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# Budgetary Dilemmas Related to Climate Change<sup>1</sup>

## ABSTRACT

The global warming –either it is true or false hypothesis– has been built into the policy making both in national and international level. Public finances are recommended to be involved into the funding of mitigation and adaptation. The purpose of the paper is to gather the challenges and dilemmas implied by the climate change on fiscal spending and revenues, responsibilities and opportunities, balance and debt

**Keywords:** public finance, fiscal sustainability, climate change.

**JEL :** D62, E62, H23, H40, H80, H84, H87

## Dilemas presupuestales relacionados con el cambio climático

## RESUMEN

El calentamiento global, bien se trate de una hipótesis verdadera o falsa, ha sido incorporado en la elaboración de políticas tanto en el ámbito nacional como internacional. Se recomienda que las finanzas públicas participen en la financiación de la mitigación y la adaptación. La investigación explica los retos y dilemas que implica el cambio climático sobre el gasto fiscal y los ingresos, las responsabilidades y las oportunidades, el equilibrio y la deuda.

**Palabras clave:** finanzas públicas, sostenibilidad fiscal, cambio climático.

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## Dilemas orçamentais relacionados com a mudança climática

### RESUMO

O aquecimento global, embora se trate de uma hipótese verdadeira ou falsa, tem sido incorporado na elaboração de políticas tanto no âmbito nacional quanto no internacional. Recomenda-se que as finanças públicas participem do financiamento da sua mitigação e adaptação. O propósito deste trabalho é reunir os desafios e dilemas que a mudança climática implica em relação com o gasto fiscal e os ingressos, as responsabilidades e as oportunidades, o equilíbrio e a dívida.

**Palavras-chave:** finanças públicas, sustentabilidade fiscal, mudança climática.

## INTRODUCTION

In most industrialized and emerging countries, there are many factors that could ruin fiscal sustainability before any mentioning of the cost of climate change. The aging population, the welfare state reform, the recovery from global crisis, the tax competition, the rigidities of labour markets, or treatment of poverty (etc.) already have resulted robust debt levels. The determining debt level warns for an important constraint in the beginning: The fiscal cost of mitigation and adaptation can not be financed simply from public debt. Even a new type of taxes is not risk free in a very bounded fiscal room for maneuver.

The climate change modifies the circumstances of public finances, too. Nevertheless, the climate change is an expected occurrence in the future of the 21st century, which depends on many factors. This uncertainty or probability creates a more complex challenge for fiscal decision making. The regional variability of extent of warming or frequency and intensity of extreme weather events (cyclones, hurricanes, storms) or importance of coastal rise in the sea level still increases the complexity of fiscal analysis.

The mitigation and adaptation to climate change means any private or public action to prevent the change of temperature or adjust to a changed climate. Aaheim & Aasen (2008) distinguish autonomous and planned ways. The autonomous adaptation is the case, when private individuals do something for adjustment in uncoordinated way. This could have been a cheap way for public finances, but also results suboptimal solution because of bias for individual free riding, emergence of common pool resource problem, or uncertainty. That is why planned adjustment, namely fiscal adaptation is necessary, too, to motivate the private sector for (pro-)action. Nevertheless, the autonomous adjustment also has impact on tax revenues and public transfers. E.g., energy saving means less pollution-related tax payment, or direct investments in renewable energy equipment can create right to get public subsidy.

To adopt the debt sustainability aspect into the frame of climate change aspects, the long-term solvency, the budget constraint, the primary gap indicator has been applied. Besides indebtedness, refocusing fiscal spending and resetting the extent of public budget invoke the Keynesian fiscal crowding out impact.

This study overviews the public finances dilemmas related to climate change. The sustainability is in focus, but this time the fiscal one and not the development aspect. The purpose is understand the main connections between the two fields of economics.

## GENERAL POLICY DILEMMAS BY THE UNCERTAIN NATURE OF CLIMATE CHANGE

As a methodological simplification, the climate change can be translated as significant shift in average temperature, thus there is a variable or factor for calculations<sup>2</sup>. The modeling of fiscal impacts shall be examined in the frame of temperature change causing damages or benefits, and cost of mitigation or adaptation. If climate change got realized globally, it does not mean a generally same extent of change of temperature in every region and territory of the Earth (it is possible more or less warming in temperature or even cooling is a likely outcome in certain regions). As warming may be so different, the physical impact can be various. In some region, the rise of sea might will take costal territories, in some region the hart illnesses might will rise by warmer climate, in other territories the agricultural lands will dry out, somewhere else the disappearance of ice and snow create land cultivation opportunities or ruin the winter tourism etc. But what is the likelihood in a continent, a country, a county or a city/village level? If there are more scenarios, what are the effective mitigation and adaptation actions? What is the critical mass or

<sup>2</sup> The estimation of global and regional probability, extent and direction of temperature change is a natural science question, thus in public finances study, it will be treated as an external factor.

scale of action? Will the actors wait for each other to act? Who should act first? Should the state intervene, motivate, initiate? And so on. If such uncertain probabilities are accumulated (namely multiplied), finally the likelihood of effective actions can be low.

The Intergovernmental Panel on Climate Change (IPCC, 2001) projections on expectable change of temperature in 100 years term horizon, which forecasts 1,9-5,8 Celsius (3-10 Fahrenheit) gradual warming by the concentration of greenhouse gases in the atmosphere. The uncertainty of temperature change can be illustrated in a fan chart of probable further future expectations.

Besides high uncertainty, the economic actors should agree in the distribution of financing between public and private players. The economic motivation for participation can be established, if the participants can get at least so much benefit from mitigation and adaptation actions as much cost they invest. Nevertheless, there are private actors (or maybe even state actors in the international relations), who are not able to finance themselves the adaptation. Thus, the public decision makers must determine the extent of equity toward poor economic actors (Centre for European Policy Studies [CEPS] & Centre for European Economic Research [ZEW], 2010). This aspect raises the *equity vs. efficiency trade-off dilemma*, whether the fiscal resources should be used for subsidizing rich or poor actors (by direct spending or tax refunding). To resolve the dilemma, the economic theory knows the utilitarian approach and the Rawls approach. In case of climate change mitigation, the specific carbon emission per household of different social groups can guide the balancing between equity and efficiency. However, equity is not just a dilemma in social class dimension, but in geographical view, too. Which are the populated and industrial areas deserving protection against higher sea level or other natural damages? See the bad practice case of New Orleans in 2005. How well developed hurricane warning system has it done worth to be financed? How big efforts and how quickly has it done worth to save people right after the

catastrophe? Or see the Dutch agricultural lands under the sea level. How far should they be protected? Do these lands produce enough income to protect them from the sea?

The policy making, in relation to market motivation, must decide another dilemma between short-term profit and long-term supply what can be called *supply security dilemma* (CEPS & ZEW, 2010) In which territories should the state sustain the supply of energy, food, transportation, safe water and sewage system, pipelines? The prices and the (in)elasticity of the (network) service markets, the intensity of destructive competition<sup>3</sup>, will decide the short-term profit. When the profit is negative, the state may force the service companies to supply, or maybe not.

In case of climate change, the likelihood of irreversibility is important determinant. As a *mitigation vs. adaptation dilemma*, we have to see that, although an early mitigation action can look like unworthy because of high uncertainty and low probability of occurrence of damages far before the forecasted warming or disasters, an overdue mitigation can not reverse the natural, environmental changes. In this case, only adaptation remains as option (CEPS & ZEW, 2010). The economics of decision theory suppose to use the net present value (NPV) to choose the more worthy option. In climate change relation, the comparable options are the NPV of an earlier mitigation or the NPV of a later adaptation.

To estimate the fiscal costs, the market capacity, propensity and perfection is preferable to be examined. It should be estimated, how far can the government levy the burden of adaptation on the private sector (solvency, marginal proactive propensity etc.), and can the market manage the risk to have demand and supply to meet and avoid the market failures. In climate disasters, first of all, the insurance sector should be helped to be able

<sup>3</sup> Destructive competition: service markets where a) the fix cost (exit cost) is high, b) the competition is intensive and presses the price to low level and c) the demand is very volatile (some times much, some times few), the three characteristics together cause frequent bankruptcy what endangers the supply security.

to manage the risk as far as possible. To treat the impacts of climate change, it is possible to mitigate, what means much effort devoted to reducing emissions of greenhouse gases:

*Here public sector involvement may involve replacing existing taxes with new ones that promote reduced emission. Or there may be more active use of regulation, whether of the command-and-control or the market-based type [...], in which case the fiscal consequences are likely to be more limited (Heller, 2003, p. 25).*

If mitigation is too late, or it is too expensive for preventing a not too likely event, the adaptation to new/changed circumstances can be another response. The extent and cost of adaptation is regional or country specific, as it depends on the intensity of climate change, the embodiment of environmental or geographic changes, and the side effects on economy and physical assets. Heller (2003) thinks the following:

*Although much of the burden of re-locating resources and financing new investment will undoubtedly fall on the private sector, it is unlikely that the public sector will remain unscathed, especially in countries, such as many developing countries, where the net economic impact of climate change is expected to negative. Areas of potential public sector involvement include outlays on infrastructure [...], other public goods in the areas of disease prevention and agricultural extension and research [...], and subsidies (to facilitate the resettlement of population) (p. 23).*

As the significant warming is forecasted for century long, the public fiscal intervention is far more necessary in case of produced capital stocks, buildings, physical infrastructure with lifetime over 50. Especially, if unexpected or unlikely,

radically destructive disasters or abrupt changes cause high scale of short-term cost.

The methodology on surveying fiscal impacts by climate change distinguishes fiscal cost of mitigation and adaptation, besides direct and indirect costs. It also introduces cost benefit analyses to evaluate the propensity of policy makers for action or passivity. Scenarios shall be drafted to see the different outcomes. The scenarios shall contain the possible losses in the natural and artificial environment and resources. Impacts on public budget are based on damage of income opportunities and capital/wealth/natural assets. In the followings, there is a composed list of actions when the fiscal correction of market failures is necessary.

When fiscal cost of climate change is under survey, two main type of cost, the direct and the indirect costs can be distinguished. The direct costs are easily identifiable, however it is assumed to be smaller part of total costs. The difficulties with the identification of indirect costs alert for efficiency challenges, because the transparency of total cost of adaptation gets deteriorated. If costs are not transparent, economic participants will not be willing to finance it or support it, thus, the absent funding ruins the efficiency of any actions. The mechanism of direct and indirect costs can be described by the model on drivers of fiscal impacts.

## **FISCAL POLICY MAKERS' DILEMMAS IN CLIMATE CHANGE CONTEXT**

Through the recognition of indebtedness of highly developed (and climate sensitive) countries, the climate dilemmas of public finances can be worded. The *redistribution dilemma* is the following. As there is no satisfying room for issuing more debt to cover the fiscal climate adaptation, the two options for fiscal policy are the redistribution among the items of taxes and spending or levy as much cost as possible on the private sector through perfect markets, like a sophisticated insurance sector. However, the two horns of the dilemma demand challenging balancing. If the private sector with limited time horizon got no fiscal (public) impulse

at all, the private perception on net present value of adaptation will be considered to be negative, as individuals of the private sector cannot optimize for the endless future, or more than a few generation (see the paradox of Ricardian equivalence<sup>4</sup>). In the contrary case, getting excessive fiscal subsidies, the community of individuals of the private sector will expect any adaptation from the state, thus remain passive.

The *preference dilemma* rooted also in the limited room for issuing debt. The fiscal decision makers are forced by indebtedness to select among private actors, and create preference lists. Who should be compensated for damages, and who not? If rising sea level swallows coastal real estates, should the owners get subsidies, and how much? If productivity of agricultural lands were ruined by desertification, should the state bother with ensuring alternative income for rural workers and entrepreneurs? Should the ski parks get public or EU subsidies for snow guns if climate warming means too high temperature for snowing? Etc.

The increasing green tax burden, bond issue and funding for mitigation and adaptation raises the *crowding-out dilemma* whether does it worth to increase the fiscal crowding-out effect in the capital markets or not. This effect is very regional market specific because of the interest rate elasticity and marginal propensity of saving and investment. Of course, less investment can mean less carbon emitting production growth, but

also slower technological development in carbon reduction, too.

Heller (2003, pp. 120-150) recommends conceptual aspects for long-term fiscal planning to finance long term mitigation and adaptation to any sustainability problem. This can be understood as a *long-term solvency dilemma*. Certain aspects are the limits or “stop sign” for certain ways of adaptation. First of all, the public financing has social welfare function, namely, the support for more vulnerable groups in the society. The climate change enlightens, too, that decisions makers should take into account the interest of the future generations as one of the most vulnerable group. Thus, the aims of policy making shall contain the objective of achieving fairness across generations, what means excluding Ponzi games (Buiter & Kletzer, 1992) in budgeting, counter-weighting short-term political interest and eventually a kind of self-limitation in long-term borrowing for financing current outlays. The necessity of self-limitation rooted in the political economy recognition that there are individual interests behind the decisions, the principal-agent problem is an existing occurrence in public policy, and short-term interests are overweight, long-term interests are underscored in discretionary decisions. Institutional solutions, like fiscal rules, fiscal councils can improve the transparency and suppress political myopia, thus, treat the political obstacles.

Besides, the government must be able to assess correctly and ensure the financial sustainability, namely, the long-term public solvency. Sustainability means not only focusing on budget balance, but also, the sustainability of the tax burden, the adequate risk management on fiscal threats and weaknesses, the sustainable institutional mechanisms to ensure the far future balance, and the limitation on future policy makers’ discretionary decisions. The decision makers must preserve the scope for stabilization measures, even though they prefer to use the fiscal policy as an instrument for having influence on the economy. The efficiency of allocation for Pareto efficient income production means practically the elimination of distorting effects in tax system, the distribution of spending in optimal

4 In the economics models, it is a reasonable assumption, that the states as actors are immortal, so they should be considered as infinite ones. That is why, the Ricardian equivalence can presume, that it is indifferent for the state to finance a new item of spending either from raising tax or from public debt. If it was true, this aspect gives opportunity for infinite Ponzi game for states, and just always accumulates higher and higher debt by promising higher and higher future tax revenues. However, O’Connell & Zeldes (1988) and also Buiter (2004) emphasized, that it is not possible because of the finite or limited horizon of individual households as buyer of public bonds. As the buyers are thinking in finite future and they are in limited number, the assumption of public bonds with infinite maturity is unrealistic. Besides, the imperfection of capital markets can not treat perfectly the uncertainty of the future. That is why it is expectable from the state to pay all the debts in the unseen future, namely what is expressed in the form of PV (debt + future expenditures) = PV (future revenues).

structure referring to the equity vs. efficiency trade-off, and the suppression on red tape concerning the public finances. Of course, not just the present, but the legacy of fiscal policy will disperse the position of countries or regions. Simply, the fiscal legacy can be expressed in the current scale of public debt. And not only the extent of debt, but its structure will matter, since in dynamic view, it can be the root of suddenly intensifying side effects. For example, indebtedness in foreign currency can modify significantly the solvency of debtors in a foreign exchange rate shock without short term risk management instruments. Such impacts are called nonlinearities by Heller (2003, p. 149).

In case of threats on fiscal sustainability, the state must be ready to anticipate market reactions driven by short-sighted interest. Private sector's propensity for funding or resource saving can determine crucially the effectiveness and scope of public policy actions for adaptation. The governments must think about market side effects of the structure of realizing the long-term sustainability. Will the market help or weaken certain stimulating or restricting actions? What will be, for example, the effect of lower or higher risk premium on private savings and investments? E.g., it is well known about debt crisis impacts, that when the direct danger of collapse get milder the private interest groups get less devoted to public finances reforms, so, the politicians will ease the previous restrictions and deteriorate the previously improved fiscal balance or balancing program.

The fiscal policy makers ought to face with a *reform dilemma*, too. The green adaptation causes structural changes in public finances. This aspect supposes to treat the green reform, also, as a structural fiscal reform together with balancing. The simplest way to move toward fiscal balance is, when the incomes grow faster than the expenditures in absolute share. Thus, at once, the collapse of economic growth dynamics can be avoided.

That means, the absolute growth of tax burden should be lower than the GDP-growth, and comparing even to tax increase, the growth of public expenditures should be much lower.

However, this demands the public green spending not to be automatic, because the rigid expenditure types insensitive for business cycles will make the adjustment of spending unmanageable to the governmental solvency. Nevertheless, the tax incomes cannot be decreased until the expenditures will not decline at least in the same scale. Besides, the expansion possibility of state debt means also limit in the play of tax reduction (Tomkiewitz, 2005).

The green reform basically is making an attempt to increase the net present value achievable through the fiscal policy, explained with the instruments of cost-benefit analysis is the following:

$$\max PV \{\text{benefit of society} - \text{cost of society}\}$$

However, this cost-benefit analysis is fairly complex, that is why the results must be treated carefully to avoid misleading understandings. First of all, it is hard to measure any side effects of public expenditures and absorption. During the estimation of benefits the experts must face the comparison problem, how commensurable are the individuals' subjective utility. Wildawsky (1997) guess, the appraisal methods used in practice are very uncertain, at least in case of public services. The net present value calculation is uncertain in dynamics, as the costs can vary in the future (Kutasi, 2006).

The structural green reform of public finances is not simply a corner-cutting or spare of expenditure targets. Any kind of efficiency-seeking restructuring related to revenues or expenditures can be mentioned under this category that will have a positive long-term impact for years or decades. In certain circumstances, the previous level of expenditures can be held. The essence of reform of public finances is, that the previous financing mechanisms get changed or reorganized to create more efficient structure independently form the current budget deficit or surplus.

In Drazen's (1998) approach, the fiscal reform is a common pool. Everyone consider this common pool to be made, but everyone wants it to be financed by others. This way, the possible utility created

by a possible reform for everyone is in vain if there is high probability for burdening the cost on the certain individuals. This will be a “war of attrition” impact on the reform, as most of the individuals will not support it. Moreover, the distribution of costs means actually a dispute on distribution of tax burden in the planning stage of restructuring, what will impede more the execution. Besides, the support of reform will be ruined much more in case of uncertainty of individual benefits. Many researches were made to find relation between the success of reform execution and the political institutional system (see e.g. Strauch & von Hagen, 2000; von Hagen, Hughes-Hallett & Strauch, 2002; Alesina & Perotti, 1999; Poterba & von Hagen, 1999; Benczes, 2004, 2008). These surveys concluded that mostly the plurality of decision makers, the pressure for consensus or the multi-party government usually weaken the fiscal discipline as well the not transparent budgeting procedures or the strong bargaining power of spending ministers against financial minister. Although, the political and multi-party system can not be question of restructuring, making efforts for transparency of budgeting procedure and dealing can do a lot for disciplined public finances (Kutasi, 2006).

In public revenue aspect, the *dilemma of government control* is to use Pigovian carbon tax or command and control the externalities caused by CO<sub>2</sub> emission (see Pigou, 1920). Critic on green tax is called the “green paradox” by Sinn (2008), who suggested that increasing emission taxes accelerate global warming because resource owners start to fear of higher future taxation and for this reason they start to increase near-term extraction. Edenhofer & Kalkuhl (2011) tested Sinn’s model for increasing unit taxes on emission, and found that an accelerated resource extraction due to increasing carbon taxes (namely, the green paradox) is limited to the following specific conditions: “The initial tax level has to be lower than a certain threshold and the tax has to grow permanently at a rate higher than the discount rate of resource owners” (Edenhofer & Kalkuhl, 2011, p. 2211). This means that most ranges of carbon taxes for warming mitigation is not

risky for the green paradox. They suggest “quantity instruments” to avoid any risk of the paradox.

The expectation from implementation of carbon tax is to mitigate carbon emission by pricing the cost of future damage and thus enforcing emission efficiency. The function of carbon tax is to raise the price of CO<sub>2</sub> emission. However, to identify the real tax impacts on energy demand and CO<sub>2</sub> emission is a serious challenge for policy-makers. As it was established by International Monetary Fund (IMF, 2008), the conditions of success in mitigation policy are complex.

As any mitigation policies, the carbon taxation must be flexible, robust and enforceable. According to Kim *et al.* (2011), carbon tax has an important advantage over other mitigation measures, namely, that they create a common price for emissions, which makes polluters more efficient in emission reduction. Efficiency of green tax can be understood as how much CO<sub>2</sub> emission can be reduced in energy use and production or in transportation, if a carbon tax is adopted in the mentioned industries.

In comparison to command and control, the advantages of carbon tax can be summarized in lower compliance costs, and a continuous incentive to adapt in the technology of energy use and conservation (Cooper, 1998; Pizer, 1997). The main advantages of market-based carbon taxation are the following according to Cooper (1998), Pizer (1997), Pearce (1991), Nordhaus (2007) and Kim *et al.* (2011):

- a) Creating a common price for emission taxation makes firms with lower abatement costs emit more. The carbon tax fixes the price of emissions effectively.
- b) The cost for CO<sub>2</sub> emission encourages a switch to low-emission technologies and activities, and the development of emission-reducing technologies.
- c) Carbon-tax systems can make use of existing tax collection mechanisms and require less intensive emission monitoring efforts.



- d) Carbon tax provides for greater flexibility and adjustment capability for both firms and public finances in case of changing economic conditions, allowing firms to reduce emissions more during the periods of slow demand growth, and providing opportunity for tax easing.
- e) The carbon tax can induce a technological change to avoid higher cost, which results in lower emission and at the same time technological shift toward better productivity or cost efficiency (Gerlagh & Lise, 2005).

The disadvantages are as follows:

- a) The new type of tax generates administrative and transaction costs.
- b) Without other tax easing, the higher tax burden results a crowding out impact by government.
- c) Under carbon tax, the quantity of emission reductions is uncertain. Impact of tax is very dependent on non-constant price elasticity and income elasticity.
- d) Taxes may be politically difficult to implement (Kim *et al.*, 2011).

Besides, as any type of tax, Pigovian tax has a deadweight loss impact, too, on consumers' benefit. The question is whether this deadweight loss or the damage from warming is bigger. The calculation of deadweight demands the knowledge of the price elasticity, and the estimation of damage by warming needs the very uncertain probabilities of climate change. Thus, it is not simple to match the alternative losses (about critics on Pigovian tax, see: Buchanan, 1969; Nye, 2008).

## CONCLUSIONS

It can be established, that climate change has introduced a new aspect into the structure of public finances both in expenditure and in revenue side. The exact fiscal impact in a given country is very

uncertain since neither the exact regional natural impact is unsure, nor the unilateral national/regional mitigation could be enough and efficient without global cooperation. The fiscal impacts can be mapped by calculating with direct spending related to damages caused by climate change, and with indirect impacts in revenues and new expenditure themes caused through climate impacts on the economic growth, health condition, social relations and energy demand.

It is clear, that the multi-year fiscal stimuli to anticipate the global crisis started in 2008 created unfavorable fiscal rigidity for new types of spending, like climate change related mitigation and adaptation. It is not an easy task to enforce the political decision makers to prefer a 50-100 year-long problem to their short term interest related to political cycles, either. However, there are good practices how to build-in automatisms into the budget by funding, how to keep the balanced budget by restructuring of spending and tax systems, how to involve the private (autonomous) financial resources through insurance and funding. The government must find the optimum distribution of adaptation cost between public (planned) and private (autonomous) adapting actors and the adequate structure of incentives to motivate the private individuals for cooperation and participation in mitigation and adaptation to climate change.

The climate change raises several dilemmas for fiscal policy makers. They should beware the social balance, solidarity and preferences at the same time. That is why it is hard to pick the optimum mix of taxes and spending for mitigation as an intervention into the original redistribution mechanisms. The policy makers must also pay attention for smooth energy supply of the economy beside inciting CO<sub>2</sub> emission cuts. The timing of intervention is a big challenge, too. Too early can mean waste of money, too late might result irreversible damages.

The public budget must be the reserve for mitigation with complex structure. Either infrastructural or social or health or industrial or employment, etc. aspects can connect to the climate problem.

The fiscal policy makers must take care for the capital markets, the public bond markets and the public solvency while they spend for mitigation. It is not simple to introduce any fiscal item or action for mitigation and adaptation since fiscal crowding-out and multiplier effects must be simulated on savings, investments, carbon emission, economic growth, competitiveness, external balance and employment. The simulation in the same time means testing the policy risk, namely the potential failure of green budget reform, and the political

risk, namely losing the next elections because unwanted side effects.

As climate change is global problem, international/global cooperation is likely to be the most efficient also in fiscal aspect. International cooperation can give solution for risk distribution, low income insolvency, credible funding with private investors, technological cooperation and access to knowledge, efficiency of early warning and reserving sustainable national budgets, all together.

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