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Summaries

Sustainable development in an aging economy

TETSUO ONO and YASUO MAEDA

In this paper, we consider the effects of population aging on economic growth and the environment. It is often suggested that aging is harmful for economic growth and the environment since the old people dissave and decrease investment in capital and the environment. However, it is also suggested that aging is beneficial for economic growth and the environment since the young people invest more in capital and the environment in preparation for their longer lifetimes. Focusing on an aging population is therefore important for analyzing whether we can obtain sustainable development in the future.

We first show that an annuity market plays an important role in determining the effects of aging on economic growth and the environment. In the case of a perfect annuity, agents annuitise all their wealth and bequeath nothing to their heirs. A perfect annuitisation eliminates the negative income effect of aging through unintentional bequests. Hence, aging is beneficial to economic growth and the environment under a certain condition. In the case of an imperfect annuity where there are some unintentional bequests, aging leads to a decrease in unintentional bequests, implying a negative income effect on growth and the environment. Since there are two competing effects of aging under imperfect annuity, greater longevity leads to either higher or lower levels of capital and environmental quality.

Second, we show that higher annuitisation rate yields lower levels of capital and environmental quality. An increase in annuitisation rate leads to the fall of unintentional bequests, thereby implying a negative income effect on capital and the environment. The zero annuitisation rate is the best way to obtain higher capital and environmental quality given the longevity of agents. We finally consider the effects of aging in case of zero annuitisation rate, and show that aging may be beneficial to growth and the environment under a certain condition.

The quality of life in the dynamics of economic development

KERRY KRUTILLA AND RAFAEL REUVENY

The neoclassical economic growth model and its various extensions in the fields of environmental economics and endogenous technological progress typically represent agents' welfare (or, utility) as a function that only depends on agents' consumption, when the models are analytically solved. This simplified welfare function specification is narrower than the specifications of welfare described in the quality-of-life literature and emphasized by proponents of sustainable development. In the quality-of-life literature, agents' welfare may include additional variables, such as natural resources, property rights, institutions, and the level of democracy. The purpose of this paper is to analyze the mathematical properties of an economic growth model that is based on a broader definition of agents' welfare. Our welfare measure includes two arguments: consumption and the stock of natural resources, or nature capital. This formulation enables an analysis of the consequences of the dynamical tension between conventionally defined economic growth, where welfare depends only on consumption, and the force of nature capital preservation. With no technological progress, our model yields multiple steady states, with diverse stability properties, and diverse responses of the steady states to changes in parameters, all of which differ from the standard case. With exogenous technological progress, our model exhibits unusual responses of the dynamic path to changes in the model's parameters, as well as unusual dynamic trajectories along which the economy evolves over time. These unusual dynamic outcomes have a number of policy-relevant implications for the analysis of sustainable development. In particular, they imply that the currently observed wealth differences between poor and rich countries may not close on their own, even if markets are set free and similar technological progress is provided free of charge to all countries. A once and for all wealth transfer from rich countries to poor countries may be needed if the goal is to close the North–South wealth gap.

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Issues in production, recycling and international trade: analysing the Chinese plastic sector using an Optimal Life Cycle (OLC) model

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In this paper, we address a number of issues pertaining to the recycling of waste and the international trade in waste products. The first issue looks at the economics of production. Over the last decade, the use of secondary commodities as inputs for the manufacture of final goods has increased and in many cases replaced primary commodities. It is postulated that the social cost is lower in secondary production. The second issue looks at waste collection and the disposable problem. Secondary commodities are produced from recyclable waste. Recyclable waste in turn must be separated from generic waste before it can be processed into secondary commodities. The costs and benefits of the complete process of collection, separation, and recycling need to be incorporated within the overall decision-making framework before actual decisions can be made with respect to choosing primary and/or secondary production processes. The third issue looks at the trade of recyclable waste. Many critics argue that trade in recyclable waste is a disguise for waste dumping by the exporting countries. Moreover, critics contend that import of waste plastics will crowd out the domestic waste collection system.

In order to address these issues in a systematic matter that evaluates both private and social costs, we develop an Optimal Life Cycle (OLC) model. A life cycle analysis in essence tracks the development of a product beginning from the raw material stage and ending with its final disposal. The unique character of the OLC model is that it allows us to include the recycling stages within the overall production system. All inputs needed at each stage, irrespective of whether it is primary production, secondary production, or final disposal, are computed. Similarly, all outputs including effluents are documented. The methodology allows us to compute the environmental intensities of the various stages thereby permitting us, within an optimization framework to make calculated decisions on choosing the appropriate choice of technologies in the design of the sector.

A number of experiments were run in order to observe how the design of a sector changes under different assumptions. In this paper we use the plastic sector in China as our case study. In the first experiment only financial[1] cost, sometimes also referred to as private cost, is minimized.

[1] Financial or private cost here includes production, transportation and import costs.

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The results were compared and contrasted with the present situation in China. The results highlighted two crucial points. First, the sector is presently inefficient and not using the best available technology (BAT) that is available. Second, capacity constraints in secondary resin production are partly to blame for not choosing the BAT. In the second experiment, social cost (external[2] cost together with financial cost) is minimized. Two additional experiments, one under a free trade regime and the other under a plastic waste import ban, were run.

The results from these scenarios clearly demonstrate the following three points without dispute. First, recycling can improve the economic and environmental performance of the plastic sector. Second, the best available technology is not presently being used by the sector. Third, trade in recyclable waste produces economic and environmental gains for the sector.

Assessment of China's pollution levy system: an equilibrium pollution approach

TINGSONG JIANG and WARWICK J. MCKIBBIN

China's pollution levy system has been criticized as ineffective because it is often asserted that the levy rate is too low to give incentives for firms to comply with the environmental regulation. From some critics' point of view, the levy is merely a local financing mechanism. Moreover, the strictness of enforcement is thought to vary widely, so factories in different regions face very different penalties for pollution. This paper examines the effectiveness and efficiency of the pollution levy system according to the theory of equilibrium pollution.

The idea of equilibrium pollution is simple. As the pollution levy is a part of a firm's costs, the firm would try to reduce this cost if it wanted to maximize its profits. From this principle, it is possible to establish the relationship between firm's demand for the polluting rights or environmental absorption capacity and levy rates. However, the government (as an agent of the community) controls the supply of such rights. Increasing the supply of polluting rights would increase the output level and thus the income available to the community but decrease the enjoyment from the environmental amenity. Therefore the government should weigh up the gains from more output against the losses from a poor environmental outcome in order to achieve maximum welfare of the community. From this principle, the supply relationship of polluting rights could also be

[2] External cost is the cost incurred by polluting activities of the sector.

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established. The realized pollution is determined jointly by the demand for polluting rights or environmental absorption capacity and the supply of these rights.

This idea can be used to assess the effectiveness and efficiency of the pollution levy system. If we can estimate a well-behaved, that is downward-sloping demand function for pollution, we may conclude that the system is effective because firms respond to the pollution levy rates. Moreover, if we could also estimate a well-behaved supply function, we may conclude that the system is efficient because it satisfies the welfare maximization principle.

Following this idea, we estimate the pollution demand and supply system for wastewater, waste gas, and solid wastes, using environmental and economic data for 28 Chinese provinces for a period of five years (1992–6). A common feature of these estimates is that there is a downward-sloping demand function, no matter whether the system is estimated for only one pollutant or multiple pollutants. This suggests that China's pollution levy system is actually effective. In regions with higher pollution levy rates, firms tend to have lower pollution intensity. However, we rarely find a well-behaved supply function of pollution when the system is estimated for multiple pollutants. Despite the problem of data accuracy, this may suggest that the levy rates are set arbitrarily by the government rather than according to a certain welfare principle, that is China's pollution levy system is not efficient. However, if the demand and supply system is estimated for wastewater only, a well-behaved supply curve is found. This suggests that the levy system works effectively and efficiently in the single market of wastewater. This is understandable because water pollution is a more local problem and the regional governments could receive higher pressure from the local public when they set the levy rates.

The impacts of economic reform on the efficiency of silviculture: a non-parametric approach

YAOQI ZHANG

Institutions and organizations are of primary interest in economics and management sciences. Issues associated with institutions and organizations have received greater attention in recent years owing particularly to the economic transition in the former Eastern European countries and China. The theoretical aspects of such studies have been promoted by the new institutional economics.

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This study uses the economic reforms in the management of state-owned forest in China to empirically test the impacts of different economic regimes on the efficiency of silvicultural activities. Since the mid 1980s, the state-owned forestry bureaux (SOFBs) in China have carried out various reforms. The old economic regime represented a more centralized and planned economy, while the current one is becoming more decentralized and market-oriented. The efficiency of silvicultural activities, if measured by the outputs corresponding to their inputs, could be a good indicator of the change in efficiency during these two regimes. We have chosen successfully planted and tended areas as the measured outputs rather than using the growth of forests, which is much more difficult to measure and is greatly dependent on forest conditions (for example, age, species, soil, and climate). Total expense is used as the measured input. We hypothesize that efficiency has been affected by adopting economic reforms. The purpose of this study is to test this hypothesis, to measure the quantitative impacts and to explain the causes.

As outputs are not priced, we can only measure technical efficiency, that is, outputs in respect to inputs; Data Envelopment Analysis (DEA) is applied in the examination. Efficiency is measured by relative gain or loss compared with the frontier, and it is further divided into pure technical efficiency and scale efficiency.

The empirical results show that relative efficiency on average is improved by 27 per cent and 24 per cent by constant returns to scale (CRS) and various returns to scale (VRS), respectively, and only a small number of forestry bureaus (3 of 40 by CRS and 8 of 40 bureaux by VRS) show some loss in efficiency. Comparatively speaking, the scale efficiency change is relatively small. The study further analyses the causes of efficiency gains and concludes that reductions in labour shirking and administration costs are two major reasons for the efficiency gains. Since a large number of SOFBs are still far behind the frontier, in terms of both CRS and VRS, there is still great potential for improvement through deeper economic reforms and reorganization of the SOFBs. In organizing silvicultural activities, new contracting systems that aim to overcome labour shirking and reduce administration costs through streamlining the bureaucratic system could be important in future reforms.

Environmental degradation and the demand for children: searching for the vicious circle in Pakistan

DEON FILMER and LANT H. PRITCHETT

This paper explores empirically the hypothesis that, because of their important role in collection activities related to common property environmental goods (for example, firewood and water collection), the demand for children may increase with local resource depletion, setting up a vicious circle in the interaction between resource depletion and population growth. Analysis of a large household survey from Pakistan with detailed information on female time allocation (child and adult), firewood use and collection activities, and fertility establishes five findings.

1 Collection activities absorb a substantial part of total household resources. The time devoted to firewood collection accounts for an average of 6.2 per cent of household expenditure—as high as 7.9 per cent in Baluchistan and 8.8 per cent in the Sindh.
2 A substantial fraction of firewood is collected from household's own land—especially for the poor. Nevertheless, in the Sindh, about 90 per cent of the firewood collection is on public or private land belonging to others.
3 Children spend relatively more of their time on collection activities, which absorb a quarter of their time. However, since they devote much less total time to household tasks—these rise from 10 hours per week at age ten to over 50 at aged 30—female children accounted for only 16 per cent of all household hours devoted to collection activities.
4 Older female children do make a net contribution: the time that women in the household work on household tasks is reduced by 2.2 hours a week in household activities for each child aged 10–15 and by 3.4 hours for each child over 15.
5 Firewood availability does seem to be related to fertility. While not purporting to 'test' any specific behavioral model, we show in descriptive reduced-form multivariate regressions that, even after controlling for other determinants of fertility, households living in areas in which the distance from firewood is greater tend to have more children, while households living in areas in which firewood is more expensive tend to have fewer children. As would be expected this relationship is complex and varies across regions of Pakistan—being particularly strong in the Sindh where indications of fuelwood scarcity are the greatest.

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The relationship between environmental values and income in a transition economy: surface water quality in Latvia

RICHARD C. READY, JÂNIS MALZUBRIS, and SILVA SENKANE

Even with foreign assistance, Central and Eastern European (CEE) countries lack the resources needed to modernize their outdated and deteriorating environmental infrastructures. With low per capita incomes and high unemployment, citizens of CEE countries face more immediate issues than environmental quality. However, incomes in CEE countries are expected to rise as political and economic reforms are implemented. Will support for environmental investments increase as per capita income increases?

This question was investigated in a contingent valuation study of a surface water quality improvement in Latvia. The contingent valuation method is a survey-based approach to measuring the value that residents place on environmental goods. Residents of Sigulda, Latvia were willing to pay, on average 0.27 Lats per person per month (1 Lat = 2 US$) to fund investments in the local sewage collection and treatment system that would improve water quality in the Gauja River to the point where the river would be safe for swimming. That quantity represented 0.7 per cent of household income, a level that is similar to that found in similar studies conducted in the United States and the Philippines. However, that amount is insufficient to fund the required capital improvements, which would cost about 0.9 Lats per person per month.

A cross-sectional analysis showed that willingness to pay for the improvement was positively related to income. While the point income elasticity of willingness to pay for the average resident was relatively low (0.59), that elasticity increases with income, approaching 1 for higher-income residents. This result suggests that support for environmental investments will increase as incomes increase over time. For example, the value model estimated in this study shows that if real incomes of Sigulda residents increase to 60 per cent of the EU average, average willingness to pay for this programme will increase by 130 per cent.

A positive link between income and willingness to invest in environmental quality has implications for the timing of greater integration with Western Europe. Latvia is not now investing sufficient amounts to meet the environmental requirements for admissions in the EU. While economic growth will allow Latvia to increase its level of investment, that growth will reach its full potential only with greater integration with Western Europe. If public willingness to spend money on environmental improvements will only develop after incomes have risen from their current levels, then economic integration may have to occur prior to environmental conformance.

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