

Systems Research Institute, Polish Academy of Sciences

Preprints

TRANSITION TO ADVANCED MARKET ECONOMIES



Abstracts

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SESSION 10

NATURAL RESOURCES, ENERGY AND POLLUTION

PIGOVIAN TAXES AND TRADABLE POLLUTION PERMITS IN DYNAMIC GENERAL EQUILIBRIUM MODEL

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The purpose of this work is to discuss the problems posed by water pollution, as well as resolutions in a dynamic context.

Our model has its origins in the public goods literature, more precisely in works concerned with dynamic processes for optimum resource allocation.

We consider an economy with a set of firms that generate wastes as a byproduct in their production process.

These public "bads" may be purified by these firms themselves and/or directed to a common property resource. Negative effects to consumers are achieved through their utility functions. In this framework, we correct this problem of externality by using incentive instruments: to impose a tax à la Pigou, or to create a market in tradable permits. Our objective is to bring the economy from a laissez-faire equilibrium (where firms are free to pollute) to an efficient state in the sense of Pareto.

In order to achieve this, we use a dynamic general equilibrium model (dynamic: in the sense that adjustments are not instantaneous):

- i) we characterize an efficient state for this economy;
- ii) Pigovian taxes or tradable permits are used to achieve a Pareto optimum;
- iii) we use stability analysis to simulate the evolution of this economy to the optimum;
- iv) finally, we establish the main properties of the process (feasibility, individual rationality, convergence, stability).

MODELING OF POLISH COAL MINING

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The transition from centrally planned to market economy affects the methods of economic analysis. The models which were used in the past are not valid presently although they were the seed which initialized the development of methods and applications.

The most important mineral in Poland is coal as it constitutes 80% of primary energy. As a consequence the possibilities of output growth were always in spotlight. The result is relatively high interest in application of mathematical and computer methods for optimization and forecasting of coal mining. There is more than twenty years of experience in modeling of coal mining development.

The authors have developed in the last years several versions of such models. The early version was able to consider important constraints such as investments, energy supply, employment etc. The subsequent version includes possibility of determining technology and capacity of the mine waters desalination plants. The last version focusses on economic effectiveness of mines and includes the possibility of mine closing. Certain elements which determine the influence of economic transition on the future of coal mining are also considered. Diverse optimization criteria were used. At the early stages it was costs or social costs, at present minimization of subsidies and economic effectiveness.

In the paper the authors try to characterize the stages of model development and application of results.

DATA BASE FOR MINERAL ECONOMY RESEARCH

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Poland is a country where mineral resources and their management are of great importance for the national economy. Polish transition to the market economy causes that problems connected with all the aspects of mineral economy are especially important. Many research centers deal with different kinds of analysis in this field.

Therefore, there is strong necessity for organizing one data base system, which will enable to gather and manage data for any particular research connected with problems of mineral industries.

The Mineral and Energy Economy Research Centre of Polish Academy of Sciences worked up the idea of such data base.

It allows to gather all kinds of data necessary for analyzing the present state and the future of mineral industries on the national and branch levels.

Systems analysis was applied to prepare the data base structure. Minerals system consists of many elements, of different characteristics and properties. Only two of them, called "TECHNOLOGY" and "RESERVE" are sufficient to complete the description of all existing elements in the mineral economy system.

The data base has a very simple structure and allows to gather all data connected with any management of minerals, starting from deposit management, through mining, processing, utilization to the impact on environment.

DECISION SUPPORT SYSTEM FOR ADVANCED ENERGY MANAGEMENT IN HEATING POWER PLANTS

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AN ANALYSIS OF MARKET RELATIONS IN AN ENERGY SYSTEM

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Implementation of market relations in post- communist countries is rather complicated. It is very important to ensure that all decisions in this area should be compatible with a market mechanism.

The mathematical analysis of market relations in the Lithuanian energy system have shown that economic relations should be based on the marginal cost and marginal efficiency.

In this paper the conditions of equilibrium in the energy exchanges between countries are shown. The exchange tariff should be based on the marginal energy cost of the energy exporting country. Model of market relations in a national energy system reflects energy demand and energy costs. From the model the equilibrium conditions between an energy system and rest of economy could be derived. It is easy to show graphically that the marginal cost should be included in consumer energy prices. Inclusion of the marginal cost is very important for implementation of energy saving measures. This paper provides also a theoretical basis for the interaction between the energy sector and the environment.

COMPUTER SYSTEM FOR ENERGY SECTOR EXPANSION ANALYSIS WITH EMPHASIS ON ENVIRONMENT QUALITY CONTROL

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The environment protection is conditioned by the following factors:

- the availability of technologies which will enable to utilize the nonrenewable as well as renewable energy sources in order to decrease or eliminate the air pollutant emission,
- the availability of the financial expenditures to be required to introduce these technologies to the economy,
- the control of atmospheric air quality in order to take into account the regional distribution of pollution sources and the regional expansion of the pollutants.

The decision making process, which would enable to take into account the mentioned above factors, requires the tool in the form of the computer system in order to explain the number of questions such as:

- what kind of energy sector expansion scenario should be chosen to decrease energy consumption as well as air pollutant emission ?
- how to distribute regionally the new plants in the country in order to control and to reduce the regional expansion of the pollutants ?
- what financial expenditures should be required to realize the proposed energy and environment project ?
- what are the conditions under which the economy could provide the required financial expenditures ?

A computer system which enables to explain the above questions has been developed in the System Research Institute. In the paper some of the results are presented which involve

ADVANCED INFORMATION SYSTEMS AND OPERATION RESEARCH CHALLENGE AND OPPORTUNITY FOR CENTRAL AND EASTERN EUROPEAN CITIES DURING TRANSITION TO ADVANCED DEMOCRACY AND MARKET ECONOMIES

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The emerging democracies and market economies in the Eastern Europe constitute probably the most significant but also the most tough event in Europe of the past 74 years.

The emerging revolutionary change requires unconventional methods and tools already available in the West but not well known yet in the East, such as advanced information systems, operation and systems research.

Eastern European cities have common problems which could be solved more efficiently by joint efforts and cooperation with the ones from Western Europe, for benefits for all Europe. Eurobarometer, spring 1991, has shown that the most important issue facing European society is pollution. Therefore, dramatic change in the environmental management in Central and Eastern European cities is the most urgent one. Advanced informatic and OR/SR could contribute significantly by the development and widespread implementation of the integrated decision support system, which consists of a simulation model for air pollution monitoring, a geographical information system, a discrete optimization module for interactive selection of preferred alternatives. The common framework could be formed by an expert system coordinating the modules and interacting with the user in a high-level, problem-oriented way. All modules of the systems should have a common graphics interface and allow for easy user interaction.

Citizens and experts participation in the city decision making process could also be dramatically enlarged and improved by advanced information systems and OR/SR. What matters most today is the ability to think together, not alone. To think imaginatively about matters of substance, incorporating many perspectives and reaching beyond conventional categories. To create new concepts that make new connections. Interactive Multicriteria Team Decision Computer Support Systems together with Computer Multi-Media Systems available just now, could be effective and efficient vehicles for the enlargement of citizen participation in the city decision making processes. Moreover Approval Voting Computer Support Systems could be very useful for design of committees as well as for large group decision making tasks.

Advanced informatic and OR/SR could also dramatically improve the overall management of Local Public Administration and stimulate the transfer of know-how and technology from West to East.

Advanced informatic and operation research invented in the Western Europe recently has been promoted from the backroom to the boardroom. It is there to support top management decisions, whilst maintaining its traditional role of providing reliable tools for stock and production control, transportation etc.

The role of the advanced information systems and operation research in the catching up with the Western European cities social, political and management technologies by the Eastern ones is impossible to overestimate. People of the New Europe must be willing to transfer technology rapidly from one part of Europe to another to work on projects in which countries and cities combine their forces.

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