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Sustainable growth in a resource-based economy

Abstracts

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Lecture 1

Introduction.

The Dasgupta-Heal-Solow-Stiglitz (DHSS) model. Imperfect economies

The lecture reviews the history of the questions connected with sustainable economic growth, limited resources, and intergenerational justice, starting from the work of T. Malthus. The properties of and justifications for the DHSS model are considered. The main results obtained with the DHSS model are reviewed, including the work of Asheim (2005). The lecture introduces the notions of static economic imperfection, defined via non-optimality of the initial conditions, and dynamic imperfection connected here with the deviations from the standard Hotelling Rule. Simple examples are provided.

Lecture 2

The roles of saving and extraction in sustainability

Two new results are presented for the DHSS model with an essential nonrenewable resource:

- (1) the pattern of resource extraction can be more important for sustainable growth than the pattern of saving when the Hotelling Rule modifier is not small enough;
- (2) the qualitative behavior of the long-run per capita output can be examined along any smooth enough path of extraction for any variable saving rate using the “index of sustainable extraction” introduced in the paper.

Lecture 3

**Consistency of a criterion with the initial conditions
in an imperfect economy.**

Stickiness of extraction and saving

There is a large body of research devoted to the understanding of sustainable growth in resource-based economies. Some of this research is inapplicable to the real economy. This is a result of inconsistency between the commonly used criteria and the initial states of imperfect economies. The inconsistency can lead to either inferior, unsustainable, or nonexistent optimal paths of consumption per capita if the criterion is not linked to the initial state. It is demonstrated using the DHSS model with the constant consumption per capita as a benchmark criterion. The results show that the inconsistency in this case can imply Pareto inferior paths of consumption per capita.

Lecture 4

A constant-utility criterion linked to an imperfect economy affected by irreversible global warming

The question of formulation of a social planner criterion for an imperfect economy is studied using an example of a polluting economy negatively affected by growing temperature.

Imperfection of the economy is expressed here in deviations from the optimal initial state. It is shown that a criterion not linked to initial state almost always implies either unsustainable or inefficient paths in the economy. The constant-utility criterion is linked here to the initial reserve. This criterion implies efficient resource use and the paths of utility asymptotically approaching some constants, which depend on the parameters of the temperature function. The criterion can be formulated for the cases when the reserve estimate changes over time and when the high level of temperature can cause extinction.

Lecture 5

Maximin-optimal sustainable growth in a resource-based imperfect economy

A welfare criterion is linked here to the opportunities for sustainable development in an imperfect economy. The approach implies a dependence of the criterion on the economy's current state. The economy-linked criterion is constructed using an example with the maximin principle applied to a hybrid level-growth measure. This measure includes as special cases the conventional measures of consumption level and percent change as a measure of growth. The hybrid measure or geometrically weighted percent can be used for measuring sustainable growth as an alternative to percent. The problem is considered for the DHSS model. Closed form solutions are obtained for the optimal paths of tax, capital, extraction, and consumption including the paths, dynamically consistent with the updates in reserve estimates.