THE IMPACT OF ENVIRONMENTAL POLICY ON WELFARE AND GROWTH

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Overview

The upcoming United Nations Climate Change Conference in Paris represents an important opportunity to reach a global, legally binding agreement on climate change policy. The urgence of such a treaty has been expressed by world leaders and ordinary citizens alike, but in order to achieve concrete results a consensus among nations must be reached. No such consensus can be achieved if some parties feel that they are taking on a larger burden than their fair share. Equity, in other words, is an important ingredient to the solution of the climate problem.

In order to assess the equity of a given climate agreement, it is crucial to understand the distribution of economic costs of the implied environmental policy, both within as well as across different economies. A growing body of literature focuses on the distribution of economic costs of climate policy across different socio-economic categories within a given economy and the equity concerns that they raise. Although these insights are important in informing domestic climate policy and in achieving political consensus at the national level, distributional issues across different countries are more relevant to international negotiations. This paper therefore aims to identify some of the drivers of the economic burden of environmental policy across economies with different characteristics.

Due to the nature of the problem of climate change, climate policy is by necessity a long-term issue, making its economic assessement far from straight-forward. A tax on emissions will not only affect welfare in relation to an economy's current consumption and production behavior. Its impacts also depend, among other factors, on how consumers trade off the current against future consumption, and on the evolution of consumption as income levels grow. Non-homothetic preferences, which imply income-dependent consumption patterns, should thus be incorporated into an analysis that aims to address these issues. The potential relevance of accounting for this characteristic of preferences is especially high in developing countries, since subsistence consumption is one possible driver of income-dependent consumption patterns: as income rises, a larger fraction of resources becomes available for discretionary consumption, thus reducing the expenditure share on subsistence consumption goods.

In the context of growth, the role of subsistence consumption has been adressed in a number of papers, such as Echevarria (1997), Steger (2000) and Herrendorf et al. (2013). This literature has tended to focus on the decline of the agricultural sector and the rise of services, and the models that have studied this issue have correspondingly modeled non-homothetic preferences to be functions of agricultural consumption and other goods. To the best of my knowledge, no reference has addressed the effects of climate and energy policy in the context of an endogenous growth model with non-homothetic preferences. This paper is a modest attempt to fill this gap.

Methods

This paper formulates a stylized endogenous growth model with non-homothetic preferences. It extends the single-sector, linear production model with subsistence consumption of Steger (2000) to include an explicit representation of the polluting, carbon-intensive sector. Production is thus divided into a 'clean' and a 'dirty' sector, and preferences may exhibit a subsistence level of consumption in the dirty sector.

Policy seeks to reduce emissions by taxing dirty consumption at a constant rate, and redistributing the tax revenue to consumers lump sum. Disutility from pollution is not taken into consideration, but one could equivalently assume that preferences are separable in pollution, such as not to influence the consumption decisions. This approach results in a comparison of the costs of climate policy across different economies. The benefits of emissions reductions, which in any case are a function of worldwide reductions, can be considered separately at a later stage. This paper also extends the initial model to include possible losses in the tax revenue due to government inefficiencies, a potentially relevant issue in developing countries.

Analytical, closed-form solutions are obtained for all endogenously determined quantities ('clean' and 'dirty' consumption, capital stock and savings rate) as functions of the model parameters and the tax rate. This in turn delivers an exact, analytical representation of the utility level achieved at market equilibrium. These analytical expressions are then employed to study the impact of climate policy on the manifold of economies spanned by all possible model parameters. The goal is to identify which characteristics imply that an economy will be more or less negatively affected by climate policy compared to others.

Results

Although the model on which this paper is based is very simple, the dependence of the welfare impacts of climate policy on model parameters is not straight-forward. For the basic model, subsistence consumption, as well as population growth (in the presence of subsistence consumption), both result in welfare impacts that are less adverse as compared to the case with homothetic preferences. Furthermore, welfare impacts are found to be a U-shaped function of the long-run expenditure share on the polluting good. Growth of the capital stock is not affected by the environmental tax, independently of if the preferences are homothetic or non-homothetic.

Once financial frictions are introduced into the model, the independence of growth from policy can be understood as a knife-edge case. Without financial frictions, the change in expenditure caused by the environmental tax is exactly offset by a change in the lump-sum tax transfer, leaving the amount of consumption good dedicated to savings unchanged. With financial frictions the transfers are no longer sufficient to cover the increased expenditure, resulting in lower savings rates and lower growth rates of the capital stock. This phenomenon concerns only the transitional dynamics, which are caused by the presence of subsistence consumption. Asymptotically, the savings and growth rates are not affected by the climate policy. In the case of homothetic preferences there are no transitional dynamics, and thus the policy has no effect on growth, even in the presence of financial frictions.

Conclusions

In this paper I find that, contrarily to what one may intuitively expect, a policy to reduce emissions does not necessarily disproportionately burden economies that exhibit caracteristics of developing countries (such as a higher degree of non-homotheticity and an associated larger distance from balanced growth, or a higher population growth). Financial fricions, on the other hand, reduce growth rates in the measure in which preferences display subsistence consumption.

The above insights into some of the channels through which growth and welfare are impacted by climate policy may encourage developing countries to adopt binding pledges to reduce greenhouse gas emissions. It should nonetheless be noted that, to ensure its simplicity and analytical tractability, a number of important features have been omitted in this analysis, such as international trade, intermediate inputs, technological progress and decreasing returns to production. Future research will extend the model in these directions to test if its results are robust.

References

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