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Summaries

Can NNP be used for welfare comparisons?

GEIR B. ASHEIM

This paper contains a critical assessment of the claim that comprehensive net national product (NNP) can be used for welfare comparisons. The assertion that NNP is endowed with welfare significance has been subject to controversy, from the seminal contributions by Samuelson and Weitzman to a number of more recent articles. Here I contribute to this debate in the following two ways:

1. I give an interpretation of the basic insights and results of welfare accounting in a general setting.
2. Building on these insights I warn against using NNP for measuring the welfare effects of capital perturbations, and derive the result that real NNP growth in variable consumption and net investment prices can be used to indicate welfare improvement.

The general conclusion is that greater NNP corresponds to welfare enhancement only if net investment flows are revalued. Real utility-NNP and real measurable NNP made comparable across time by means of a consumer price index allow for such revaluation, and thus indicate welfare improvement. I reconcile my results with the findings presented in the relevant literature. I use the Dasgupta–Heal–Solow model to illustrate the analysis and results.

I invoke weak assumptions concerning how dynamic welfare is derived – by not necessarily assuming discounted utilitarianism – and how the economy functions – by not necessarily assuming an optimal resource allocation mechanism. Throughout I am concerned with local comparisons, either 'small' perturbations, or local-in-time comparisons. I also assume that national accounts are comprehensive by including the effects of environmental amenities and natural resource depletion as well as technological progress.

Corruption, the resource curse and genuine saving

SIMON DIETZ, ERIC NEUMAYER, and INDRA DE SOYSA

Genuine saving is a measure of weak sustainable economic development, which presumes that different forms of capital are substitutable for each

other. Genuine savings measures net investment in produced, natural and human capital. It is a necessary condition for a country to achieve weak sustainable development that its genuine saving rate not be persistently negative. In other words, a country's economic development is weakly unsustainable if its total stock of capital is eroded by negative genuine savings rates.

According to data provided by the World Bank, many resource-rich countries are systematically failing to meet this condition. It is well-known that resource-rich countries have grown slower than resource-poor countries, at least over the last three decades or so. This so-called resource curse represents a puzzle since the free gift of nature in the form of natural resource deposits should be a blessing, not a curse to the economy. It follows that beside the resource curse on economic growth, resource abundance might additionally have a negative effect on genuine saving. In fact, the two are closely related, as insufficient genuine saving now reduces future consumption growth. This implies that resource-abundant countries with slow growth in the past and negative GS are unlikely to be able to sustain even their comparatively small increases in income into the future.

We discuss several potential explanations for the puzzling resource curse. There are persuasive theoretical and empirical arguments in the literature that suggest corruption in particular may be a major explanatory factor in the resource curse. They often describe a process in which investment is either misdirected or discouraged altogether. However, other aspects of institutional quality might also matter. We regress gross and genuine saving on three indicators of institutional quality in interaction with an indicator of resource abundance in a panel of data spanning up to 115 countries and 18 years. The indicators of institutional quality are corruption, bureaucratic quality and the rule of law. We find that reducing corruption has a positive impact on genuine saving in interaction with resource abundance. That is, the negative effect of resource abundance on genuine saving is reduced as corruption is reduced. By and large, none of the other indicators of institutional quality matter.

The policy implication is that resource-rich countries can improve their weak sustainability performance by fighting corruption, difficult as this may be. This is not to say that countries should only focus on anti-corruption measures: there are many other very persuasive reasons why all aspects of institutional quality should be improved. Indeed, improvements on one dimension are almost certain to lead to improvements in others. Nevertheless, in order to put themselves on a more sustainable investment pathway, we recommend that resource-rich countries as a priority strive to reduce the corrupt practices that stymie investment and make it unproductive.

Natural resource use conflict: gold mining in tropical rainforest in Ghana

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The location of gold deposits within valuable natural environments imposes a dilemma that requires an exchange of future benefits from the

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environments for current benefits from extracted gold. A profit tax – one based on net revenues from extraction – will not usually change the optimal rate of extraction. However, an *ad valorem* severance tax – one based on gross revenues from extraction – will usually change this rate (e.g., Dasgupta and Heal, 1979; Hanley et al., 1997). Because severance taxes are widely used in practice, it is fortunate that this distortionary effect can be harnessed to internalize the opportunity costs of environments that are lost or damaged during the gold extraction process. This paper presents the details of an efficient severance tax, and illustrates such a tax using data for gold mining in Ghana's rainforests.

Our approach must differ in two important ways from classic extraction problems examined by Hotelling (1931) and many subsequent authors. First, gold deposits in Ghana are found in tropical forests that can provide *in situ* benefits to rural populations if the gold beneath them is not extracted. Second, the capital needed for gold extraction is derived from foreign direct investment (FDI). The former difference will require forest benefits to be considered, while the latter will require that profits from gold extraction be no less than zero.

By extending the literature on sharecropping, we formulate and derive results from a dynamic optimization program for the mining firm (the tenant) and the resource manager of the country (the landlord). The mining firm maximizes a discounted stream of profits from extracting gold. Revenue per unit extracted is equal to the gold price minus the severance tax, subject to the rate of the gold stock depletion. The resource manager, on the other hand, maximizes the discounted sum of tax revenues and benefits from the forest stock, subject to depletion in the gold and forest stocks, and a profit constraint that requires mining in each period to at least break even.

We find that a severance tax can be used to lead mining firms to choose gold extraction that also is optimal for the manager's extraction problem, if the tax is set equal to the ratio of marginal forest benefits to marginal benefit from gold extraction. The optimal tax must change at a rate equal to the difference between the discount rate and rate of change in the price of gold. The optimal tax is positively related to the discount rate and negatively related to the price of gold. Empirical simulations suggest that the current 3 per cent tax rate is too low to fully represent the external cost of extraction (i.e., lost forest benefits). We conclude that ignoring environmental opportunity costs of extraction when selecting the tax rate may lead to irreversible loss of forest ecosystems. Because similar conflicts are common in other tropical countries, the results from this Ghanaian analysis may cautiously be extended to other natural resources in developing countries.

Environmental taxation in a dualistic economy

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A major instrument for the environmental policy in both developing and developed countries is the taxation of pollution generating activities.

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Given the administrative difficulties of those countries in employing sophisticated instruments, we use simple production taxes as instruments of environmental policy. In the framework of the Harris- Todaro model, with an industrial (urban) and agricultural (rural) sector, we introduce a production-production externality and more specifically we assume that the activities of the industrial sector negatively affect the output of the rural sector. The government in its effort to reduce pollution imposes a tax on the production of the polluting sector. We examine the distributional, national income and employment effects of such a tax. We take two versions of the Harris-Todaro model, the short run, where only labour is mobile between the rural and the urban sector and a longer run version, where all factors of production are intersectorally mobile.

In the short run, the imposition of the tax will reduce pollution, and therefore will benefit agricultural production. Also the employment in the industrial (urban) sector will fall, but employment in the rural sector will rise. Our analysis finds that the return to land rises and the return to capital in the industrial sector falls. The critical question, however, is what happens to the urban unemployment. On the one hand the production of the urban sector falls, but the labour released may be employed in the rural sector or remain unemployed in the urban sector. To what extent the rural sector absorbs the released labour is not clear. The change in the urban unemployment depends on factor substitutability and relative factor intensities. If the elasticity of factor substitution in agriculture is high, and unemployment in the urban sector is already high, then (urban) unemployment may fall.

In the longer run, the return to capital falls as a result of the imposition of the tax, and the employment in the urban sector will fall. Under the plausible assumption that the rural sector is relatively labour intensive, employment in that sector will rise, the rural wage rate will rise and the urban unemployment will fall.

Finally, with regard to the effects of taxation on national income, we find that if the share of the agricultural sector in the national income is higher than the share of the manufacturing sector, then in most plausible cases the imposition of taxation will be national income enhancing, both in the short as well as in the longer run.

The effect of environmental regulations: a restricted cost function for Korean manufacturing industries

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Though the Pollution Prevention Act, the first environmental law, was enacted in 1963, it did not make a contribution toward protecting people's

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health, mostly because the government of Korea was mainly concerned with achieving rapid economic development with little consideration for the environment. The Environmental Conservation Act became effective in 1977, introducing an environmental assessment and environmental standards. This Act dealt with more comprehensive problems including degradation of natural resources. In 1979, an air quality standard for sulfur dioxide was established. In 1983, the environmental standards were set for other major pollutants: carbon monoxide, nitrogen dioxide, fine particulates, and ozone. As environmental problems were getting more serious and complex due to the number of pollutants produced by industrialization, the Environmental Conservation Act of 1990 was divided into six laws based on pollution media. In 1993, the environmental standards for some air pollutants such as sulfur dioxide and carbon monoxide were tightened. Currently, allowed emission standards have been set for 28 air pollutants and 29 water pollutants.

Firms subject to environmental regulations bear additional expenses associated with the installation and operation of pollution abatement facilities. Environmental regulations often change firms' incentives in a number of ways, including altering the level of investment and the choice of input combinations. As a result, a direct and/or indirect reduction in productivity growth is inevitable.

To determine the proper balance between the two seemingly conflicting goals of environmental conservation and economic growth, it is necessary to investigate the effects of environmental regulations on firms' productivity. There are two basic frameworks that enable us to estimate the effect of regulations on industry performance: growth accounting and dual cost function estimation. In the growth accounting model the impacts are directly attainable from regressing the total factor productivity (TFP) growth on the explanatory variables that measure regulations and other factors that might affect productivity.

Duality theory makes it possible to identify the sources of productivity growth, including the effects of regulation by estimating the cost function. The advantages of estimating the dual cost function over the production function or distance function include the exogeneity of the regressors, the ease with which the input demand function can be derived, and simpler formulas for elasticities of demand and substitution. However, unbiased estimates are premised on the existence of good data on input prices. In manufacturing industries, price data for raw materials or intermediate goods, which are key inputs in terms of their cost shares, are not always available.

In Korea, raw materials have often been excluded from cost functions due to the lack of price data. This may result in serious misspecification unless reproducible inputs are separable from raw materials. This paper uses the theory of restricted cost functions to analyze the impact of environmental regulations on Korean manufacturing industries over the period 1982–93. The use of a restricted cost function treats raw materials as restricted inputs, which are assumed to be set equal to firms' cost minimizing levels. The resulting estimates gauge the effects of environmental regulations on measures including the elasticities of cost and input demands and the rate of productivity growth.

This analysis rejects the separability of the reproducible inputs from raw materials, meaning that the exclusion of raw materials would create biased estimates of regulatory effects. The average annual estimate of cost elasticity with respect to regulations was 0.067 over the sample period. The mean values of input demand elasticities with respect to regulations over the sample period were 0.139, −0.587, and 0.815 for capital, labor, and energy, respectively. Environmental regulations are shown to be responsible for a 12 percent reduction in the average annual rate of productivity growth over the period 1982–93.

Optimization model for integrated municipal solid waste management in Mumbai, India

SARIKA RATHI

Mumbai, one of the largest mega cities in India, generates a huge quantity of Municipal Solid Waste (MSW) everyday. It generated 6,256 tons of waste per day in 2001, which is estimated to be 0.53 kilogram of waste per capita per day. The Municipal Corporation of Greater Mumbai (MCGM) spent 61,435 million rupees (1,413 million dollars) in 2001–02 providing MSW management services. In spite of spending a large amount of money on MSW management, the MCGM has failed to keep the city clean and waste litters all over the place, which can result in serious health and environmental problems. There is an emerging global consensus towards involving private sector and public participation in waste management. In this paper, an optimization model is developed to integrate various waste management options and the role of various stakeholders involved in waste management. The following options are considered for developing an integrated waste management system:

- Community compost plants
- Mechanical aerobic compost plant
- Sanitary landfills

The model suggests the optimum strategy is processing all waste at community compost plants and transporting only inert materials to dumpsites. Further, three scenarios are generated to test robustness of optimal strategy under different situations. It is found that when a cost of segregation of Rs. 700 ($16) is imposed on a community compost plant and revenue from compost and environmental costs are assumed to be zero, the optimal strategy changes completely. In this case, all waste is processed at sanitary landfill. This scenario represents the present-day situation in Mumbai where the MCGM does not take into consideration the value of organic materials and environmental costs of waste management while planning out waste management strategy.

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There are 24 wards[1] in Mumbai which are highly diversified. In the city wards the cost of land and labour is much higher as compared to suburban wards. Hence, a sensitivity analysis is carried out to test the behaviour of the optimal solution to varying the cost of land and labour. It is found that as the cost of land and labour increases, waste management strategy moves away from the community compost plant. Hence, depending on the cost of land and labour, waste management strategy can differ from ward to ward. It would be interesting to carry out a spatial analysis to determine waste management strategy at the ward level. Due to unavailability of environmental cost figures in the Indian context, data are used from a study done for California, which is a limitation of the current study. There is a need to carry out further research to estimate environmental costs of waste management in the Indian context.

Open access in a spatially delineated artisanal fishery: the case of Minahasa, Indonesia

CHRISTOPHER LIESE, MARTIN D. SMITH,
and RANDALL A. KRAMER

When property rights for natural resources do not exist or are not enforced, overexploitation often occurs. This situation is common in developing countries, which contain many of the world's most valuable environmental assets. A crucial question for development agencies and conservationists is: when will economic development worsen threats to natural resources? Small-scale fishing on coral reefs provides a useful setting in which to examine this question. Coral reefs are important environmental resources in developing countries because they supply ecosystem services, serve as repositories of marine biodiversity, and support both large-scale and small-scale fisheries. Yet many reefs are seriously threatened by human exploitation.

Development projects often facilitate flows of natural resources, labor, and capital by building transportation systems and other forms of infrastructure. Conventional wisdom among conservationists is that the process of linking remote communities to the broader market economy will aggravate threats to environmental assets like coral reefs. This reasoning implicitly focuses on the product market alone and assumes that market integration will simply increase the returns to fishing. However, market development can also create employment opportunities for fishermen in

[1] Wards are subdivisions of Mumbai city into smaller parts for administrative purposes.

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other sectors of the economy. Job creation thus raises the opportunity cost of fishing time and provides a countervailing force against the product market effect. We hypothesize that as the effective distance from well-functioning modern markets increases, the added transaction costs in the labor and product markets lead to falling returns to resource exploitation and falling opportunity costs of time. While lower returns reduce pressure on the resource, lower opportunity costs increase it. Market development can thus exacerbate or ameliorate the tendency toward severe exploitation of natural resources that have no established property rights.

To test our hypothesis, we analyze household survey data from small-scale fishermen in Minahasa, Indonesia. We develop a model that predicts individual fish catch per unit of time spent fishing based on characteristics of individual fishermen and the development status of their villages. We use variation across different villages and across fishermen within the villages to resolve the effects of development. Some fishermen, for instance, have greater employment prospects outside of fishing than others. Similarly, some villages are closer than others to urban centers where fresh fish are sold. Though our data set only covers a snapshot in time, we find strong evidence for the countervailing forces of product and labor market effects. Economic development is not necessarily bad for the resource base even when property rights are lacking. Development projects that lower the effective distance of the product market, such as transportation infrastructure projects, will lead to more exploitation. Development projects that raise the opportunity cost of time by expanding the scope and scale of the labor market, such as new employment opportunities or increasing education, or by reducing poverty, reduce the pressure on the resource. Though development poses many threats to coral reefs, we focus on the effects of reef fisheries on the reefs.

Overfishing in the Gulf of Thailand: policy challenges and bioeconomic analysis

MAHFUZUDDIN AHMED, PONGPAT BOONCHUWONGSE, WARAPORN DECHBOON, and DALE SQUIRES

In the backdrop of rapid increase of fishing effort, falling profits of individual vessels and lower economic rent have raised serious concerns about the sustainability of fisheries in the Gulf of Thailand. This paper estimates maximum sustainable yield (MSY) and maximum economic yield (MEY) from Schaefer and Fox surplus production bioeconomic models to find evidence of biological and economic overfishing, and their consequences in the Gulf of Thailand demersal fisheries. Using bioeconomic assessment as a basis, the paper discusses Pareto-improving economic policies to shift fisheries toward MEY and MEI. To this end the Pareto-efficient levels

of yield and effort found under open access are compared with the estimated economic and biological optimum – MSY and MEY. Empirical results demonstrate that the Gulf of Thailand fishery is far removed from either a biological or economic optimum, a situation that can only be mitigated through effort reduction. The fishery could earn additional economic rents by curtailing both excessive fishing effort and exploitation rates.

The paper examines alternative policy instruments to reduce overfishing in order to restore fish stocks to sustainable levels. The discussion emphasizes strengthening fishery management for implementing limited access, and a combination of co-management, and decentralization of fisheries management. The use of license fees that serves as a double dividend tax to reduce fishing effort and fund monitoring and enforcement has been proposed as one of the possible economic instruments. The cornerstone of effective conservation and management of the Gulf of Thailand demersal fisheries is proper implementation of the current license limitation program for all gear types enhanced by co-management, decentralization of management, and area specific considerations. The limited access policy includes prohibiting construction of new trawlers and phasing out of the biologically destructive push net fishery. The limited access program might also be tailored to specific geographic areas for some gear types to protect juvenile species in inshore areas and potentially enhance conservation incentives by limiting players in an area.

Optimal resource utilization based solely on achieving economic efficiency inadequately addresses broader social issues. With the notable exception of joint fishing ventures for offshore pelagic fish stocks, management interventions that curtail fisheries production and employment will increase conflicts among gear types and between gainers and losers, at least in the short run. The ultimate success of a national fisheries policy lies in the correct and timely mix of fisheries management and non-fisheries development. Only broad-based rural development will put an end to the continual drift into common resources and major urban centers. In its absence, fisheries regulation cannot be effective and, if effective, will simply push the problems into some other sector: unemployed fishers have little choice but to encroach on reserved forests, mineral concessions and public lands or simply move into the urban centers creating a host of social and environmental problems.