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The political economy of mitigation and adaptation☆

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ABSTRACT

Climate policies have very uneven effects in terms of their fiscal impact. While mitigation of climate change typically raises revenues, adaptation is costly to the taxpayer, and the more so, the more distortionary the tax system. Moreover, the benefits and costs of mitigation and adaptation vary across generations. In an OLG model with majority voting, we show that even in the absence of international pollution spillovers and strategic considerations, neither mitigation nor adaptation can be expected to be set efficiently. The reason is that voters have incentives to use climate policy as an instrument for redistribution. We find that these incentives depend on the underlying tax system. Furthermore, the chosen mitigation *or* adaptation level may be inefficiently high in a political equilibrium with a distortionary income tax system, although not simultaneously. This finding suggests that a distortionary income tax system favors one policy (mitigation or adaptation) at the expense of the other. The calibration of our model to the German economy reveals that *both* mitigation *and* adaptation are lower than their socially optimal levels.

1. Introduction

The set of current climate policies consists of two elements: mitigation of greenhouse gas (GHG) emissions such as CO_2 and adaptation to the adverse impacts of climate change. Due to its public good properties, mitigation benefits all countries; thus, the reduction of GHG emissions to their efficient levels should not be expected. Adaptation, by contrast, is more local in its effects. It ranges, depending on the specific measure at hand, from purely *private* goods (e.g., air conditioners) to local *public* goods (e.g., flood prevention through dykes). Many economic models of climate change therefore implicitly or explicitly assume that adaptation is carried out efficiently, except when it serves as a strategic variable in non-cooperative frameworks (Buob and Stephan, 2011; Heuson et al., 2015).

Mitigation and adaptation differ in another important respect that has been neglected in economic theory (with the exception of Barrage, 2016). While the former is able to *raise* fiscal revenues (consider an environmental tax or the auctioning of permits under an emissions trading scheme), public adaptation *requires* revenues (for example, the construction of dykes to protect against rising sea levels or of transport infrastructure that is resistant to extreme weather events, as well as the building of capacities to fight and manage wildfires). The costs of public adaptation have been estimated to be quite significant (see, e.g., Egenhofer et al., 2010; Jones et al., 2013; Israel, 2013), and they need to be financed by the tax-payer.

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Be it from the revenue or the expenditure side of the public budget, both types of climate policies interact with the welfare costs of pre-existing taxes in the economy. The reason is that most countries heavily rely on distortionary income taxes to finance public expenditure. As a consequence, adaptation comes at an additional cost, while the revenues from environmental regulation can be used to reduce these distortionary taxes and may thus yield a "double dividend" (see Goulder, 1995, for an excellent survey).

In this paper, we argue that the politically sustainable levels of mitigation and public adaptation and their efficiency properties are heavily influenced by their differential fiscal effects and their interaction with the existing tax system. In particular, we show that, in a one-country model, where we would *ex ante* expect efficient levels of mitigation and adaptation to prevail, voters have incentives to use and distort climate policies for redistributive purposes. Importantly, this holds both under a distortionary income tax system as well as under a lump-sum tax regime (the latter of which is a fictitious scenario but in fact the standard case in the environmental economics literature) whenever emissions and adaptation exhibit stock properties. The contribution of our paper is to demonstrate that these incentives lead to inefficiently *low* levels of mitigation and adaptation under the latter regime and might even lead to inefficiently *high* mitigation or adaptation under the former regime (albeit not at the same time). Put differently, under a distortionary tax system, the incentives to choose high mitigation levels and high adaptation levels are diametrical.

The intuition for these results is as follows. Both mitigation and adaptation exhibit highly differential effects on individuals at different income levels. Under a linear income tax, adaptation is more costly to individual taxpayers with higher incomes. These individuals pay higher taxes at a particular level of adaptation than do individuals with lower incomes. The excess burden of income taxation also makes adaptation more costly to taxpayers overall compared to a regime with lump-sum taxation. Mitigation policies, on the other hand, have been found to be regressive in developed countries and thereby affect low-income individuals to a greater extent than high-income individuals (see, e.g., Bach, 2009; Poterba, 1991; Ekins et al., 2011). At the same time, revenues from environmental taxation are generally returned to individuals through reduced income taxes or social security contributions (see Bosquet, 2000), which is more beneficial to high-income individuals. As a consequence, we can expect that a distortionary income tax system induces high-income individuals to vote for *higher* ecotaxes (and thus more mitigation) but *lower* adaptation expenditures than low-income individuals. In a political equilibrium, a combination of policies that minimizes the aggregate tax burden of the majority will be chosen. This combination is associated with a certain level of redistribution from rich to poor households, or vice versa. By contrast, a lump-sum tax regime is redistributive neutral across income groups because individuals of *all* income levels incur (approximately) the same benefits and costs of mitigation and adaptation. As a consequence, all individuals vote for the same levels of mitigation and adaptation under this regime.

Since age constitutes a second important dimension (in addition to income) along which differential impacts of climate policies can be observed, we incorporate an overlapping generations (OLG) framework, with two generations alive at each point in time – the young and the old. This can be justified on two grounds. On the one hand, reductions in taxes or social security contributions from recycling ecotax revenues are primarily incurred by the working population and to a much lesser degree by retired individuals. On the other hand, young and old individuals enjoy different benefits from mitigation and adaptation policies simply because of their different time horizons. The young will – on average – benefit more (longer) from emissions reductions than will the old. The same holds true for expenditures on public adaptation that endure over time, such as sea walls and transport infrastructure.

Specifically, we assume that the young work whereas the old are retired. Voters are heterogeneous with respect to age and income. They have preferences over 'non-dirty' (numéraire) and 'dirty' consumption goods, such as fossil fuels, over the level of emissions (caused by dirty good consumption) and over the level of adaptation investment. All agents vote on the ecotax rate that applies to consumption of the polluting good and on the level of adaptation investments. Given this multi-dimensional issue space, we invoke Shepsle's (1979) concept of structure-induced equilibrium (SIE). It separates the bi-dimensional policy space into single dimensions by assuming that institutions have been assigned the unique power to determine policies related to their field of responsibility. In our model, the ministry of the environment proposes a green tax rate for a given level of adaptation investment, while the ministry of finance suggests a level of adaptation investment for a given environmental tax rate. This assumption is in line with the chain of delegation observed in parliamentary democracies (Strøm, 2000; Schnapp, 2001). The ministries' proposals can be treated as their best responses (reaction functions) and are rooted in the median voter's preferences regarding the issue at stake. Their intersection describes the SIE of the voting game.

We compare the political outcome with the choices made by a utilitarian social planner and find that whether mitigation and adaptation are inefficiently low or high crucially depends on the characteristics of the underlying tax system. The mode of financing has a twofold impact on the budget constraints of the agents in our model: first, through the recycling of ecotax revenue and, second, through the financing of adaptation. When adaptation is financed and ecotax revenue is recycled through a lump-sum tax system, both mitigation and adaptation are lower in the political equilibrium than their socially optimal levels if both policy options exhibit stock characteristics. This is because voters do not internalize the full marginal damage resulting from their consumption of the polluting good; rather, part of the uninternalized damage is loaded onto future generations. If, by contrast, distortionary taxes are in place, the median voter may prefer inefficiently high mitigation given a sufficiently high income *or* inefficiently high adaptation given a sufficiently low income, albeit not at the same time.

The intuition underlying this result goes as follows. Due to differences in environmental concerns, the social planner internalizes environmental damage to a greater extent than do individuals. However, high-income earners benefit more from the regressive nature of ecotaxes relative to low-income individuals. That is, the decrease in proportional income taxes caused by the additional ecotax revenue exceeds the direct costs of the ecotax for high-income individuals. This fiscal motive due to the recycling of green tax revenue may thus induce the median voter to choose an inefficiently high level of mitigation. Moreover, the financing of adaptation is relatively costly for these individuals such that they desire adaptation investments that are inefficiently low. The reverse case arises when the median voter has a relatively low income. For her, the financial relief from additional ecotax revenue through a cut in