Summaries

Intergenerational cost–benefit analysis of climate change: an endogenous abatement approach

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Problems posed by climate change are unprecedented in complexity, length of time, and potential severity of effects. How seriously these problems should be taken depends on many factors such as the degree of reliability of projections spanning over centuries, the commitment of the current generations to future generations, and the rate and the direction of technological progress in the future. When analyzing various dimensions of climate change and proposed control policies, a key challenge is the existence of considerable time lags which are endemic to the climate system. Because of the long-run characteristics of the problem, it is natural to consider the distributions of costs and benefits associated with control policies over distinct generations. However, the issue of intergenerational cost–benefit involvement has often been overshadowed by focus in the literature on the philosophical debate over discounting of future generations' costs and benefits and concern about optimal policy design. By pointing out the cost-saving potentials of endogenous development of abatement technologies, this paper studies the intergenerational welfare impacts of climate change and a control policy. The model considers endogenous abatement activities rather than autonomous energy efficiency improvements. To incorporate endogenous abatement activities, profit stimulated R&D with realistic market distortions is employed. In such a framework, a control policy has the dual role of discouraging emissions and triggering new abatement technologies. The results from numerical simulations show that the omission of entrepreneurial response to a control policy is likely to result in overestimation of costs associated with that policy. In other words, development of greener or energy efficient technologies induced by an emission tax can substantially lower the costs of compliance with the control policy. Although induced innovation has a potential to reduce the compliance costs with the control policy, current and near-future generations will bear some net costs. The higher the damage projected from climate change, the earlier the net benefit will arrive. The distributional effects of climate change and any potential control policy over multiple generations lead to intergenerational welfare and risk-sharing dilemmas. Policymakers have neither perfect information nor the necessary

instruments to make the desired distributions to create net benefits for all generations under the threat of climate change. In conclusion, an important contribution to the literature would be to construct an ITC model to study the risk-sharing issue within the context of political economy.

Pollution-reducing infrastructure and urban environmental policy

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The paper is concerned with environmental problems in cities. We introduce pollution-reducing infrastructure into an urban economics model as a public good which serves to abate polluting emissions from households' consumption. These features of the model are innovative and based on stylized facts observed for the case of Bombay, the largest urban agglomeration in India. There, (i) private households contribute considerably to environmental problems (due to sewage effluents, domestic waste, and individual traffic, etc.) and (ii) an improved infrastructural endowment (sewage systems, public sanitation facilities, waste collection and disposal, paved roads, etc.) could considerably reduce environmental pollution. The model assumptions and the analysis aim at general theoretical insights, which hold for other cities as well.

We show that the optimal supply of pollution-reducing infrastructure and the optimal allocation of goods consumption, which causes polluting emissions, are interrelated, such that infrastructural supply and Pigouvian taxes have to be determined simultaneously. Because consumption of goods and of residential space are interrelated, too, the use of pollution-reducing infrastructure affects the spatial distribution of households over the city. In the decentralized economy, the rent for living space is no longer a sufficient incentive for households to locate at the optimal positions. Rather, transfer payments are needed in order to obtain the efficient spatial distribution of households.

Despite these interrelations, an optimal allocation can be determined and implemented as a spatial market equilibrium with the help of three policy instruments. If infrastructure is supplied publicly, these are (i) the efficient provision of infrastructure, (ii) a Pigouvian tax on consumption, and (iii) income transfers. All of these instruments have to be spatially differentiated. For infrastructure, which can be provided privately, the three instruments are (i) a Pigouvian subsidy on infrastructure, (ii) a Pigouvian tax on emissions, and (iii) income transfers. In this setting, the subsidy on infrastructural supply and the income transfers have to be spatially differentiated.

Providing pollution-reducing infrastructure is most important in growing cities in developing countries. In a comparative static analysis we show that, due to the public-good character of infrastructure, the higher the population size, the higher is the efficient infrastructural supply all over the city.

Introducing pollution-reducing infrastructure as an instrument of environmental policy leads to comparatively complicated policy recommendations. Taking the interrelations between the efficient supply of pollution-reducing infrastructure and Pigouvian taxes into account has important advantages, though. First, it can lead to considerable welfare gains. Second, Pigouvian taxes are lower. Third, the spatial heterogeneities are lower.

In order to apply the model empirically, a variety of extensions should be taken into account, as discussed in the conclusions. Yet, the present analysis takes up issues which are of major importance, as the case of Bombay shows, but which have not yet been studied in economics. Thereby, it opens the field for a more realistic description of urban environmental problems and improved policy options to solve these problems.

Agricultural expansion, forest products as safety nets, and deforestation

PHILIPPE DELACOTE

Non-timber forest products (all biological materials, other than timber, which are extracted from forests for human use) extraction is a risk-management strategy frequently used by poor households of developing countries. Indeed, rural communities in Africa, South America, and Asia often lack insurance or credit mechanisms to protect them against agricultural risk (price shocks, seasonal flooding, unpredictable soil quality, pests, crop diseases, or illnesses). In this context, households may extract from commonly held forests a large variety of products such as edible fruits, vegetables, or medicinal plants, ro smooth their consumption. This paper considers what may be the impact of this safety net use of NTFP on the land use and deforestation.

Two main risk-management strategies may be used. First, the household can diversify its activities between agricultural exploitation and NTFP extraction, in a manner close to portfolio diversification between equities and bonds. Second, the household can choose to extract NTFP only if the agricultural output is bad. NTFP extraction works here as an insurance or coping strategy. This paper considers the potential impact of those two strategies on land use.

The representative agricultural household chooses how the land will be used, between agricultural land and forests. It faces a simple trade-off: agriculture is more profitable, but risky, while NTFP extraction is safer, but less productive. The variables influencing the land use are therefore agricultural profitability, NTFP quantities, agricultural risk, and risk aversion.

Overall, it appears that risk reduction may increase deforestation. Indeed, if agricultural risk reduces, the household will naturally increase the agricultural area and reduce the forest area. For example, the introduction of an insurance or micro-credit mechanism could increase deforestation. In the same manner, if the household becomes less risk averse, it will decrease its NTFP extraction to focus more on agriculture, and thus will deforest more. Finally, if forests provide a lot of NTFP, the household will keep more land in forests if it uses the diversification strategy.

Does natural resource extraction mitigate poverty and inequality? Evidence from rural Mexico and a Lacandona Rainforest Community

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The potential importance of natural resources for the livelihood of poor rural households has long been recognized but seldom quantified and analyzed. In this paper, we examine distributional and poverty effects of natural resource extraction at the national, regional, and community levels. To do this, we use new data from a national rural household survey and a community survey implemented in the Lacandona Rainforest (*Selva Lacandona*) of Mexico. First, we explore whether income from natural resource extraction affects poverty and inequality. Then we calculate the marginal impact of a change in the price of natural resources on inequality. Finally, using information from Frontera Corozal, a community in the Selva Lacandona, we evaluate the short-run poverty effects of changes in the price of a non-timber forest product (the *xate* palm), which is extracted from this and other threatened forest areas in Mexico and Guatemala.

Our findings highlight the importance of income from natural resource extraction in alleviating poverty and income inequality in rural Mexico. Results show that the number of poor individuals increases 4.2 per cent and inequality increases 2.4 per cent when natural resource income is not taken into consideration. Inequality in the distribution of natural resource income is relatively high. Nevertheless, an unequally distributed income source

may favor the poor. For example, welfare transfers are usually unequally distributed (most households do not receive them), but they are directed disproportionately at poor households. This is the case for natural resource income in all of our samples. A 10 per cent increase in income from natural resources, other things being equal, reduces the Gini coefficient of total income inequality by 0.2 per cent in Mexico. In the South-Southeast region and in Frontera Corozal, a 10 per cent increase in natural resource income reduces the Gini coefficient by 0.36 per cent and 0.11 per cent, respectively.

A doubling of the price of xate fronds in Frontera Corozal is associated with a 6 per cent decrease in the number of poor individuals in Frontera Corozal in the short run. Nevertheless, in the long run, sustained price increases could lead to overexploitation of the resource, leaving everyone worse off. The interrelationship between extraction decisions and the resource base as well as the institutional setting surrounding price increases will determine whether or not this perverse outcome prevails.

Beating negative externality through groundwater recharge in India: a resource economic analysis

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Having experimented with a whole set of strategies for poverty reduction and resources conservation in the dryland regions of India, the policy focus has shifted to watershed-based strategies. This renewed interest is due to its cost-effective nature and due to its ability to integrate resource conservation with poverty alleviation in an area approach. While much research is on field-based evaluation of watershed programs, we made a modest attempt to (i) study the groundwater economics in a watershed context; (ii) make a systematic evaluation of the interface between watershed treatment and groundwater potential and use in the watershed, taking a resource economics perspective and with intensive survey information; and (iii) evaluate empirically testable hypotheses within a regression-based quantitative framework. This study also provides insights on the economics, equity, and sustainability aspects of groundwater use in the watershed. The study was carried out in a dryland region of the Southern State of Karnataka, India. The well failure rate was a meagre 11 per cent when compared with the corresponding failure rate of 40 per cent in the eastern dry zone of Karnataka state. About 56 per cent of the beneficiaries belong to marginal and small farms.

The study reveals the positive impact of groundwater recharge as induced by watershed treatments. Similar to large farms, small and

marginal farms also derived benefit from groundwater extraction due to the neutralising effects of a watershed program on the externalities caused by well interference. The watershed development program resulted in positive externalities by (i) reducing the cost of groundwater used for irrigation; (ii) reducing the negative economic externalities due to well interference; (iii) increasing physical access (enhanced water used per acre of gross irrigated area) to groundwater resources for irrigation through groundwater recharge; and (iv) reduced cost of groundwater. The impact of the watershed program is reflected in the cultivation of high value crop. Given the scarcity of groundwater in many parts of India, this paper draws policy implications for sustainable groundwater management.

Pollution haven hypothesis and the role of dirty industries in Turkey's exports

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The pollution haven hypothesis argues that dirty industries flee from environmentally strict industrialized countries to the less developed economies, which provide pollution havens for these industries with their lax environmental standards. According to this hypothesis, both the industrial production structure and the trade patterns of countries are affected. The share of dirty industries is expected to increase, while that of clean industries to decline over time in pollution havens. Also, since the pollution havens are becoming larger producers of the dirty industries, the share of dirty industries is expected to increase in the exports of a pollution haven.

In this study, the pollution haven argument from a trade perspective for Turkey is examined. Using available data on the Turkish manufacturing industry at four-digit ISIC detail, we analyze the impact of dirty industries on the exports of Turkey by using a panel of 67 sectors for the 1994–1997 period. The general format of the model estimated is the same as the export demand functions that could be seen in the theoretical and applied literature with some modification to account for the environmental impact. The exports of Turkey are formulated as a function of the terms of trade, the effective exchange rate, foreign income, the Herfindahl index measuring the concentration in industries, which is used to control for market structure variations among different sectors, and, finally, a pollution intensity index, which will establish the relationship between dirty industries and trade in log-linear form.

The construction of pollution indices is an important component of the study. The only available data for the Turkish manufacturing industry are solid and liquid waste quantities. Different solid and liquid waste

indices and a weighted average of them are calculated by considering the size differences of industries. For this purpose three different measures, i.e. number of employees, real value added, and real value of output of manufacturing industries are included in the indices. In addition, these indices are adjusted to account for the toxicity level of waste produced. In the study these alternative pollution indices are used in estimations. The model is run by utilizing fixed effects and random effects panel data estimation techniques. In general, all the results show that the terms of trade and the exchange rate variables have significant coefficients with expected signs. An increase in relative prices decreases the demand for exports and depreciation of the domestic currency increases the demand for exports. The coefficient of the Herfindahl index variable is also significant and negative in all cases, implying that increased levels of competition in industries encourages demand for exports. We also see that the coefficient of the pollution index is positive and significant. Therefore, we can conclude that during the period of analysis, as the dirtiness of the industries increases the demand for exports increases as well. This can be taken as evidence for the trade effect of the pollution haven hypothesis.

Valuation of the Woopo Wetland in Korea: a contingent valuation study

SEUNG-JUN KWAK, SEUNG-HOON YOO, and CHUNG-KI LEE

In Korea, economic analysis for public development projects has been performed without considering the environmental costs caused by them. In recent years, however, government agencies are increasingly considering the total value of natural resources in their appraisal of policy alternatives. Therefore, measuring the explicit value of environmental quality is an essential step for evaluating policies that affect the use of natural resources.

   The main objective of this study is to measure the conservation value of the Woopo Wetland. With respect to the relationship between conservation and non-use values for wetland resources, respondents' comments suggest that a substantial portion of their value of the Woopo Wetland is related to its conservation value. In the survey, respondents utilized the hypothetical market to state their willingness to pay (WTP) for the proposed conservation program at a particular tax price and then expressed whether they would be willing to pay such an amount to obtain improved environmental characteristics. The empirical results show that the mean WTP and the truncated mean WTP per household in the sample obtained using the dichotomous choice referendum format were 2,731 and 3,960 Korean won (USD 2.10 and 3.05), respectively, annually for five years.

Consequently, the results of this empirical study imply that the Woopo Wetland is an important natural resource with a considerably high conservation value, and provide valuable information when decision makers set up policies of development or conservation. The conservation value of the Woopo Wetland can be utilized as a preliminary standard for developing appropriate measures, such as a financing plan for executing the ecological park program and pricing an entrance fee for an ecological park.

Negotiating on water: insights from non-cooperative bargaining theory

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It is now widely recognized that water resources are becoming increasingly scarce, both in terms of quantity and quality. This is despite the fact that water is fundamental for life, and a major component of current strategies in many areas of national and international policy development, as well as an integral part of recent efforts towards the achievement of sustainable development.

The causes of water scarcity are manifold: on the one hand, pressures on the resource are continuing to increase; on the other hand, the very nature of water resources often leads to their economic scarcity. To complicate matters further, water availability and quality are not known with certainty at any point in time – an uncertainty exacerbated by climate change, which is felt most in developing countries.

In recent years, one of the responses to the problem of unsustainable water management has been to promote collective negotiated decision-making procedures, both at the national and at the international level. The idea is that negotiated decisions can lead to management choices that are better adapted to local conditions, and this can result in easier implementation, less litigation, and improved stability of agreements. Yet, despite the recent interest in the subject, relatively little is understood about the interactions between the structure and the outcomes of the negotiating process in general, and with respect to water management in particular.

Non-cooperative bargaining theory may offer useful insights into this problem, as often cooperation cannot be ensured, and binding agreements are not a feasible option. In such contexts, the strategic choices of the actors involved in the bargaining process need to be explicitly modelled in order to determine the final outcome of the negotiation.

Despite the fact that the characteristics intrinsic to water resources make the approach of non-cooperative bargaining theory particularly appealing for application in this field, few theoretical models have been applied to water problems. In addition, most of the applications fail to explicitly address the *process* through which an agreement is reached. A notable exception is the Rausser–Simon model (Rausser and Simon, 1992), which may provide a useful tool to support negotiations in real life.

The applications surveyed in this paper indicate that the outcome of any negotiation depends on the set of rules applied, the number of issues negotiated, and the position of negotiators with respect to their opponents. Furthermore, it emerges that equity considerations and political costs must be integrated into the problem specification and analysis, and must also be carefully managed throughout the negotiation process. Crucially, improved solutions can emerge, provided the settings in which the players act are shaped in the right form. Exploring the problem within a non-cooperative, game theoretic framework may indeed help in the definition of the set of rules and the constitutional framework for managing actors' behaviour.

Thus, the proposed approach may support policy making directly and indirectly by (i) shortening the time span needed to reach an agreement through the (theoretical) identification of the values for which a proposed policy is more likely to be accepted, so that policies which would be (almost) certainly rejected can be ruled out at the outset; and (ii) helping to select among a set of policies the one which is self-enforcing and, therefore, acceptable for the majority of stakeholders.