (exceeding gross wages, e.g. because of employer's social security contributions). These labour-saving innovations substitute labour by capital and enable employers to permanently reduce labour demand (thereby implementing a path-dependency). Thus, an increasing labour productivity on imperfect labour markets need not cause increasing labour demand but, instead, represents the result from a substitution of labour by capital (increasing capital intensity and decreasing capital productivity) and by this goes hand in hand with a decline in labour demand. In this case causality works opposite to standard theory: an increase in labour productivity does not occur exogenously (because of learning effects or exogenous technological progress) and causes higher labour demand at the prevailing wage level. Instead, labour productivity increases in response to exogenously increasing wage costs (caused by political decisions and non-competitive wage negotiations) through an increasing demand of (endogenously produced) labour-saving technological progress. Therefore, with imperfect labour markets and a considerable gap between wage costs and wages, an ecological tax reform that reduces this gap induces a more labour-intensive mode of production. This would, thereby, increase labour intensity and decrease labour productivity, but at the same time, increase labour demand. In other words, the difference between the arguments of labour demand and supply (wage costs and wages) and, thus, labour market distortions become reduced. This train of thought stands in perfect accordance with the empirical finding that can be observed in Western Europe where, over many years, an increase in labour productivity goes hand in hand with an increase in involuntary unemployment.

unemployment rises with the alteration of the price differential between labour and resources (energy).

3.3. Some Additional Political-Economic Considerations

The analysis of the double dividend issue from a real-world perspective on competitive market processes must be supplemented by some political-economic considerations. They especially concern problems of the implementation in the socio-political system (including lobbyism).

A reduction of involuntary unemployment becomes more difficult or even impossible if unions use the declining wage costs as an argument to claim higher (profit independent) wages (*Carraro, Galeotti and Gallo 1996; Ekins 1997; Kirchgässner 1998b; Majocchi 1996*). This strengthens the case for cutting employer's social security contributions instead of wage or income taxes: if wage taxes are reduced the participation of the employers (declining wage costs) depends on the readiness of the unions to accept declining gross wages. As union members will most likely prefer to consume the rising net wages, an acceptance of declining wages by the unions seems rather improbable in the real world. With a cut in employer's social security contributions (financed by the ecological taxes) it should be easier to achieve the acceptance of the unions because they need not agree to wage cuts (which have a highly symbolic character) but would "only" have to be modest concerning their call for increasing wages.

With non-altruistic, utility-maximizing politicians the danger arises that ecological taxes will be used to maximize the public budget and to give in to lobbyism (*Böckem 1999; Oates 1995; Zimmermann and Gaynor 1999*). The first aspect doubts if the revenue-neutrality will be kept in the course of time or whether politicians will end up in a "coalition against taxpayers and voters" (*Zimmermann and Gaynor 1999*). However, this notion seems to me as extreme as the one of politicians as pure altruists. Real-world politicians will probably act both altruistic and non-altruistic. Since it cannot be clarified generally and context-independent whether budget-maximization or strict revenue-neutrality maximizes votes and, thus, the individual utility of the respective politicians, the total effect becomes ambivalent, as e.g. *Oates (1995, p. 920)* states: "Leviathan could turn out to be either a friend or a foe of the environment". The second aspect points to the danger of exceptions and special rules for lobbying groups, which may finally destroy the desired effects of the ecological tax reform.²⁰ The current trial on an ecological tax reform in Germany offers many examples on this subject. However, the threat of discriminating rules because of lobbyism is present in every tax system and challenges every kind of environmental policy. In any case, the danger of enslaving the market forces is less serious with so-called market conformal devices of environmental policy,²¹ compared to direct bureaucratic regulations. Nevertheless, it must be stated clearly that a revenue-neutral ecological tax reform is no substitute for pro-market reforms, for example of labour markets and of social security systems.

4. Conclusion

The notion of a double dividend from a revenue-neutral ecological tax reform with a cut in wage costs appears doubtful from an optimal taxation view. Although – from the viewpoint of

²⁰ A deeper analysis on different interest groups and their attitude towards ecological tax reforms is discussed in *Pezzey and Park (1998)* and *Zimmermann and Gaynor (1999)*.

²¹ Along with ecological tax reforms, systems of tradable permits to pollute and systems of voluntary approaches are normally discussed as market conformal devices of environmental policy. However, I elsewhere argue that both tradable permits (*Budzinski 2000, pp. 275 – 284*) and voluntary approaches (*Budzinski 2001*) need not be market conformal in every case.

real-world economies – some rather heroic assumptions have to be implemented to achieve this result, it at least seems ambivalent whether a second dividend as an *efficiency dividend* may occur. The market process view does not help to clarify this result since efficiency becomes a relative term depending on the prevailing institutional arrangements and on the incentives on individual action set by them.

Concerning a second dividend as an *employment dividend* the case is somehow different. When considering involuntary unemployment, even in the optimal taxation framework an employment dividend becomes possible although not certain. Dropping other assumptions (e.g. initial optimal tax system, labour as the only imperfect mobile factor), according to *Bovenberg et al.*, even a triple dividend may occur. The market process view strengthens the case for an employment dividend by explicitly integrating effects of dynamic competition and innovation. In this framework, the reduction of involuntary unemployment is no result of efficiency gains but of (a) declining wage costs which boost labour demand, (b) of a shift in the bias of the innovation process from labour saving to resource saving technical progress, and (c) of an evolution of the consumption basket because of changing relative prices: labour intensive goods will gain more consumer demand, resource or energy intensive ones less.

The empirical and simulation literature on the double dividend debate argues in favour of an existing employment dividend²² (even though competition and innovation effects are often left aside). *Ekins* (1997, p. 153) concludes his overview over the international empirical literature: “All these studies tend to confirm (...) that an employment dividend from environmental taxation is both probable and significant.” (see similarly *Kirchgässner* 1998a, 1998b). Focusing on the wide range of optimal taxation papers on this subject, *Park and Pezzey* (1999, p. 159) conclude concerning a positive economic dividend: “In very general terms, theoretical papers most commonly refute it, while empirical papers most commonly support it.”

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²² See among others *Barker* (1997); *Carraro, Galeotti and Gallo* (1996); *DIW* (1995); *Ekins* (1997, pp. 152); *Kirchgässner* (1998b, pp. 282); *Kümmel, Lindenberger and Eichhorn* (2000); *Majocchi* (1996); *Meyer et al.* (1999); *Ribeiro et al.* (1999).

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