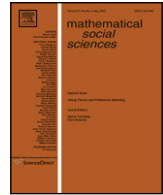




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### Editorial

## Introduction to the special issue on sustainability

Sustainability has become a key concept in the evaluation of progress accomplished by societies. Recently, the Stiglitz Commission created by the French government to reflect on the measurement of economic performance and social progress has clearly identified sustainability, which “poses the challenge of determining if at least the current level of well-being can be maintained for future generations”,<sup>1</sup> as a central issue. The induced research agenda is tremendous: many related normative and positive issues are still wide open due to the diversity of fields that are essential to a rigorous appraisal of sustainability. This special issue is a contribution of *Mathematical Social Sciences* to the ongoing debates. The sustainability topics addressed in this issue include intergenerational justice, environment (natural resources and climate change), demography and economic (monetary) policy. The approaches are either normative or positive. Measurement issues are not treated although they are certainly an important component of the sustainability debate (see Asheim, 2003; Arrow et al., 2004).

The normative questions are on the top of many research agendas. The axiomatic foundation of sustainable development has been decisively launched by Chichilnisky (1996), resulting in the concept of *sustainable preferences*. The paper of Geir Asheim and Tapan Mitra takes this track. The authors introduce *sustainable discounted utilitarianism* (SDU), allowing to resolve intergenerational conflicts while satisfying the two main Chichilnisky axioms (no dictatorship of the present and no dictatorship of the future). In contrast to previous attempts to construct sustainable preferences, Asheim and Mitra’s SDU has the invaluable virtue to be free of the existence problems usually encountered. The authors illustrate this property by two applications to standard economic growth models.

Hippolyte d’Albis and Stefan Ambec address the insightful question of fair intergenerational sharing of scarce natural resources. Due to the scarcity characteristic (implying that meeting future generations’ needs, by requiring less extraction today, is detrimental to present generations), the induced intergenerational justice problem is tricky and require nontrivial compensation schemes between generations to be resolved. The authors devise resource allocations according to two fairness criteria, allowing each generation to get at least what it can achieve by itself on one hand, and assuring a solidarity principle on the other. The paper provides an interesting uniqueness property of such a fair allocation, and examines the resulting (notably extraction) dynamics.

The two previous papers consider deterministic environments. A noticeable part of the difficulty in dealing with sustainability can be attributed to the (partial) unpredictability of the future natural and social environments. Graciela Chichilnisky proposes an axiomatic approach to deal with a certain class of uncertain events, the so-called *black swans*, which are rare events with major consequences

<sup>1</sup> Page 16 of the published report of this commission, available at [http://www.stiglitz-sen-fitoussi.fr/documents/rapport\\_anglais.pdf](http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf).

like environmental catastrophes or market crashes. Rather than omitting these outliers (as considered from the classical statistical point of view), the author proposes a new axiomatic approach allowing to account for them and examines the induced likelihoods or subjective probability distributions. In particular, Chichilnisky amends the classical Arrow's monotone continuity axiom (1971) which is shown to lead to neglect *black swans*, and she introduces an alternative axiom (which is actually the logical negation of monotone continuity).

Two papers on climate follow. Antoine d'Autume, John Hartwick and Katheline Schubert examine the issue of sustainable development in the presence of global warming. In their model, consumption of fossil resources provokes global warming, and the latter negatively affects the producers and the households through a variety of channels. Then, the question of optimal depletion of natural resources becomes even more crucial than in the standard settings à la Dasgupta and Heal (1979). The authors are able to address this issue using several social welfare criteria, namely the Rawlsian maximin and the zero discounting criterion due to Ramsey (1928). Moreover, they deliver very nice closed-form solutions to the optimal dynamics in certain relevant cases.

Sustainable development has also the tricky characteristic that it is international in nature in some dimensions. The case of optimal handling of transfrontier pollution is paradigmatic in this respect. Marc Germain, Henry Tulkens and Alphonse Magnus provide a dynamic game framework for the study of cooperation in international pollution problems. Beside the dynamic nature of the approach taken, the authors also significantly increase the realism of their model by considering both capital and pollution accumulation in contrast to previous attempts only dealing with the latter. They end up identifying a transfer scheme between countries leading to cooperation and discouraging partial coalitions.

This special issue also addresses some of the questions on the demographics of sustainable development. The question of (socially) optimal population size has been at the heart of a quite intense philosophical debate following Parfit (1984) who suggests that total utilitarianism leads to increase population size indefinitely, even if the average welfare tends to zero. This raises the question of how to devise social welfare functions properly accounting for the latter trade-off and the associated sustainable fertility rates. It also calls for a revision of the standard social welfare criteria to integrate the fact that people do invest in their health and the health of their children to reduce mortality. David de la Croix and Gregory Ponthière tackle the latter question and attempt to identify *golden rules* of capital accumulation under endogenous longevity. In contrast to the classical framework of *golden rules*, the authors incorporate health spending, which diverts resources from capital accumulation but lengthens individuals' lifetimes. They ultimately point at two decisive determinants of the shape of the obtained *golden rules*: whether health spending improves consumption enjoyment, and whether the social planner has an instantaneous welfarist view or adheres to a complete life view.

Noël Bonneuil takes a more positive approach and revisits the demographic transition, that is the decline of fertility and mortality from high to low levels, which is admittedly one of the most salient features of the development process. Rather than taking the widely disseminated view of the demographic transition advocated by Galor and Weil (2000), which highlights the role of technological progress in getting out a pre-transition Malthusian regime, the author outlines the role of family regulation after Bergstrom (2007). This results in a nice application of the micro-economics of the family to the demographic transition, replicating the observed timing in historical data, that's mortality decline preceding that in fertility.

A last dimension of sustainability investigated in this special issue is what one would call sustainable economic policies. Beside the classical sustainability issues in this field (mostly related to pension and social security systems), the viability of asset and monetary markets deserves a central place as we are still involved in a global crisis with well-known financial determinants. Stefano Bosi and Thomas Seegmuller study the occurrence of bubbles and the way to rule them out in a monetary extension of Tirole's overlapping generations model (1985). Interestingly enough, the authors emphasize the role played by collaterals and credit markets in the emergence of bubble fluctuations.

This special issue was made possible thanks to the kind support of many efficient referees, and to the encouraging help of the editor, Jean-Francois Laslier, and associate editor, Jean-Marc Tallon. Special thanks go to Phu Nguyen-Van who organized the excellent conference on "Sustainable

Development: Demographic, Energy and Inter-generational Aspects”, at University Louis Pasteur of Strasbourg (France) on November 28–29, 2008. Part of the papers published in this special issue were preselected at this conference before undergoing the usual refereeing process of this journal.<sup>2</sup>

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