Putting a price tag on emissions and resources

An economist's view on policy interventions for intergenerational fairness and sustainability

Modern economies are confronted with major problems: the exhaustion of natural resources, the degradation of the environment and the financing of the needs of an aging population – all challenge the welfare of both present and future generations. This paper discusses a proposal which is designed to bring about a double dividend. On the one hand, a virgin resource tax could stimulate the reduction of natural resource use by making sustainable technologies economically profitable. On the other hand, it could provide a way to finance the pension system.

Gunter Stephan

Putting a price tag on emissions and resources. An economist's view on policy interventions for intergenerational fairness and sustainability | *GAIA* 29/4 (2020): 215 – 217 | **Keywords:** circular economy, environmental economics, fairness, green tax, sustainability

Equity and efficiency are key pillars of sustainability. This follows from the Brundtland report (WCED 1987), which states: the present generation has to use scarce resources efficiently in satisfying its needs and in doing so it should not harm the future generations' welfare.[1] To express it in more technical terms: all generations should be treated symmetrically in the sense that the level of welfare of each generation has to be at least equal to that enjoyed by the previous generation (see Pezzey 1992). Hence the welfare of future generations should not be discounted. This, however, is only one aspect of intergenerational equity. Economic theory shows (for example see Stephan and Müller-Fürstenberger 1998 b) that the kind of intergenerational fairness just mentioned can be achieved only if the present generation significantly invests in the future environment by reducing both emissions and resource use. As is well known since Koopmans' (1967) seminal paper on optimal growth, this implies that the present generation has to increase its savings and hence to reduce conventional consumption, or as Nobel Prize winner Kenneth Arrow (1999) puts it: for being fair to future generations the present one has to accept that investing in future generations' welfare will harm their own conventional wealth. In other words, to guarantee equity for future generations, the present one itself is treated unfairly unless there is some form of compensation through intergenerational transfers, as we will discuss later.

Behavioural economics (see Güth et al. 1982) has shown that individuals resist solutions if they feel they are unfair to them. This immediately raises an important question: under what conditions would the present generation be willing to support the transition to a more sustainable economy? Environmental economists would typically argue that improved environmental quality has the features of a public good, therefore the incentive to voluntarily invest in a sustainable economy will be low unless a high degree of intergenerational altruism prevails, that is, if the welfare of the present generation depends both on their own wellbeing and that of future generations. But what if we cannot count on that? The typical way out of this dilemma, proposed by economists, is to establish a system of intergenerational transfers, for example, a pension system. This idea is discussed in a wider context. Thereby the main message of this paper is that the intergenerational fairness issue could be overcome by a tax on virgin resources combined with a redistribution of tax income aimed at financing the pension system.

Sustainability, taxing resources and intergenerational transfers

Fair intergenerational distribution is a central requirement for sustainability (see Asheim 2007). Markets, if perfect, usually grant efficiency, which however is not the most central requirement for the sustainable management of natural and environmental resources. But markets are bad at granting equity. In particular, intergenerational conflicts will not necessarily be solved in a perfect market economy. Distributional problems arise because the present generation, through its capital and resource >

Prof. em. Dr. Dr. Gunter Stephan | University of Bern | Department of Economics *and* Oeschger Centre for Climate Change Research | Schanzeneck 1 | 3001 Bern | Switzerland | gunter.stephan@vwi.unibe.ch

https://doi.org/10.14512/gaia.29.4.3
Submitted April 16, 2020; revised version accepted October 16, 2020 (double-blind peer review).

1 "Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, p. 43).

management policy, determines the endowment of future generations.

Lessons from a numerical thought experiment

Environmental quality such as clean air has the feature of a public good. Therefore, generations cannot provide an improvement of environmental quality for their offspring by acting individually. Without some cooperation, for example, through policy interventions, future generations are likely to be wealthier in terms of physical capital endowment, but poorer in terms of environmental quality. It is common sense, at least among economists, that investing in future environmental quality must reduce the accumulation of physical capital and lead to losses in economic growth and material wealth. However, in an empirical analysis based on a computable general equilibrium model, Stephan and Müller-Fürstenberger (1998a) have shown that there are good reasons to believe that climate policy, for example, can pay a double dividend if property rights on carbon emissions are used for policy intervention. First, if carbon rights are used as policy measures, this could reduce the economic damage of climate change. Second, if carbon rights are attributed to the working generation,[2] this would generate a significant redistribution of income and might lead to a larger physical capital stock and therefore to an increase in social welfare. The reasoning is almost obvious.[3] The working generations determine through their savings/consumption decisions about the accumulation of the society's stock of physical capital. The more income is available to them, the higher are their savings. And since savings are equal to net investment, as a well-known result in macroeconomics says, this implies investments in capital formation.

One could imagine a tax on virgin resources that makes the use of raw material and energy more expensive and hence recycling and resource-saving innovations more profitable.

Policy interventions: taxing virgin resources and tax redistribution

The European Commission strongly advocates the use of market-based instruments among Member States. In the EU *Thematic Strategy on the Sustainable Use of Natural Resources*[4] the Commission calls for greater decoupling of material use from economic growth and increased resource productivity, which could be achieved through, for instance, properly designed taxes and charges.

Both green taxes, such as taxes on emissions and natural resources, as well as tradable property rights, such as emission permits, promote economically efficient environmental policies. Both put a price tag on environmental services and resources, both enforce equalisation of the marginal costs of abatement across groups and over time. But welfare effects can be quite different. For example, the intergenerational allocation of tradable property rights can be seen as an alternative to transferring income between generations. Therefore, the question: who gets what? becomes an important one.

A simple approach is to combine the issue of financing the pension system with that of sustainability. One might argue that this makes a complex problem even more complex. It is important to recall, however, that, for example, Switzerland has a long tradition of combining economic incentives with the compensation of distributional effects. A typical example is the CO_2 law, which envisages putting a price tag on CO_2 on the one hand and reducing regressive welfare effects through tax recycling[5] on the other. To be more precise, one could imagine a tax on virgin resources that makes the use of raw material and energy more expensive and hence recycling and resource-saving innovations more profitable. The tax income could then be used to finance the pension system. This would reduce the financial burden on the working generation to finance the pension system and therefore increase their disposable income.[6] A further idea would be bequest taxation and reducing taxes on sustainable investments. This would make investing in environmental quality competitive to gifting material wealth to future generations.

Significant side effects of taxing virgin resources

Switzerland heavily depends on imports of raw material. In 2006, more than six tonnes of material were imported per capita (Bundesamt für Statistik 2008). Around 75 percent of the companies in the machine, electrical and metal industries use at least one of the following critical raw materials directly or indirectly in the manufacturing process: chromium, molybdenum, magnesium, tungsten, graphite, and cobalt. The burn-off rates of most of these critical materials are below 30 years, which means that proved reserves will be exhausted within the next 30 years if we continue to extract at present rates (for details see EASAC 2015). Given Switzerland's high dependence on imports of these materials, security of supply becomes an important issue. Furthermore, the entropy law tells us that resource use and environmental degradation are two sides of the same coin (see Faber et al. 1995). Conse-

2 In this paper the lifetime of each generation is split into two periods: 1. working period and 2. retirement.

3 Matthies et al. (2020, in this issue) have revealed that citizens have problems to understand CO_2 pricing schemes.

4 *https://www.eea.europa.eu/policy-documents/thematic-strategy-on-the-sustainable*

5 Tax recycling means that the tax income is paid back to the population, for example on a constant per capita basis. This can have a welfare-increasing effect (see Stephan et al. 1992, Diekmann and Bruderer Enzler 2019).

6 This was the idea behind the green tax reform in Germany during the Schröder administration (see Stephan et al. 2003).

quently, recycling and increasing resource efficiency in production are important tasks.

This gives rise to a further motive for implementing taxes on virgin natural resources. Existing market prices for virgin materials are today not high enough to allow investments in a circular economy or for the development and implementation of more efficient technologies that are profitable at the firm level (see EASAC 2015). Taxes on virgin natural resources therefore change relative prices and might encourage the substitution of secondary and recycled materials with virgin materials. And since virgin materials are often associated with more negative externalities than recycled materials, this may also be less harmful to the environment. One frequently mentioned reason is that the processing of secondary materials tends to be less energy-intensive[7]. In addition, recycling is one way of avoiding the disposal of solid waste. As already mentioned, taxes on virgin materials will change the relative price between virgin and recycled materials and in this way influence waste disposal behaviour. Finally, it needs to be said that some economists (for instance see Conrad 1999) argue that a tax on virgin materials is preferable to a tax on waste because the environmental aspects are integrated at the beginning of the production process.

Conclusions

The Swedish Environmental Protection Agency, among others, argues that taxes on virgin natural resources should be given serious consideration (SEPA 2002) because they may be compatible with so-called integrated product policies (IPP), which aim at encouraging the diffusion of environmental management techniques along the entire supply chain of a product (rather than focusing on end-of-pipe solutions). Indeed, taxes on virgin resources could have several effects. On the one hand, they could change the relative prices of resources, which would make the use of secondary resources more profitable. This would in turn stimulate the innovation and implementation of a circular economy and hence reduce the dependence on imports of scarce resources. On the other hand, if the tax income is used to finance the pension system, the contributions of the current working generation could be reduced accordingly. The disposable income of the working generation would increase and consequently also their consumption and savings. Overall, this could create a comparative advantage for the entire economy, as the outcome of the green tax reform in Germany demonstrates (see Stephan et al. 2003). Finally, though, there is an important caveat. In order to minimise monitoring and administration costs, government authorities might want to specify taxes on virgin resources as import tax. This, however, might be in conflict with international agreements, such as WTO regulations (see Sabatier and Jenkins-Smith 1993).

7 There are, however, cases where the energy inputs into recycling outweigh the energy-saving effect of using these recycled resources in consumption and production. A typical example is plastic recycling.

Helpful comments by two anonymous referees are gratefully acknowledged.

References

Arrow, K. J. 1999. Inter-generational equity and the rate of discount in long-term social investment. In: *Contemporary economic issues.* International Economic Association series. Edited by M. R. Sertel. London: Palgrave Macmillan.

Asheim, G. 2007. Economic analysis of sustainability. In: *Justifying, characterizing and indicating sustainability.* Edited by G. Asheim. Berlin: Springer.

Bundesamt für Statistik. 2008. *Materialaufwand der Schweiz.* Umweltstatistik Schweiz Nr. 14. Neuenburg: Bundesamt für Statistik.

Conrad, K. 1999. Resource and waste taxation in the theory of the firm with recycling activities. *Environmental and Resource Economics* 14: 217–242.

Diekmann, A., H. Bruderer Enzler. 2019. Eine CO_2-Abgabe mit Rückerstattung hilft dem Klimaschutz und ist sozial gerecht. *GAIA* 28/3: 271–274. DOI: 10.14512/gaia.28.3.7.

EASAC (European Academies Science Advisory Council). 2015. *Circular economy: A commentary from the natural and social sciences.* Brussels: EASAC.

Faber, M., H. Niemes, G. Stephan. 1995. *Entropy, environment and resources: An essay in physico-economics.* Heidelberg: Springer.

Güth, W., R. Schmittberger, B. Schwarze. 1982. An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior and Organization* 3: 367–388.

Koopmans, T. 1967. Objectives, constraints, and outcomes in optimal growth models. *Econometrica* 35: 1–15.

Matthies, E., A. Becker, S. Bobeth. 2020. CO_2-Bepreisung zwischen wirkungsvollem Instrument und Überforderung? Eine Pilotstudie zu Bedingungen der Akzeptabilität. *GAIA* 29/4: 249–257. DOI: 10.14512/gaia.29.4.10.

Pezzey, J. 1992. Sustainabilty: An interdisciplinary guide. *Environmental Values* 1: 321–362.

Sabatier, P. A., H. C. Jenkins-Smith. 1993. *Policy change and learning: An advocacy coalition approach.* Oxford, UK: Westview.

SEPA (Swedish Environmental Protection Agency). 2002. *På väg mot miljöanpassade produkter.* Report 5225. Stockholm: SEPA.

Stephan, G., G. Müller-Fürstenberger. 1998 a. The double dividend of carbon rights. *International Journal of Environment and Pollution* 10: 485–494.

Stephan, G., G. Müller-Fürstenberger. 1998 b. Discounting and the economic costs of altruism in greenhouse gas abatement. *Kyklos* 51: 321–338.

Stephan, G., G. Müller-Fürstenberger, S. Herbst. 2003. *Energie, Mobilität und Wirtschaft: Die Auswirkungen einer Ökosteuer auf Wirtschaft, Verkehr und Arbeit.* Heidelberg: Physica.

Stephan, G., R. van Nieuwkoop, T. Wiedmer. 1992. Social incidence and economic costs of carbon limits: A computable equilibrium analysis for Switzerland. *Environmental and Resource Economics* 2: 569–591.

WCED (World Commission on Environment and Development). 1987. *Our common future.* Oxford, UK: Oxford University Press.

Gunter Stephan
Studies in mathematics, physics and economics. 1980 PhD in economics, 1987 habilitation in economics, both University of Heidelberg, Germany. Professor emeritus, department of economics, University of Bern, Switzerland. Co-President of the Steering Committee of the National Research Program *Sustainable economy: Resource-friendly, future-oriented, innovative* (NRP 73) of the Swiss National Science Foundation. Member scientific board of the Oeschger Centre for Climate Change Research, University of Bern, Switzerland. Member Scientific Advisory Board of Deutsches Institut für Wirtschaftsforschung (DIW), Berlin, Germany. Research interests: environmental and resource economics, economics of global climate change, integrated assessment of climate change and variability.