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**Improved Allocation through Environmental Taxes?  
Theory and Reality: The Example Germany**

"Society must be prepared to transform social costs into private costs through political intervention."

K.W. KAPP, 1950

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**Abstract**

The social costs of two evils inherent in market economies – unemployment and pollution – have been the subject of theoretical debate throughout the 20<sup>th</sup> century. But only lately, since these evils have been recognized as a global threat, some serious political efforts are undertaken to reinternalize these social costs.

One such initiative, first formulated in the European Commission's 1994 'White Book' [EC, White Book, 1994], is that of a tax shift: Some of the tax burden on economic 'goods' like the employment of labor is to be relieved at the expense of a (higher) tax load on an economic 'bad', in particular pollution, in the form of environmental taxes. They act as a disincentive for all kinds of polluting activities, while the extra revenue can be used to reduce the gross cost of labor and to create jobs in new environment oriented technologies. We'll present these arguments and a first evaluation of the allocation effects of the German 'ecotax' that has been introduced in yearly steps since 1999.

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## Table of Contents

Introduction: Objectives and Instruments .....	2
Rational Man – Irrational Society or: the Prisoners' Dilemma .....	3
Monetarization and the Quest for the 'Equilibrium Level' of Tax Incentives and Disincentives ..	4
The Hard Way towards a Greener Valley .....	5
Interlude on Optimization .....	6
Modes and Means of Production .....	6
The German 'Ecotax': A Large Scale Socio-Economic Experiment .....	7
Literature .....	9

## Introduction: Objectives and Instruments

It is certainly true that basic judgments on the standards of and the requirements for sustainability, i.e. for life on this earth, lie outside the realm and scope of the 'disembedded' economic system – and hence to a large extent also outside the focus of the prevailing economic theory. Yet the continuing deterioration of the environment in many parts of the world, the imminent danger of a drastic change in climate and the destructive effects of continual high unemployment have created a new interest for those economists who have since the early 20<sup>th</sup> century analyzed these evils inherent in market economies and proposed some solutions. One possible instrument to fight pollution and increase employment will be the main subject of this article: environmental taxes<sup>3</sup>.

Unfortunately some of the early proposals like the PIGOU-tax or the COASE contracts have for a long time just remained beautiful toys for the kind of mathematicians that are called theoretical economists.

In reality we are confronted not with the standard textbook example of one paper mill upstream and one fisherman downstream who risks losing his job, but with millions of polluting activities with an impact on 400 million people in Europe alone and with 20 million unemployed in the EU15.

We do not know and have no way to measure the marginal social cost of each of such activity as required by theory in order to determine the optimum PIGOU tax rate, nor can we set up COASE contracts between millions of partners.

KAPP's work, on the other hand, was always aimed at a realistic political concept of economics beyond mere mathematical games; yet his general concept of social costs was to a large extent ignored by mainstream social science. But maybe this is changing: the threat of global warming, the political instability resulting from high structural unemployment, the abundance of financial capital not finding interesting investment opportunities, and, last but not least, the foreseeable end of cheap oil and gas – all this acts as a pressure on governments to reduce the dependence on fossil fuels and to pave the way for new, labor-intensive worldwide investments in renewable energy, energy saving and all kinds of solar technology.

Certainly the advocates of such policies are growing in number all over the globe; yet they face enormous obstacles: the resistance of traditional big industries, often in collusion with governments

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<sup>3</sup> For the authors' contributions to this subject cf. [Jarass/Obermair, EU Tax Policy, 1993], [Jarass/Obermair, Environmental Taxes, 1996] and [Jarass/Obermair, More Jobs, 1997, revised 1999]; for social cost arguments in infrastructure planning see e.g. [Jarass/Nießlein/Obermair, Theory of Social Costs, 1989].

and sometimes even with labor unions, but also the more subtle mental reservations of the common economic actors described in the next section.

### **Rational Man – Irrational Society or: the Prisoners' Dilemma**

In many cases the individual economic subject has insufficient information about his cost situation with respect to public goods like environmental quality or adequate levels of employment. Two simple examples may serve as an illustration for such situations:

"I would, of course, not dump my garbage into the ditches. But, I suspect, all the others will continue to do it. Hence not doing it myself, I will only hurt my own interests without helping to keep ditches clean."

"I would, of course, hire some more workers. But, I suspect, all my competitors will invest in production automats. Hence not investing that way myself, I will only hurt my own interests without improving employment."

In abstract language: on the basis of his insufficient information the individual has no better choice than to maximize his private benefit, even knowing that he might thus hurt the benefit of all. A situation like this is what game theory describes as 'The Prisoners' Dilemma'. In other contexts it has simply been called 'harmful competition'! It is also the result of unfair or harmful competition when governments do not tighten their environmental protection laws, because other countries with (even) lower standards would gain a cost advantage for their products.

In all these cases the defense of the public goods that are not covered by the price mechanism of the market requires institutional solutions, some kind of regulation organized by a superior authority. Here KAPP's admonition, quoted as the motto above, comes in: "Society must be prepared to transform social costs into private costs through political intervention."

Essentially two types of instruments are available for such political intervention:

- Normative (non-fiscal) instruments, i.e. rules with limit values and sanctions.
- Price instruments by government regulation, e.g. tax incentives and disincentives.

In many cases the two types of instruments should and do in fact act together as in the following case:

A (world-wide) trade in pollution licenses, in particular with respect to CO<sub>2</sub>-emissions, as an instrument against the greenhouse effect, is generally advocated by the leading climatologists, c.f. [Schellnhuber, Danger, 2003]. It may be described as a combination of normative and price instruments: after strictly controlled upper limits for greenhouse gas emissions have been fixed by international agreement for each national economy (normative aspect), the price that the high emission industrialized countries have to pay to low emission developing countries for additional emission rights follows supply and demand (market aspect). The revenue for the poor countries ought to be invested (again by supranational normative control) mostly in CO<sub>2</sub>-reducing technology

Does 'global rationality' as a prerequisite for the completion and supervision of such treaties have a chance? Or will islands be drowned in rising oceans and hundreds of million of people starve or fill new refugee camps before such comprehensive international agreements can be pushed through? Questions that will not be pursued further in this essay. Instead we return to what could be achieved on a national or - at best – European level.

Norms are of course indispensable and quite effective for the protection of the biosphere: limits on the immission of toxic or noxious agents, radioactive material etc. into air, water and soil. Ideally they should be internationally standardized (also to avoid the above mentioned unfair competition). At least for radioactive isotopes this has been achieved through UN-institutions. In many other cases we are far from such standardization. Moreover norms alone may also prove insufficient and may indeed impede technical innovation: once the prescribed values are achieved there is no incentive

for further improvement and for the development of technical alternatives. As a remedy against unemployment normative solutions have, at least if used on a large scale, not turned out very helpful – meaningful jobs are not created by norms on levels of employment; government financed meaningless work where there is no demand for the results of the work, practiced not only formerly in the COMECON states, but also in some areas of Western Europe, has been a disaster both for public finance and for the work ethic of the population.

This is where the second instrument comes in: Price instruments furnish additional information. The cost expectation for socially desirable economic activities can be lowered, that for socially undesirable behavior increased, e.g. by appropriate taxation. Taxes should hence be fixed at such levels that socially or environmentally preferred standards become competitive on the market (hence called standard-price taxes).

There is a counterargument against such tax instruments which is quite popular throughout the political spectrum from right to left: Government tax policy should always remain strictly fiscal and not begin to interact with the economy (in German: "Nicht steuern mit Steuern!")

Now, who argues like this must be stricken with blindness: the fiscal policy of governments is not in a state of economic innocence, on the contrary, in the last 25 years the tax policy of most continental European states has interfered strongly with the allocation of production factors. They have shifted much of the tax load away from capital income and wealth onto the production factor labor, c.f. [Jarass/Obermair, More Jobs, 1999]. Example Germany: the effective tax rate on both labor and capital income was around 30% up to 1980; in 2002, however, the load of taxes and contributions on labor amounts to nearly 40%, that on capital income to less than 20%. Taxes on natural resources and environment remained low and amounted to less than 3% of GDP in nearly all countries. Expressed in real purchasing power the price of gasoline was lower in 2000 than in the 1960s before the first oil price crisis. The most polluting activity – air traffic – is still subsidized by the tax exemption for kerosene etc. etc.

And the price mechanism of the market did in fact work:

- as the investment in labor-saving technologies is subsidized whereas the load of taxes and contributions on labor went up, so did unemployment;
- as the real price of fossil energy went down, so did the efforts to curb its consumption.

Thus, even if inadvertently, government tax policies have to a large extent contributed to the present socially undesirably allocation of the production factors labor, capital and natural resources: 'rational man – irrational society!'

To reverse this trend at least to some degree the new German government has tried since 1998 to introduce a serious environmental tax<sup>4</sup>. Before we describe this project and its positive and negative consequences, some matters of principle will be taken up: the problem of the monetarization of the social costs of environmental damage and the related problem of fixing the appropriate rates of environmental taxes in such a way, that they may lead to a new 'equilibrium' between the forces of the economy and the requirements of sustainability.

### **Monetarization and the Quest for the 'Equilibrium Level' of Tax Incentives and Disincentives**

Talking of costs, we talk about money; talking of social costs, we talk about monetarization, we must write out a price tag. But what is the monetary value, of course at today's market price, of all the specific damage, deterioration or loss that human activities – industry, traffic, energy conversion

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<sup>4</sup> A stocktaking of taxes in the EU that could be labelled 'environmental', compiled by the authors in 1996 for the European Commission [Jarass/Obermair, Environmental Taxes, 1996], showed that the economic impact of these relatively low taxes, often restricted to narrow sectors and a few special products, cannot have been too high.

and our daily life style – do to the biosphere, to the habitat of plants and of animals of all kind including humans?

For the social cost of air pollution the German Federal Agency for the Environment ('Umweltbundesamt') has arrived some years ago at such a figure (45 billion € per annum) by adding up a rather inhomogeneous set of entries: financial loss in forestry due to dying trees, reduced yield in agriculture, health expenses and loss of working hours due to increasing respiratory diseases, repair costs for eroded stone or steel and concrete both on historical buildings and on modern technical construction etc. etc. But such lists can hardly be complete: when a sinking tanker spills thousands of tons of oil one may be able to estimate the financial loss for fishery, but how many seabirds will be killed and what is their monetary value?

And the social cost of continuous unemployment – can it be measured in terms of the social assistance payments for those who are not or no longer covered by unemployment insurance? What about depressions, alcoholism, neglected children or the development of slums?

What this brief list of examples shows is that monetarization of social costs may at best result in a crude first approximation that gives an indication of the order of magnitude of the problems involved. Moreover, even if one could do better, it would not really be helpful: in order to determine the rates of tax incentives and disincentives that would compensate the social costs, one would also need all kinds of elasticities with respect to the deployment of production factors. In the end one would be caught up in mere mathematical games based on some rather unrealistic assumptions:

- that the outputs of an economy, the social product, the level of employment, the quality of life etc. are continuous and differentiable functions (in the mathematical sense) of the inputs in terms of relative factor prices etc.;
- that one is never far away from some kind of equilibrium;
- that the velocities of adjustment are very high and all transaction cost very low and so on.

So let's leave neoclassical idealizations and turn briefly to a somewhat different point of view that originates in the theory of optimization.

### **The Hard Way towards a Greener Valley**

There seems to be a broad consensus at least in European societies that one should fight unemployment and struggle for the improvement of the environment. Yet most concrete measures to improve the situation in this respect are confronted with objections, impediments or with vetoes from influential groups. A paradoxical situation: something that a large majority holds to be desirable finds active support at best from small minorities.

One could describe this as a case of split collective consciousness or quote the 'innate conservatism' of human nature, but such psychological explanations, even if plausible, are not very helpful, because they deal with symptoms, not with causes. The cause of innate conservatism lies in the fact that an established economy finds itself, due to the negotiating margin of its participants, at any time near some dynamic or 'flow' equilibrium, i.e. a local or relative optimum (=maximum with constraints) of the benefit function of its members. By virtue of the negotiation process leading to such equilibria they are stable against not too big perturbations: after an excursion the system is pushed back to a state close to the original one (like a ball always rolling back to the lowest directly attainable point of a valley) because a deviation from the equilibrium results in decreased benefits for most participants. The unexplained 'innate conservatism' thus appears as a completely rational reaction based on long collective experience.

So is there no way out? Are we really trapped in the present mode of production where the return on capital is the prime motor of the economy, where the means of production are selected to maximize productivity at the expense of employment and environment? In the attempts to formulate

answers to this crucial question we invoke an analytical tool that has been developed in the last decades: optimization theory.

### Interlude on Optimization

There exists now a vast literature on the mathematics of optimization, covering a wide range from Operations Research to Statistical Mechanics, from the traveling salesman problem, c.f. [LK, Operations Research, 1973] to the physics of glasses, see [KGV, Science, 1983]. For an updated list of references see [BBOMS, Traveling Salesman, 2001]. The two prototype examples of this range are in fact the traveling salesman, who tries to visit N-many clients in one tour with the shortest or fastest possible route (while may-be trying to visit the most important clients at short regular intervals) and the arrangement of N-many molecules in an amorphous material like glass where the attractive forces and the hard core repulsion between the atoms bring about structures that represent a relative minimum of the total energy.

It is characteristic of such systems with a very large number of independent state variables (N steps in the tour, N molecular positions in the sample) that besides the true absolute minimum of the benefit function (of the total length of the tour, of the total potential energy of the sample) there are many 'good' relative minima that represent excellent approximations of the true minimum. However, in the space spanned by the state variables (the sequence of individual steps, the positions of individual molecules) these different relative minima are as a rule far away from each other and separated by regions with very unfavorable values of the benefit function. It is like in a huge mountain range: there are many deep, warm, green valleys, separated by high saddles; if a group of people want to go from 'their' valley to another warmer and greener one, they all have to go through a lot of hardship.

This structural insight, not the (futile) attempt to do any quantitative computations, motivates this digression: we may gain some heuristic arguments that explain the evident stability of an untenable state of affairs.

### Modes and Means of Production

The adjective 'capitalist' has more or less vanished from public debates and even from the social science vocabulary; the traditions of the University of Trento and the title of this conference represent a remarkable exception. For the general public the word 'capitalism' is a no-no word; for most economists the capitalist mode of production represents the 'natural' order of human affairs or the final destiny of history and is therefore not even worth being explicitly mentioned: from this point of view a market economy cannot be anything but a capitalist economy and hence there is only one equilibrium which is – apart from some minor deficiencies – simply identical with the present state of affairs.

But this is not true – even the cursory sketch of optimization theory given above indicates that any system with a large number of variables must exhibit several (locally stable) relative optima of the total social benefit, all maintained under the same conditions of free market exchange; only the composition and weight of individual goals entering the 'benefit function' will differ greatly between these different equilibria. There is one, which we know, in which the predominant social goal is to maximize the yield for the givers of capital; there is another free market equilibrium (w. Vogt has shown its hypothetical existence and stability under the usual mathematical assumptions of neoclassical theory [W. Vogt, Labourist Economy, 1986]) where the quality of life of the working class dominates the mix of individual benefits and a similar one [Jarass/Nieblein/Obermair, Theory of Social Costs, 1989] in which also the quality of the ecosphere – call it 'sustainability' - is given priority over profit; see also [Daly, Steady State Economics, 1977].

Yet here we are: even given a 'volonté generale' to realize a sustainable economy, how do we get from here to there? The new 'greener valley' lies far away, there is no easy way to get there due to

the very property of local stability: Small or medium size changes of the variables, in our case of the relative deployment of production factors, will only lead to non-optimal conditions both for the profit rate of capital and for the quality of life for labor and will not yet produce an essential ecological improvement. Here we have a model explanation of the paradoxical situation described above: the new equilibrium cannot be reached spontaneously. Attempts to get there by drastic political measures meet broad disapproval based on the (correct) assessment that both labor and capital will for a long time suffer considerable reductions of their benefits.

Experienced inhabitants of mountainous regions know how to react: do not go over the tops, but over the lowest saddle and decrease the efforts to overcome it. This is where environmental taxes come in: fiscal incentives in favor of ecological and labor intensive technologies, shifting the tax load from the production factor labor to increased costs for the input of environmental quality, may ease the transition and improve, even in the short term, the benefits of ecological means of production. This, then, is the expected effect in our metaphorical language: the profit-oriented optimum becomes less profitable, the saddle less steep and the green valley even greener. To do this job, the pace of the cost shift must follow typical economic and technological adjustment times; we even have an experimental clue for such adjustment times: after the oil price increase in the 1970ies, the decreased fuel consumption of new cars and the improved efficiency of industrial and public utility energy conversion has nearly compensated this increase within 5 years. (Don't underestimate the versatility of capital.)

### **The German 'Ecotax': A Large Scale Socio-Economic Experiment**

The tax shift proposed around 1990 by the former EC-President Delors and elaborated in the White Book [EC, White Book, 1994] and the subsequent studies was never realized on the European level. Instead at least targets for the reduction of green house gases from 1990 to 2008/12 were set for each of the EU15 countries which would result in an overall reduction of 8%, with higher targets for some developed industrialized Member States (-21% for Germany and Denmark, -12.5% for the United Kingdom) and increased limits for some southern European countries (+15% for Spain and +27% for Portugal). This target sharing is to take into account the differing geographic, climatic, economic and social points of departure. The specific instruments for meeting these targets are left for the national governments to decide.

More specific plans were developed step by step in Germany since the early 1990ies, mostly by NGOs and research institutes. In 1994 Greenpeace Germany commissioned a first comprehensive study on the measures and results of an 'Ecological Tax Reform (ETR)' The scenario was: increase the tax on carburants by 7% annually over a 10 year period, increasing the consumer price by a total of more than 50%, while keeping the total state revenue constant by redistributing the increment to the citizens by a lowering of taxes and, in particular, social security contributions, on labor – Delors' concept of a tax shift.

The study [DIW, Ecotax Reform, 1994], performed by the German Institute of Economic Research gave a projection of the main effects of these measures:

- The overall reduction of primary energy consumption would be 20% over the 10 year period, that of CO<sub>2</sub>-emissions 21%.
- Between 400 and 800 thousand new, additional jobs could be created due to reduced labor costs and the price incentives for energy conservation and renewable energy technologies.

This is the 'double dividend' hypothesis; its practical test, 1998-2003, will be described below.

When spokesmen of the Green Party advocated a final price of DM 5 or € 2.50 for the liter of gasoline or diesel oil in 1998 there was a public outcry (this price may indeed not be to far from the actual social cost of automobile and truck traffic), but the predicted election disaster did not occur and the newly elected red-green government was able to pass the ecotax-legislation and start a (considerably downsized) program of ecological taxation:

- beginning in April 1999 the tax on carburants went up in 5 yearly steps of 3.07 €cents per liter;
- an extra tax on consumer electricity was introduced: + 1 €cent per kWh<sub>e</sub> in 1999 and additional steps of + 0,26 €cents per kWh<sub>e</sub> each year from 2000 to 2003;
- single increases in 1999 on natural gas: + 0,16 €cents per kWh<sub>th</sub> and on light heating fuel oil: + 2 €cents per liter (equivalent to approx. 0,2 €cents per kWh<sub>th</sub>).

But, of course, exemptions had to be made for powerful lobby groups, for energy intensive industries and for agriculture.

On the other hand the extra revenue estimated at 14 billion € for 2002 (i.e. about 3% of total tax revenue excl. social security contributions) was redistributed in the form of a reduction of employers' and employees' social security contributions by overall 1.7%-points: the state pension insurance rates could be lowered for some time from 20.3% to 19.1% of gross wage; an additional government expenditure of 200 million € could be provided for renewable energies.

Thus it appears that, in spite of the exceptions and exemptions (a minus of 4 billion € of revenue with respect to the full rates now paid only by consumer and small industries), the double dividend concept did in fact work for some time:

- Emissions from traffic decreased by about 2% annually since 2000; the total CO<sub>2</sub> emission decreased by nearly 20% since 1990 for a variety of reasons, mostly the deindustrialization of Eastern Germany after 1990, but lately also due to the ecotax effect;
- Against a long term downward trend the number of passengers in the public transport system began to go up again with a total increase of 3% since 1999.
- The increased demand for energy efficient cars and for improved energy saving in households (heating, cooling, thermal insulation etc.) shows a favorable consumer reaction;
- it is estimated that up to 250.000 additional jobs will have been created by 2003 due to reduced labor costs and to investments in energy saving.

Thus it may appear that the ecological tax reform is a real success story. Is it really?

The figures just quoted do indeed indicate some significant allocation effects; even more important: a qualitative change of long standing trends, in particular with respect to energy consumption.

In spite of this well documented impact public opinion on this reform is rather negative; populist mass media have done their best to counteract against a government publicity campaign; they emphasize the increased gasoline and electricity bill and neglect to mention the relief in social security contributions ("Freedom of press is the freedom of rich people to have their opinion printed", Kurt Tucholsky, around 1925). Unfortunately it is also true that the lowest income group has the lowest relief and the highest relative extra cost with respect to their disposable income.

There is also severe criticism from environmentalists: some of the worst polluters have not even been touched – German hard coal is still highly subsidized, air traffic kerosene still untaxed. It can be argued that a much higher fraction of the additional revenue ought to be directly invested for environmental recovery.

Last but not least it has been argued that the temporal relief on social security contributions has only obscured the tendential bankruptcy of the existing system and impeded the efforts for the necessary fundamental reform, by which all tax payers, not only the wage earners, would have to contribute to the maintenance of a civilized society.

The saddle towards the greener valley has not yet been surmounted, but we may, with Albert Camus, "imagine Sisyphus as a fortunate person: the struggle against mountains may fill human hearts with happiness".



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