ENVIRONMENTAL AND ECONOMIC IMPLICATIONS OF TAXING AND TRADING CARBON: SOME EUROPEAN EXPERIENCES

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INTRODUCTION

When President of the European Commission Jose Manuel Barroso responded to questions about the European Union's climate policy, he explained the significance of applying market-based instruments for creating a market for low-carbon technologies, stating: "The US and Japan are much better on technology than the EU, but technology and goodwill are not enough. We need a binding cap on emissions to put a real price on

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carbon and give the right economic incentives to environmentally-friendly technologies."[1]

Developments in Europe are now greatly improving the market prospects for renewable energy technologies. The inception in 2008 of a second Kyoto commitment period with more stringent caps implies that allowances on the European carbon certificate market now trade for a significant price. The carbon allowance price adds to the impacts of recent increases in international oil prices. These changes greatly improve the economic advantages of substituting fossil fuels with renewable energy technologies, particularly biomass and wind energy.

Rising energy costs create pressures to relieve fossil fuel consumers from the politically determined price signals for carbon and energy. Nevertheless, market-based instruments are something quite different from energy prices increasing as a result of market fluctuations.

Experiences attained in member states that pioneered the use of market-based instruments provide evidence for this observation. These member states are, on average, more energy-efficient and competitive than the European Union (EU) as a whole.[2] This difference is because the properties of market-based instruments can differ from those of energy market prices, as will be clear from this article.

Europe's initial experience with market-based instruments dates back to the early 1970s when several countries introduced effluent charges on water pollutants.[3] In 1972, the Dutch Central Planning Office warned of excessive costs from a proposed extension of sewage treatment for waste water, at an estimated three percent of national income.[4] Macroeconomic modeling projected losses in industrial output, causing an overall decline in economic growth of close to four percent.[5] Despite these gloomy forecasts, the Dutch Central Bureau of Statistics estimates that the entire public and private activity of waste water treatment today captures merely 0.6% of annual gross domestic product (GDP) in the Netherlands.[6] The obtained efficiency is regarded as a result of the pioneering Dutch levy on emissions

1. *Barroso Defends EU's Climate Strategy*, ENDS EUROPE DAILY, Issue 2399, Oct. 2, 2007, http://www.endseuropedaily.com/articles/index.cfm (last visited Nov. 26, 2008).

2. Mikael Skou Andersen, *Governance by Green Taxes: Implementing Clean Water Policies in Europe,* 2 ENVTL. ECON. & POL'Y STUD. 39, 39–63 (1999).

3. *Id.*

4. *Id.*

5. MINISTRY FOR TRANSP. & PUB. WORKS, THE HAGUE, THE COMBAT AGAINST SURFACE WATER POLLUTION IN THE NETHERLANDS (1975).

6. EUROPEAN ENVTL. AGENCY [EEA], EFFECTIVENESS OF URBAN WASTEWATER TREATMENT POLICIES IN SELECTED COUNTRIES: AN EEA PILOT STUDY 38 (2005).

of waste water.[7] The price signal has provided economic incentives to control pollution at the source, reducing the projected need for costly and passive investments in end-of-pipe treatment, especially for big dischargers.[8] Costs for waste water services in other countries with some element of market-based instruments are also well below one percent of GDP. This low figure underlines that dire economic forecasts from macroeconomic models need not always materialize, especially if such models do not capture opportunities for technological innovation.

Following the Organization for Economic Co-operation and Development's (OECD) appraisal of the efficiency of market-based policy instruments in the mid-1980s and the 1988 Toronto Conference on the Changing Atmosphere, which triggered political interest in addressing climate change, the four Nordic countries soon introduced taxes on the greenhouse gas carbon dioxide (CO_2).[9] Finland (1990), Sweden (1990), Norway (1991), and Denmark (1992) were first to launch and gradually strengthen economic signals to curb emissions.[10] Concerns regarding climate change coincided with priorities to reduce income taxation and combined to a tax shifting exercise. A few years later, the Netherlands (1996) and Slovenia (1997) followed suit.[11] When at the end of the decade Germany (1998) and the United Kingdom (U.K.) (2000), two of the largest European economies, joined the club of carbon taxation,[12] more weight and significance was added. This resulted in an annual bill of more than twenty-five billion Euro which were converted from other taxes to carbon-energy taxes.[13] Details of these tax reforms are outlined in the article by Stefan Speck (this volume). Unilateral member state carbon and energy taxation initiatives were complemented by the EU Directive on Energy Taxation,[14] which was finally agreed upon in 2003 after more than ten years of negotiations, and which establishes minimum tax rates for energy

7. *Id.* at 24.

8. *Id.* at 25.

9. Mikael Skou Andersen, *Vikings and Virtues: A Decade of CO_2 Taxation*, 4 CLIMATE POL'Y 13, 27 (2004) (reviewing twenty ex-post carbon-energy tax studies).

10. *Id.*

11. Mikael Skou Andersen & Stefan Speck, *The Environmental Tax Reforms in Europe: Stabilization, Mitigation Compensation, and CO2 Stabilization*, *in* JACQUELINE COTTRELL ET AL., 6 CRITICAL ISSUES IN ENVIRONMENTAL TAXATION: INTERNATIONAL AND COMPARATIVE PERSPECTIVES, VOLUME (2009) (in press).

12. *Id.*

13. Stefan Speck, *The Design of Carbon and Broad-based Energy Taxes in European Countries*, in this volume.

14. Council Directive 2003/96, 2003 O.J. (L 283) 51 (EC) (restructuring the Community framework for the taxation of energy products and electricity).

products in all twenty-seven EU member states.[15] With respect to carbon, the EU Directive on the Emissions Trading[16] was also passed in 2003 and came into effect two years later, thereby capping member state emissions for designated sectors.[17]

Quite a lot of research has been done already to figure out environmental and economic implications of applying market-based instruments. In contrast to the 1990s when theoretical ex-ante modelling studies largely prevailed, the literature in the last decade has been enriched with more empirically based ex-post studies. Using various analytical approaches and modelling techniques, these recent studies have focused on actual experiences attained in Europe with carbon-energy taxation. This article reviews what has been learned about the impact of taxes on energy consumption and carbon emissions: according to basic behavioural and economic theory carbon-energy taxes are expected to curb emissions and decouple energy consumption from economic growth. With some qualifications, ex-post evaluation studies have largely confirmed the existence of such patterns for Europe. More controversy surrounds the broader macro-economic implications of carbon-energy taxation, especially for competition and economic growth. However, as the review of theoretical literature below indicates, the misty character of this debate seems, to some extent, to be caused by the heat of vested interests, as there is relatively broad consensus about the properties of revenue-neutral environmental tax reforms. The final section of this article addresses the differences between taxing or trading carbon. Environmental and economic implications of the emissions trading system (ETS) established in EU are considered and possible complications of both trading and taxing carbon are discussed. Less quantitative data and evidence is available to allow for firm conclusions on Europe's ETS experiences because the ETS carbon-trading system is relatively young. Due to apparent over-allocation, the system experienced a temporary collapse during the first commitment period (2005–2007).

15. *Id.*

16. Council Directive 2003/87, 3002 O.J. (L 275) 32 (EC) (establishing a scheme for greenhouse gas emission allowance trading within the Community).

17. Emission Trading Scheme (EU ETS), http://ec.europa.eu/environmentclimat/emission/index_en.htm (last visited Nov. 12, 2008).

I. IMPLICATIONS OF CARBON-ENERGY TAXATION FOR CO_2 EMISSIONS AND ENERGY CONSUMPTION

One expects carbon-energy taxes to provide incentives in two directions: a demand effect, whereby the demand for energy is reduced as a result of the price-increase caused by the tax; and a substitution effect, whereby carbon-fuels are substituted by low-carbon or carbon-neutral fuels to the extent that these are available at lower costs. While reduced energy demand may reflect either a lowering of output or actual energy savings, it is often more appropriate to monitor for energy intensity. In other words, we would expect to see changes in energy and carbon intensity as a result of carbon pricing.

The price at which CO_2 is traded under the cap of the second commitment period in the European ETS is presently twenty to twenty-five Euro per ton.[18] Compared to these price levels, unilaterally applied carbon taxes in individual EU member states have been more modest and range generally from a low, and to some extent symbolic, level for the most energy-intensive industries and up to about twenty-five Euro per ton in the cases of Sweden and Finland (although Denmark taxes energy for heating purposes in households and industries at an effective rate of about eighty Euro per ton CO_2).[19] In comparison, the Intergovernmental Panel on Climate Change (IPCC) projects that a global carbon price will require a level of thirty to forty Euro per ton CO_2 in 2020 to achieve stabilization of atmospheric greenhouse gas concentrations at 450–550 ppm.[20]

Evaluating the impact of carbon-energy taxes on CO_2 emissions is complicated because taxes in certain sectors have replaced pre-existing energy taxes, but now come under a different name and with a modified tax base—carbon content rather than gigajoules. Sweden is often mentioned as a pioneer with respect to carbon taxes, but it had taxes for industrial energy consumption already in place in 1974.[21] These taxes were modified in 1990 towards a carbon-energy tax base.[22] The actual increase in price signal depends somewhat on the fuel in question and its relative use in different sectors.

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18. PointCarbon.com, Providing Critical Insights into Energy and Environmental Markets, http://www.pointcarbon.com/ (found under Point Carbon EUA OTC assessment (EUR/t)) (last visited Nov. 26, 2008).

19. Andersen, *supra* note 9.

20. Terry Barker, COMETR Final Workshop, Avoiding Dangerous Climate Change Through Environmental Tax Reform: Existing Research and COMETR, slide 9 (Mar. 21, 2007).

21. Andersen et al., *supra* note 11.

22. *Id.*

Carbon energy taxes have been in effect in the four Nordic countries and the Netherlands for more than a decade, providing the firmest basis for ex-post assessment. Similarly, Slovenia has operated on a longer timeline, but as a country in transition, with data and conversion difficulties.[23] Comparatively, Germany and the U.K. introduced carbon energy taxes at the end of the previous decade.[24]

Carbon-energy taxes are not yet applied across-the-board with uniform rates for all emitters and fuels. Over time, member states have adjusted and extended tax rates and tax bases to achieve carbon-energy taxes in greater accordance with theoretical prescriptions.[25] However, in the short run, pragmatic considerations have prevailed. For this reason effective fuel-tax rates vary considerably from sector to sector. While exemptions, liability caps, or special arrangements that specific industries or target groups have obtained are not always immediately transparent, these circumstances are of course crucial when proper evaluations of impacts and effectiveness have to be provided. For these reasons, statements about the effectiveness and impacts of carbon-energy taxes are in most evaluation studies, provided only on a sectoral basis.[26]

The European research project, Competitiveness Effects of Environmental Tax Reforms (COMETR), has been the first comprehensive attempt to retroactively account for these implications by considering differences in sectoral tax burdens within a suitable macroeconomic framework capable of providing an overall assessment.[27] The E3ME model of Cambridge Econometrics is a time-series estimated macroeconomic model of economy-energy-environment relations of EU-25.[28] This model can also account for EU trade relations with the rest of the world.[29] For the purposes of modeling changes in fuel consumption and CO_2 emissions as a result of relative price changes and feed-backs in the economy, the model has a high resolution featuring eleven different fuels and more than forty economic sectors.[30] The COMETR project has compiled country-specific figures for carbon and energy taxes, including the relevant sector-specific

23. *Id*.
24. *Id.*
25. *Id.*
26. *Id.*
27. *See* COMETR, Competitiveness Effects of Environmental Tax Reforms, http://www2.dmu.dk/cometr (last visited Nov. 26, 2008) (COMETR is a research project under the European Union's Sixth Framework Program for Research).
28. E3ME: An Energy-Environment-Economy Model of Europe, http://www.camecon.com/suite_economic_models/e3me.htm (last visited Nov. 26, 2008).
29. *Id.*
30. *Id.*

exemption arrangements for the purpose of modeling and disentangling the impacts in E3ME.[31]

Two scenarios were generated by the E3ME for the period 1994–2012. The Baseline Case (B Case) is an endogenous solution of E3ME over the period 1994–2012.[32] This scenario includes the tax shift package in exchange for the carbon-energy taxes in each Member State, including exemptions or special treatment for the industries most affected and the compensating reduction in another tax.[33] This scenario is calibrated closely to the observed outcome by using historical data, which includes the effects of environmental tax reform (ETR) implementation.[34] The Reference Case (R Case), which is a counterfactual projection without the ETR, includes historical and expected developments in the EU economy, for example, the EU ETS.[35]

By subtracting the outcome of the counterfactual reference case from the baseline case, it becomes possible to disentangle the specific impact of the carbon-energy taxes introduced under the revenue-neutral ETR. Because the model has information for historical energy tax burdens prior to the introduction of the carbon-energy taxes, it becomes clear what impact the various tax reforms can be ascribed. In summary, this illustrates the difference between what actually happened and what would have happened had there been no ETR (with both cases projected to 2012). The exception to this is that revenue neutrality is assumed in each case through the revenue-recycling mechanisms. Exemptions, non-payments, and negotiated agreements are included as accurately as possible, subject to the total revenues matching the published figures in each case.

Six European countries that have implemented an ETR show a reduction in fuel demand (see Chart 1). The size of the reduction in fuel demand is dependent on: the tax rates imposed; how they are applied to the various fuels and fuel user groups; how easy it is for fuel users to substitute between the various fuel types and non-fuel inputs; and the scale of the secondary effects resulting from changes in economic activity. On average,

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31. COMETR, *supra* note 27 (found under "The Project").

32. The following builds on Barker, T, Junankar, S, Pollitt, H, Summerton, P, 2007, *The effects of environmental tax reform on international competitiveness* in THE EUROPEAN UNION: MODELLING WITH E3ME, in ANDERSEN, M.S., ET. AL., COMETR, Competitiveness Effects of Environmental Tax Reforms, Final Report to the European Commission, DG Research and DG TAXUD, http://www2.dmu.dk/cometr (last visited Nov. 26, 2008).

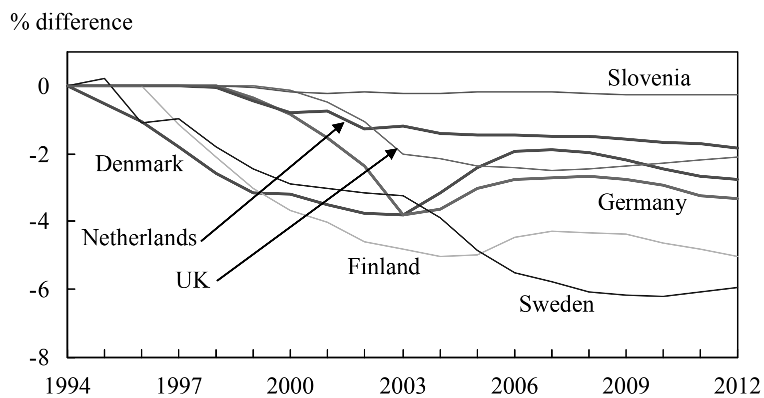
33. European Sectoral Analysis, Cambridge Econometrics, *available at* http://www.camecon.com/consultancy_capability/euro_sectoral_analysis.htm (last visited Nov. 12, 2008).

34. *Id.*

35. *Id.*

the attained reduction in fuel demand in 2004 was 2.6%, although it was slightly larger in Finland than in the other countries.

CHART 1: THE EFFECT OF ETR ON TOTAL FUEL DEMAND



Note(s) : % difference is the difference between the base case and the counterfactual reference case.
Source(s) : CE.

A key feature of the results is the recovery in fuel demand due to higher world energy prices found in several of the examined countries in 2004 and 2005 in the B Case relative to the R Case. In most of the ETRs, the environmental taxes were not increased in line with fuel prices (and may have been reduced in some cases), so the relative change in fuel prices was less in 2004 and 2005.

With lower consumption we would expect to see a reduction in greenhouse gas emissions, but total emissions will also depend on the relative consumption levels of each fuel type. For example, a tax system that encourages the use of coal is likely to produce higher emissions than one which encourages the use of natural gas or bio-fuels. E3ME includes explicit equations for fuel shares of hard coal, heavy oil, natural gas, and electricity.[36] Assumptions about the other fuel types link them to the closest modeled alternative (for example, other coal is linked to hard coal, crude oil to heavy oil). The demand for middle distillates (petrol, diesel) for transportation needs is linked to total fuel demand by that sector. These

36. E3ME Manual, Cambridge Econometrics (Apr. 20, 2006), *available at* http://www.camecon-e3memanual.com/cgi-bin/EPW_CGI.

sectors do not generally use other fuels, so fuel-share equations are not required.

The scenario results show that there are reductions in greenhouse gases (GHGs) for six member states from the ETR (see Chart 2). The effects closely follow the results for total fuel consumption, with the largest reductions occurring in regions with the highest tax rates. For example, Finland and Sweden experienced the largest reductions in emissions, in most cases exceeding the decline in fuel demand and providing evidence for the efficiency of ETRs in reducing emissions. In contrast, the German ETR was not particularly efficient in reducing emissions because it did not include coal. By 2004, the European ETRs reduced greenhouse gas emissions by an average of 3.1% for the six member countries examined, with the largest reduction of 5.9% recorded for Finland.

Martin Enevoldsen[37] has studied in detail the Danish and Dutch experiences with carbon-energy taxation and controlled outcomes against developments in Austria, which did not introduce market-based instruments or ETR. Denmark's policy of ETR began in 1992, whereas the Netherlands introduced its ETR in 1996, after several years of promoting voluntary long-term agreements with industries.[38] Between 1990 and 2000 industry in Denmark improved its energy intensity by nearly thirty percent.[39] The Netherlands and Austria only obtained improvements in the range of ten to fifteen percent.[40] A particular aspect of Denmark's carbon-energy taxation program was the earmarking of twenty percent of the revenues to co-finance energy-efficiency measures and upgrade production technology.[41] This feature of Denmark's program is believed to have been responsible for the marked impacts on energy productivity. The funds from revenue were made available in a program supervised by the Danish Energy Agency.[42] Auditors independently reviewed company energy practices and made recommendations for improvements and investments based on up to four years of return.[43] Bjørner and Togeby[44] have confirmed that companies

37. MARTIN K. ENEVOLDSEN, THE THEORY OF ENVIRONMENTAL AGREEMENTS AND TAXES 141–66 (Wallace E. Oates & Henk Folmer eds., 2005).

38. *Id.*

39. *Id.*

40. *Id.*

41. *Id.*

42. *Id.*

43. *Id.*

44. T. BUE BJØRNER & M. TOGEBY, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON. [ACEE], INDUSTRIAL COMPANIES' DEMAND FOR ENERGY, BASED ON A MICRO PANEL DATABASE: EFFECTS OF CO_2 TAXATION AND AGREEMENTS ON ENERGY SAVINGS 263–74 (1999).

participating in this program received on average sixty percent greater energy savings than companies subject to the tax only.

II. IMPLICATIONS FOR COMPETITIVENESS AND ECONOMIC PERFORMANCE

A. The Theoretical Debate on Tax Shifts

Michael Porter, a Harvard economist, argued in *The Competitive Advantage of Nations* (1990) that, contrary to conventional wisdom, environmental policies may encourage process or product-oriented innovation and improve competition, particularly when anticipating requirements that will spread internationally.[45] Porter cautioned that many environmental regulations presently violate competition principles because command-and-control requirements for specific pre-defined technologies, often end-of-pipe, do not leave room for adaptation, flexibility, and innovation.[46] References to Porter's hypothesis in the literature tend to neglect the premise that it is only by using *market-based* instruments for environmental policy implementation that competition can be improved.[47] In real company management the challenge remains to identify and harvest the low-hanging fruit despite the vigorous controversy in the 1990s over Porter's claims that there *was* low hanging fruit not yet picked by businesses.

David Pearce framed the argument slightly differently. Pearce called attention to the possible *double dividend* feature of carbon-energy taxes, referring to the improvement in social welfare that could arise if taxation shifted from goods to bads, for example, i.e., from labor to carbon.[48] Since environmental taxes serve to correct market failures, by definition they do not share the distorting properties of many other taxes.[49] By adopting a fiscally neutral package that exchanges income taxes or corporate taxes for carbon-energy taxes, the opportunity arises to reap positive benefits in terms of higher employment; this increased employment rate may improve

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45. MICHAEL E. PORTER, ON COMPETITION 187 (1998); Michael E. Porter & Claas Van Der Linde, *Toward a New Conception of the Environment-Competitiveness Relationship*, 9 J. ECON. PERSP. 97, 101 (1995).

46. *Id.*

47. Michael E. Porter, *America's Green Strategy*, 264 SCI. AM. 168, 168 (1991).

48. David W. Pearce, *The Role of Carbon Taxes in Adjusting to Global Warming*, 101 ECON. J. 938, 940–41 (1991).

49. *Id.*

short-term economic performance while the tax shift also delivers a long-term environmental dividend. Pearce's approach was adopted in the famous European Commission Whitepaper, which argued for shifting taxation to reap both dividends.[50]

Many economists have had difficulties with the "free lunch" implied in the double dividend argument, as well as with the rhetoric on the win-win options of environmental policy. Lawrence Goulder, Professor of Environmental and Resource Economics at Stanford University, differentiates between *weak* and *strong* versions of the double dividend argument.[51] The strong version claims that any environmental tax that replaces another tax will, by definition, improve social welfare. The weak version, on the other hand, merely focuses on the revenue-recycling aspect: it claims uncontroversially that, once environmental taxes have been introduced, using revenues to reduce distortionary taxes is preferable to returning revenues as a lump-sum.[52] However, Goulder presents an intermediate version of the double dividend argument as well. The intermediate version implies that context and circumstances dictate whether overall social welfare will in fact be improved as a result of ETR and depends on the specific properties of the distortionary tax that is being replaced with an environmental tax.[53]

In a similar vein, Dutch economists A. Lans Bovenberg and Ruud A. de Mooij have pointed to the existence of a possible "tax interaction effect," whereby the costs of environmental taxes increase commodity prices consequently lowering the real value of after-tax income.[54] If ETR provides too little income tax relief to offset the increase in commodity prices, employees will lower their labor supply, in turn, triggering a wage-spiral and inflation. Typically, the negative tax interaction effect will exceed the positive revenue-recycling effect, except under special circumstances where highly distortionary taxes are replaced. The formal argument hinges on two crucial assumptions: first, that income taxation *a priori* minimizes the excess tax burden; and second, ETR is introduced on top of existing environmental taxes or regulations that sufficiently internalize

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50. *Commission White Paper on Growth, Competitiveness, and Employment: The Challenges and Ways Forward into the 21st Century*, at 81, 91, COM (1993) (May 12, 1993).

51. *See* Lawrence H. Goulder, *Environmental Taxation and the 'Double Dividend': A Reader's Guide*, 2 INT'L TAX & PUB. FIN. 157, 159 (1995) (articulating the different notions of weak and strong double dividend theories and examining the theoretical and empirical support for each).

52. *Id.*

53. *Id.*

54. *See* A. Lans Bovenberg & Ruud A. de Mooij, *Environmental Levies and Distortionary Taxation*, 84 AM. ECON. REV. 1085, 1088 (1994) (arguing that environmental taxes may acerbate preexisting tax distortions).

externalities.[55] Despite these unrealistic restrictions, this argument appears to be widely accepted among tax experts.

Evidence suggests that many of the analyses which focus on the tax interaction effect are too stylized and restrictive. Bovenberg and de Mooij's first article was based on a static model. In a second article where they explore the relationships in the context of a dynamic model, the findings are relaxed somewhat: if the ETR leads to lower regulatory pressure on companies, then a double dividend may arise.[56] Nielsen[57] explores the double dividend hypothesis using a dynamic model that includes unemployment. Bovenberg shows that unemployment will be reduced if a pollution tax is introduced.[58] In this case, the tax interaction effect also influences the value of the unemployment benefit, causing more unemployed to enter the labor market.[59] However, the overall effect on the rate of economic growth could still become negative. Eban Goodstein questions the basic assumption of the tax interaction effect that higher prices will reduce labor supply.[60] Empirical studies based on micro-data have found this relationship to be ambiguous.[61] When dual-earner families are considered, higher prices lead to an increase in labor supply, as workers seek to compensate the reduction in family income generated by the price increases.[62]

Despite the controversy on the direction and magnitude of the tax interaction effect, a consensus in the literature remains—no tax interaction effect will occur when ETR lowers employers' social security contributions

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55. DANIEL WEINBRENNER, ÖKOLOGISCHE STEUERREFORM: WIRKUNGSZUSAMMENHÄNGE ZWISCHEN EMISSIONS-UND FISKALSTEUERN, WIESBADEN: DEUTSCHER UNIVERSITÄTSVERLAG (1999).

56. *See generally* A. Lans Bovenberg & Ruud A. de Mooij, *Environmental Tax Reform and Endogenous Growth*, 63 J. PUB. ECON. 207, 208 (1997) (analyzing new channels through which an environmental tax reform may yield a double dividend).

57. Søren B. Nielsen, Lars H. Pedersen & Peter B. Sørensen, *Environmental Policy, Pollution, Unemployment and Endogenous Growth,* 2 INT'L TAX & PUB. FIN. 185, 193 (1995).

58. Bovenberg, *supra* note 56.

59. *Id.*

60. *See* Eban Goodstein, *The Death of the Pigovian Tax? Policy Implications from the Double-Dividend Debate*, 3 LAND ECON. 402, 408–11 (2003) (arguing that additional empirical and theoretical analysis is needed before concluding the double-dividend is incorrect).

61. *Id.*

62. Elizabeth Gustafson & Lawrence Hadley, *Labour Supply and Money Illusion: A Dynamic Simultaneous Equation Model*, 29 Q. REV. ECON. & BUS. 63, 70 (1989).

resulting in no, or only marginal price changes.[63] In this specific case, one would expect to obtain a double dividend.[64]

B. Revenue Recycling Programs

In view of the theoretical debate, it is interesting that European countries have practiced different strategies for revenue recycling; Sweden and Finland have mainly recycled revenue by lowering income taxes.[65] For Sweden, a long-standing tax policy aim has been to lower the pressure of income taxation on labor income.[66] The tax reforms in these two countries aim to lower direct income taxes: carbon-energy taxes have contributed to securing alternative revenues for some, but not all, of these income tax reductions.[67] This observation applies for Sweden's early ETR in 1990 as well as for the most recent phase after 2001.[68] It also applies to Finland for the more comprehensive tax shifts introduced since 1996; whereas, revenues were small and the recycling was not transparent in the phase prior to 1996.[69] It would have been difficult for both countries to follow the recommendations from the fiscal literature to aim at lowering employers' social security contributions, because such contributions are relatively small in both countries.

On the other hand, Denmark and the U.K. have more closely followed the recommendations from the fiscal conventionalists, predominantly directing revenues to lower employers' social security contributions to avoid inflationary effects.[70] However, because of the imbalance between energy consumption and employee numbers, lowering social security contributions at the company level does not necessarily lead to full compensation for the individual company. Denmark and the U.K. have mitigated the imbalance via the various mechanisms for energy-intensive industries such as agreements and reduced rates for heavy industries.[71] The real purpose of these exemptions seems to have been to avoid the tax interaction effects. Finally, out of concern that incentives would otherwise

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63. Ian W. H. Parry, *Pollution Taxes and Revenue Recycling*, 29 J. ENVTL ECON. & MGMT., at S-64, S-64 to -76 (1995).

64. *See* Paul Ekins & Terry Barker, *Carbon Taxes and Carbon Emissions Trading*, 15 J. ECON. SURVS. 325, 336–37 (2003) (analyzing the effect of substituting an environmental tax for an employer's social security tax).

65. Andersen, *supra* note 11, at 523.

66. *Id.*

67. *Id.*

68. *Id.* at 524.

69. *Id.*

70. *Id.* at 525.

71. *Id.*

be too weak, both countries have earmarked between five and twenty percent of revenues for direct energy-efficiency subsidies via, for example, the Carbon Trust.[72]

The Netherlands and Germany have followed mixed approaches. In the initial phase, the Dutch reduced income taxation out of social concern.[73] This led to the increase of the basic tax-free allowance for income and to using complicated formulas for exempting basic consumption of electricity and gas.[74] In the second phase, the Dutch adhered more to the side of fiscal conventionalists and reduced the employers' wage component and corporate taxes.[75] In Germany, the ecological tax reform split the revenue recycling equally between a reduction of employers' and employees' social security contributions.[76] This reform established a program of revenue recycling more concerned with political appeal than fiscal orthodoxy, taking into account that the eco-tax reform aimed equally at gasoline prices and other fuels.[77]

Slovenia mainly restructured its existing energy taxes into fuel taxes with a carbon-energy tax base.[78] Therefore, the issue of revenue recycling did not seem to arise in the Slovenian context.

Hence, we can summarize the observations on the revenue recycling approaches by dividing the member states in question into three different groups: the fiscal conventionalists (U.K. and Denmark); the fiscal pragmatists (Sweden and Finland); and finally, the political pragmatists (Netherlands and Germany). The pragmatists are labeled as such because reforms were designed to accommodate pressing concerns with the tax systems and the electorate rather than with fiscal theory.[79]

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72. *Id.*

73. *See generally* WILLEM VERMEEND & JACOB VAN DER VAART, GREENING TAXES: THE DUTCH MODEL, KLUWER LAW INTERNATIONAL LTD (1998) (arguing the Dutch were able to reduce income taxation initially leading to an increase of the basic tax-free allowance for income).

74. *Id.*

75. Andersen, *supra* note 11, at 519.

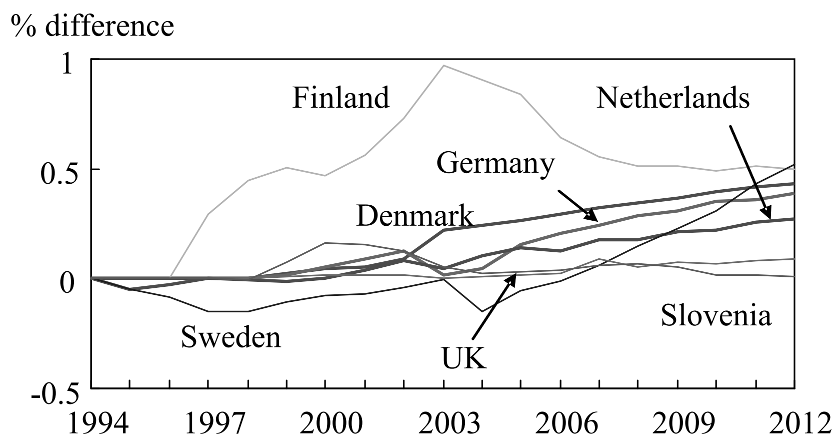
76. *Id.* at 521.

77. *Id.*

78. *Id.* at 520.

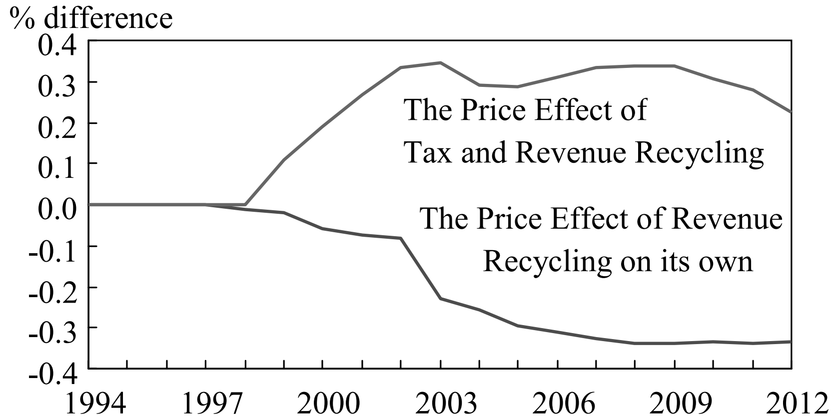
79. *Id.* at 523.

CHART 2: THE EFFECT OF ETR ON GDP



Note(s) : % difference is the difference between the base case and the cou nterfactual reference case.
Source(s) : CE.

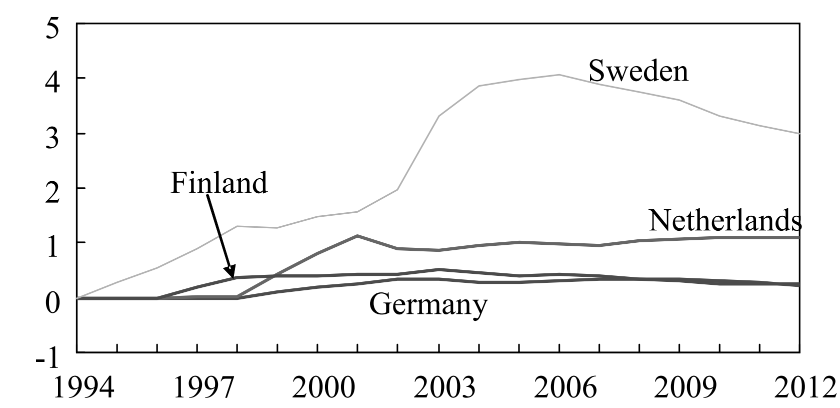
CHART 3: PRICE EFFECTS IN GERMANY



Note(s) : % difference is the difference between base case and the counter factual reference case for Tax and Revenue Recycling and is the difference between the no revenue recycling case and the base case for revenue recycling.

Source(s) : CE.

CHART 4: CONSUMER PRICE INDEX



Note(s) : % difference is the difference between the base case and the counterfactual reference case.

Source(s) : CE.

C. Macroeconomic Results

According to E3ME results, European countries that have implemented ETR did not experience a negative impact on economic growth in terms of GDP (see Chart 2). In Sweden, the effects take slightly longer to appear because the large increase in household electricity taxes depresses real incomes in the short run. Finland receives a short-term boost to GDP from the effects of the taxes on fuel demand, because a reduction in the demand for imported fuel improves the country's trade balance.

Since the ETRs result in higher fuel prices, this will likely increase the overall price level. The degree of this increase will depend on the scale of the increase in fuel costs; how easy it is for industry and consumers to switch between fuels to cheaper alternatives and non-energy inputs, and how much of the cost is passed on by industry to consumers, dictated by the level of competition in the industry and estimated econometrically for each region and sector. Revenue recycling may have a deflationary effect when the revenues are recycled through reductions in employers' social security contributions, lowering labor costs. This is demonstrated by Germany, where nearly half of the revenues were used for reducing employers' contributions (see Chart 3). In Denmark and the U.K., there were no significant increases in the overall price index. In the U.K., this is because the tax is relatively small and was compensated with slightly cheaper labor costs. In Denmark, the tax was larger, but was again compensated with lower labor costs (see Chart 4).

The consumer price index, as the measure of inflation, will record a larger increase when taxes are levied on households rather than industry. The reason for this is that the consumer price index is a weighted average of the price of consumer products, including energy. When taxes are levied on households, the whole tax is reflected in the consumer price index, rather than just the share that is passed on by industry. Therefore, it is not unexpected that Sweden shows the largest increases in the consumer price index, followed by the Netherlands (see Chart 4).

Of the four countries with revenue recycling fully or partly over income taxation, the impact is negligible in the U.K. and Denmark. This is not the case in the Netherlands and Sweden. Although further analysis is required, the Swedish experience suggests that combining carbon-energy taxes on households with reductions in income taxes could cause inflation rates at a level that triggers a possible tax interaction effect. Inherent in the logic of ETRs implemented in the U.K. and Denmark is that the consumer price index will not be discernibly affected; this is primarily because of the revenue recycling via lowering social security contributions.

D. Energy-intensive Industries

A complication arises with energy-intensive companies because the compensation that they receive, via the reduction in social security contributions, does not fully match the additional energy costs. These companies may have a small labor stock yet consume large amounts of energy. Their sensitivity depends on the degree to which they use carbon-intensive fuels (see Figure 1). In member states such as Sweden, Finland, and Slovenia, the energy-intensive industries are less sensitive to carbon-based energy taxes because they benefit from the availability of hydropower and nuclear power.[80] However, in most member states, complicated schemes have been designed to balance, cap, or reduce the tax burden of energy-intensive industries.[81]

Exemptions not only distort the desired impacts of carbon-energy taxation, but also pose a threat to fair terms of competition. According to EU law, exemptions constitute state aid and must be approved by the European authorities.[82] This requirement controls member state concessions to energy-intensive industries.[83] The state aid guidelines[84] offer certain opportunities for reducing the tax rates of energy-intensive industries, especially if these rates are higher than the EU's minimum tax rates. These opportunities are to some extent modeled on the basis of the 1995 decision regarding the Danish CO_2-taxation scheme.[85] Denmark was the first member state to obtain explicit Commission approval of its carbon-energy taxation system.[86] Because agreements between energy-intensive industries and the relevant authorities played a role in obtaining tax rate reductions in the Danish scheme, it was natural that the Commission's state aid guidelines reflected the role of agreements vis-à-vis selective tax reductions.

Member states seek to obtain exemptions and special arrangements for particular sectors due to concerns about the impacts on competition. The Energy Taxation directive stipulates that exemptions should be limited to five or, at maximum, ten years; however, base exemptions exist for dual use of fuels and for certain uses of electricity in metallurgical and mineralogical

80. Andersen, *supra* note 11, at 525.

81. *Id.*

82. Consolidated Versions of the Treaty on European Union and the Treaty Establishing the European Community 2006/67 art. 87–88, 2002 O.J. (C 325) 1.

83. *Id.*

84. Community Guidelines on State Aid for Environmental Protection, 2008/1–33, O.J. (C 82) 1.

85. State aid case N459/95, 1995 O.J. (C 324) (EN).

86. *Id.*

industries.[87] Member states make different use of these exemption mechanisms. From an environmental economic point of view it would be desirable to avoid numerous exemptions and to tax carbon-energy at a uniform rate.

The burden for energy-intensive industries remains negative but, due to many exemptions, the actual burden is rather modest. Company managers in energy-intensive industries often focus on the gross burden of ETR; unadjusted for the gains, this burden has amounted up to five percent of the gross operating surplus.[88] However, detailed analysis in COMETR of revenue recycling and energy-efficiency gains indicates that the gross burden on industries is considerably less. While the net burden for cement and glass industries is actuality below one percent of the gross operating surplus, in ferrous and non-ferrous metal industries, the burden has reached two percent in some cases.[89] Even in the Swedish case, with no offsetting of employers' social security contributions, the costs are estimated not to exceed four percent of gross operating surplus for cement and steel industries.[90]

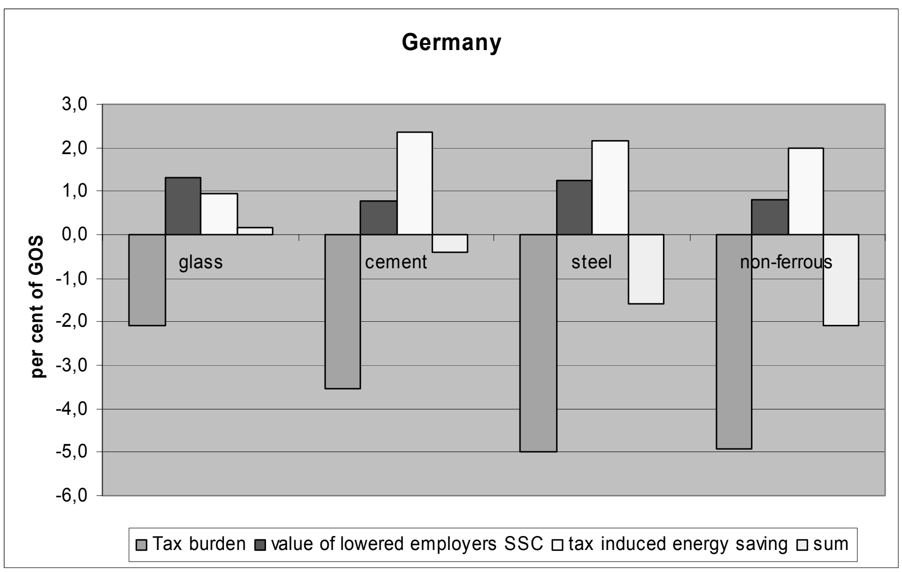


Figure 1: Energy-intensive sectors in Germany: Tax burden, value of lowered employers' social contributions (SSC) and value energy-savings

87. Council Directive 2003/96, *supra* note 14, at art. 3.
88. Andersen, *supra* note 11, at 530.
89. *Id.*
90. *Id.* at 533.

induced by the tax as percent of gross operating surplus. Source: COMETR.

III. TRADING CARBON WHILE ALSO TAXING IT

A. Effective Carbon Price Signal as a result of the ETS Cap on Emissions

Implementing a CO_2 emissions trading system (ETS) in the European Union has created a more complex regulatory environment where member state carbon-energy taxation and EU minimum energy tax rates now coexist with the trading of grandfathered emission certificates for carbon.

The EU ETS covers large installations, such as power plants larger than twenty megawatts.[91] It also covers refineries and most energy-intensive industries—notably ferrous metals, cement, glass, ceramic products, as well as pulp and paper.[92] The ETS requires member states to limit emissions to the number of allowances that their ETS installations hold, while establishing a market for allowances across all twenty-seven member states and providing some linkage to the use of Clean Development Mechanism (CDM) credits and joint implementation projects.[93]

Since emission certificates are grandfathered to industries, the carbon price signals run along two routes. Direct costs may arise as industries need to acquire certificates for additional production activities.[94] Indirect costs arise as electricity producers factor the value of certificates into power prices for all electricity consumers (see Figure 2). In most cases, the national allocation plans have provided certificates matching the historical emissions to industries.[95] Conversely, several member states have restricted allocating certificates to power plants substantially below historical emissions levels due to the pass-over ability of power producers.[96] This implies that the pass-over on power prices is the main route along which the ETS will make an economic impact on industries.

91. *Id*. at 538.
92. *Id.*
93. *Id.*
94. J. P. M. Sijm, S. J. A. Bakker, Y. Chen, H. W. Harmsen & W. Lise, *CO_2 Price Dynamics: The Implications of EU Emissions Trading for the Price of Electricity*, 05–081, ENERGY RES. CENTER OF THE NETH. 1, 72 (2005).
95. *Id.*
96. *Id.*

Numerous studies have investigated the pass-over on power prices. The most pessimistic studies assume a 100% pass-over rate. For example, McKinsey comes to a figure of 10€/MWh for a 20€/tCO_2 allowance price.[97] However, several studies show that the pass-over rate will only be 100% when power demand exceeds the base load and a coal or lignite plant that sets the marginal price.[98] During periods where hydro-power or nuclear power sets the marginal price, it is not likely that power operators will be able to factor in the full value of the certificates. One study for Germany and the Netherlands hence comes to a pass-on rate of forty to sixty percent.[99] The International Energy Agency (IEA) points out that large parts of the European electricity market are not yet fully liberalized and that price regulations will restrict pass-over.[100] Nevertheless, the IEA points to the Nordic electricity market (Nordpool) as one region where electricity trade has been successfully liberalized and where pass-over of ETS costs should be expected. Due to the significance of hydro and nuclear power, one Finnish study concludes that the average pass-over rate on the Nordpool exchange should be in the range of forty percent, for example, 4€/MWh for a twenty Euro allowance price.[101]

The studies mentioned above imply a cap-induced carbon price in the range of 4–10€/MWh for the power sector for a 20€/tCO_2 allocation price.[102] This pass-over cost can be compared with CO_2 taxes on electricity in the range of 6–12€/MWh for smaller business users in the Netherlands, the U.K., Germany, and Denmark. In contrast, large energy-intensive industries with exemptions are generally liable only to the EU minimum energy tax rate of 0.5€/MWh (this rate applies not only in member states with environmental tax reforms, but across the EU as a whole).[103]

These findings suggest that with effect from 2008 the ETS will effectively have increased the cost of CO_2/MWh for the affected energy-intensive industries to a carbon price level comparable to that of smaller business users in member states with carbon-energy taxes. This appears to

97. European Commission [EC], *Report on International Competitiveness*, EU ETS Review (Dec. 2006).

98. *Id.*

99. *Id*.

100. *See* Julia Reinaud, *CO_2 Allowance and Electricity Price Interaction: Impact on Industry's Electricity Purchasing Strategies in Europe,* INT'L ENERGY AGENCY 1, 23–32 (2007), *available at* http://www,iea.org/textbase/papers/2007/jr_price_interaction.pdf (examining the links between CO_2 prices, electricity prices, and electricity costs to industry).

101. Government Institute for Economic Research, *Impacts of the European Emission Trade System on Finnish Wholesale Electricity Prices*, VATT Discussion Papers, 405 (Helsinki) (Nov. 2006).

102. Reinaud, *supra* note 100.

103. *Id.*

be a significant increase. The ability to pass-over the value of grandfathered ETS allowances will reflect the carbon burden of the marginal power producer. Consequently, these pass-overs will likely create significant wind fall gains for electricity producers, unfortunately without providing the desired price signal distinguishing between electricity based on carbon and carbon-neutral power sources respectively. Significantly, there is no simple way to compensate energy-intensive industries for the imposed burden because there is no revenue available for recycling under the ETS-scheme.[104] Therefore, one can expect more substantial inroads on energy-intensive industries' gross operating surplus from ETS than from pre-existing ETR.

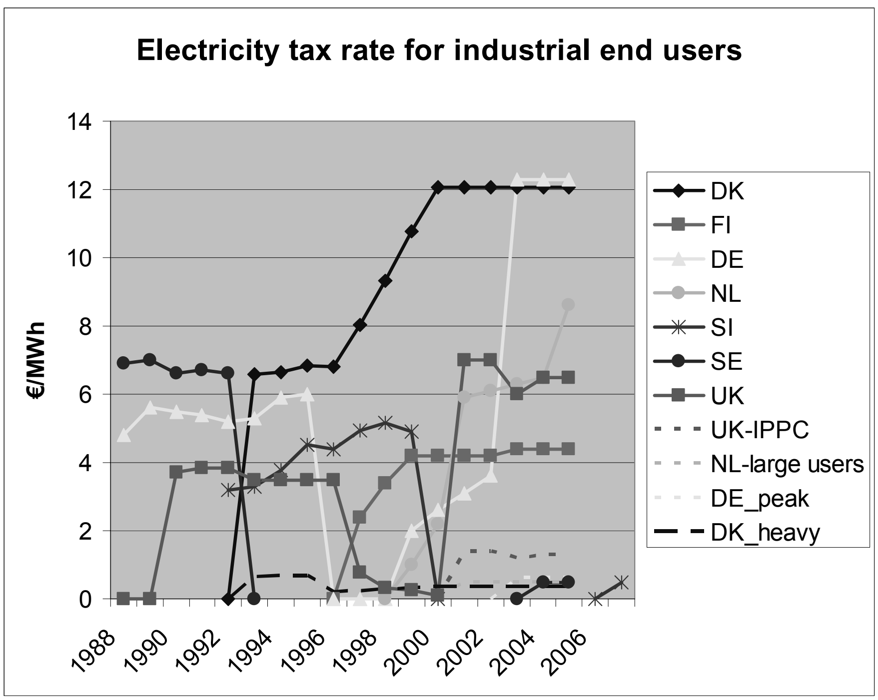


Figure 2: End-user electricity tax rates for industries 1988–2006 in the seven European countries with environmental tax reforms (Source: COMETR database).

104. Sijm, *supra* note 94, at 11.

B. Double-Regulation Complexities

It is not surprising that the simultaneous taxing and trading of carbon has evoked concerns about perceived double-regulation. The ETS-system divides emitters into two sectors: ETS and non-ETS. The double-regulation argument states that as emissions from the ETS-sector are fully regulated from the trade with certificates, there is no further need for a regulatory tax.[105] The ETS sets a cap for emissions from the ETS-sector; additional allowances must be acquired on the market, possibly with the use of other flexible instruments, if emissions exceed this cap.[106]

Consequently, some governments are considering abandoning carbon-energy taxes for the ETS-covered installations. Due to EU state aid regulations, approval will be required from the European Commission for any measures that lift taxes selectively for certain emitters as would be the case if the ETS sector was excluded.[107] On one hand, the Energy Taxation Directive foresees that installations covered by tradable quotas can be fully exempted from the minimum energy tax rates.[108] On the other hand, the Energy Taxation Directive has a broader mandate than carbon taxation only; it also covers energy-supply and tax-rate harmonization.[109] The ETS-system has created a market with volatile prices and where pass-over rates are highly dependent on regional specificities of the power markets. Accordingly, the ETS-system as such cannot necessarily guarantee the level playing field as was the intention with the harmonizing minimum energy tax rates. The issue remains whether the grandfathered allowances under ETS can qualify as a fully-fledged scheme of tradable quotas in the context of the Energy Taxation Directive.

With respect to environmental implications, the present level of carbon-energy taxation has impacted CO_2 emissions. An increase in emissions can be expected if carbon costs are lowered by removing taxes. The additional domestic emissions would need to be offset by additional allowances, acquired on the European ETS-market or on the international market for flexible mechanisms. These allowances are only available at a cost. Changes in one member state might not affect the European ETS price, but if seven member states were to remove carbon-energy taxes, a perceivable impact on the ETS price can be expected and would offset the value of the tax relief.

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105. *Id.* at 17.
106. *Id.*
107. Andersen, *supra* note 11, at 526.
108. *Id.* at 526–29.
109. *Id.*

Removing carbon-energy taxes will also inflict a loss of revenue because none is generated under the ETS-scheme.[110] If the policy aim is to raise taxes with a minimum of excess burden, few other taxes can exhibit properties as attractive as those of carbon-energy taxes. Shifting the tax burden back to labor would not be preferable. Taxing other greenhouse gases not currently subject to taxation, or other external effects, is a more desirable method with less adverse effects. If revenue sources of such a similar nature cannot be identified, then the member state will face both the cost of the additional allowances as well as the distortionary costs related to the new tax base. Based on this observation, the new tax base actually needs to be better than the present one, which means that the alternative tax-base should provide sufficient extra benefits to compensate for the additional cost of allowances.

CONCLUSION

The European Commission has proposed in its Climate Policy Package[111] that a post-2012 emissions trading system shall phase out grandfathering allowances and introduce auctioning. These changes would help solve many of the difficulties indicated here by generating revenue. Without this revenue recycling and its effect on lowering other taxes, carbon pricing will adversely affect the economies and competitiveness of the respective countries.

The experience in Europe with environmental tax reforms as summarized in this article has provided important insights to the macro-economic implications of carbon-energy taxes. Macroeconomics has been largely neglected in much of the literature, which tends to take a micro-economic perspective on using market-based instruments. By introducing carbon-energy taxation while safeguarding a revenue-neutral tax shift, the negative economic impacts from taxing carbon can be avoided and a significant contribution to reducing greenhouse gases could be achieved. Reducing employers' social security contributions appears to be the soundest approach to avoiding tax-interaction effects. A phased approach is needed whereby the cost of carbon is increased each year by 1–2€/tCO_2 from the present level in Europe. According to best estimates this would be sufficient to provide the kind of economic signal required to help reduce

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110. *Id.*

111. *Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions*, at 6, COM (2008) 30 final (Jan. 23, 2008).

greenhouse gas emissions and stabilize atmospheric emissions at a level sufficient to enabling attainment of the two degree target—provided that other major emitters impose policies of a similar stringency.