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Ülo ENNUSTE *

A MARKET-LIKE IMPLEMENTATION EXAMPLE

This paper studies an example of the implementation of the fixed social choice rule in a mixed economy where agents have asymmetric information. The implementing mechanism is based on the decomposition of this choice rule (the stochastic optimal planning problem) into an aggregated central regulation model and a detailed two-stage agents' Bayes-Walras model.

The equilibrium concept employed for the Bayes-Walras model is Bayes-Nash equilibrium in Benassy's competitive market environment [1]. In the first iterative stage agents may reveal some of their asymmetric information to other agents prior to playing this game [2]. In the example given sufficiency condition is provided for complete revelation of private information and implementation is achieved.

1. Introduction

Implementation [1] theory is concerned with the design of a game, or mechanism, for the agents to play, so that the equilibrium outcomes of the play coincide with the outcomes of the social choice rule in the given economic environment. It is easy to see that the implementing game has to manage with two painful tasks: to transfer some real values and to transfer some informational values in the given economic environment. The fulfilling of the first task may be only painful in the sense of incentives, but not technically. Real values are visible and there are taxation or lump sum transfer rules to regulate agents' incomes and utilities according to the social choice requirements.

But differently to real values, asymmetric information is fundamentally private decentralized ownership and not visible to the other agents. This means that agents with asymmetric information and without any regulation would presumably behave in a strategic manner with respect to their private information, and the implementation problem cannot be effectively dealt with.

As Blume and Easley point out [5]: "unless the economy's information structure satisfies a distribution condition called *nonexclusivity*, no Walrasian equilibrium is implementable by any trading mechanism. Nonexclusivity in information is sufficiently stringent that we view this theorem as a negative result." The necessary nonexclusivity condition requires that each agent's private information is predictable by all other agents [6, 7]. This condition is very stringent indeed, and not like those of a real working economy.

But, fortunately, this negative finding by Blume and Easley takes the distribution of information as exogenous. They have not addressed the question of the endogenous information aquisition in the market mechanisms. So the crucial problem in our Bayes-Walrasian example is to include the endogenous iterative information aquisition into implementation mechanism.

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* Eesti Teaduste Akadeemia Majanduse Instituut (Institute of Economics, Estonian Academy of Sciences). EE0105 Tallinn, Estonia pst. 7. Estonia.

[1] The terms *implementation* and *realization* are used in the same sense as e. g. in [3]. That means [4]: "A mechanism realizes an objective if, when agents are honest, the objective is met when the mechanism is used. A mechanism implements an objective if, when agents act strategically, the objective is met when the mechanism is used."

As much as the agent's information is fundamentally private the information exchange can be effectively dealt with exclusively in the incentive-compatible mechanisms. An incentive-compatible regulatory policy in which the agent has no incentive to misreport its true information can, however, be connected with considerable additional costs [8, 9]. We consider these costs as Okuno-Fujiwara et al. in [2] by adding a first stage iterative announcement game to a given basic game with asymmetric information. This first stage game can be considered as an asymmetric information game itself and its equilibrium can be studied [2].

The crucial point, for our purpose, is that although the competitive agents have exogenously asymmetric information, the asymmetry disappears to a sufficient extent during the course of their announcement contacts. We have shown that in case of our fixed social welfare correspondence that is decomposable into Bayes-Walras-Benassy submodel, the sufficient condition for truth-telling in the announcement stage is precision priority [2]. But before reading this submodel we have to introduce one more kind of regulation, the regulation of real utilities [10, 11]. All this has been done to achieve a market-like mechanism example.

In this paper we do not ask the broader question: what general choice rules can be Nash implemented when there is no competition (there are two agents or monopolies, etc.)? We believe that having obtained enough experience with a competitive model we are able to go straightforward to this question.

Also note that our approach is entirely heuristic: all models are considered to be mathematically nice and all the proofs of statements are schematic and verbal, etc.

The paper is organized as follows. Some notations and general definitions are given in the next section. In section 3 we describe the social choice correspondence as a stochastic optimal planning model. This model is decomposed into a trivial regulation model and detailed agents' activity submodels.

In section 4 we describe a Bayes-Benassy mechanism to solve these submodels. In section 5 we add a first stage announcement subgame to the given Bayes-Benassy game to work out equilibrium prices and quantities. In section 6 we show that for the given asymmetric economic competitive environment a sufficient condition for strategic information revelation about prices is the condition of priority of precision.

2. Some notations and general statements

Let I_j, $j=0, 1, \ldots, n$ denote the *a priori* asymmetric admissible information set for unit j ($j=0$ is the centre). Here we abstract away the time dependence of I_j, and with that we abstract away also the explicit study of rolling planning. Information $i_j \in I_j$ determines the probability spaces for agents (S_j, C_j, P_j). Here $s_j \in S_j$ is an elementary state of the world of j, which determines the agents' preferences, technology, initial endowments, market conditions, etc. and S_j is the set of elementary states (possibly finite) of the agent j. C_j is σ-field and P_j is probability measure. An elementary state of the economy based on the joint or pooled information is $s \in S = \bigtimes_{j=0}^{n} S_j$, $C = \sigma[\bigtimes_{j=0}^{n} C_j]$, $P = \prod_{j=0}^{n} P_j$, where $\sigma[\bigtimes_{j=0}^{n} C_j]$ is the σ-algebra of subsets of S generated by the σ-algebra C_j, $j=0, \ldots, n$.

In defining the social choice rule or social desideratum we assume the possibility of realization or the pooling of the probability spaces of the agents. The social choice rule $D(s)$ is an optimization correspondence to a set $Z(s)$ of feasible plans or outcomes, $Z(s) \subseteq J(B)$, $B \subseteq C$, where B is sub-σ-field and $J(B)$ is measurability set for plans. The task of implementation is to find for $D(s)$ a noncooperative game $N(s)$, where the equilibrium outcome $h(\mathrm{Eq}\, N(s), s) = D(s)$, where h is an outcome function.

Here we assume that model D is dynamic and has a certain structure. It has a detailed setting at the beginning of the planning period or in the threshold period and an aggregated part at the end of the period or in the horizonal period.

Now we assume that the centre, $j=0$, has all aggregated information about the economy (also for the beginning of the planning period) and the agents $j=1, \ldots, n$ have all the detailed information about themselves. Accordingly, it is reasonable to decompose D into two subproblems: the detailed threshold activity submodel A, and the threshold-horizonal aggregated regulation submodel R. There are many alternative decomposition and coordination principles for this decomposition. To discuss these problems is not our task presently. Here we assume that the regulation problem is dealt with by the centre $j=0$ (possibly with the help of some system of models). The solution of the regulation problem gives some constraints and some aggregative indicative indicators for the detailed threshold problem A. As far as the centre has all the aggregated information the above-mentioned R system of models is cooperative, and economically it is a central planning problem of allocation with constrained resources. Clearly, the decomposition of D into A and R brings the social choice rule closer to the real market economies with central regulation, and the mechanism will bear more resemblance to the regulated market.

So a small step is made towards incorporating central (public) regulation into mathematical mechanism theory of asymmetric information. This is based on some Vind's [11] ideas of coordinated equilibrium concept. The central unit is called upon to regulate the agents putting bounds on their attainable strategy sets (regulated strategy sets). If there is no regulation we will obtain the non-coordinated Bayes-Nash solution. If there is complete regulation (regulated strategy sets are centrally optimal solution sets) we will achieve centralized solution.

Now the task is to find a noncooperative stochastic game G whose outcome implements A. Here we assume the following attributes of the game[2]: the strategy domain $M = \bigtimes_{j=0}^{n} M_j$, where M_j is the strategy domain of j and $m_j \in M_j$ his strategy, his outcome function h_j: $M \times S_j \to X_j$, his belief structure or probability distribution over M_{-j}, is q_{-j}. Here $(m_j, m_{-j}) = m$, $m \in M$, and $(q_j, q_{-j}) = q$, where q_j is assumed to be independent common knowledge about j's strategy by all other agents.

The strategies $m_j^* \in M_j$ are Bayes-Nash equilibria for the game if for each $j \in N$:

$$m_j^* = \arg\max\, [e_j(h_j(m_{-j}^*, m_j, s_j)) \mid q],$$

where e_j is the expected utility function of j. Now the conditionality of the Bayes-Nash equilibrium from q leads to adding one more stage, the announcement stage, to this game [2]. In this first stage game the agents are allowed to give information about their preliminary strategies

[2] Here we omit the states s from the strategies to keep notation clear.

and the other agents revise their beliefs according to Bayes' rule. In section 5 we describe sufficient conditions for an example where the equilibrium of this sequential announcement game is complete revelation.

3. The stochastic social choice model and decentralized equilibrium

3.1. The initial model. Let us have an economy with n units or agents indexed by $j=1, \ldots, n$ and m goods indexed by $i=1, \ldots, m$. Let $s \in S$ be an elementary state of the world, C is a σ-field of the measurable subsets of S, and P is a probability measure assumed about (S, C). So (S, C, P) is an abstract probability triple of joint knowledge.

The public ownership or central resource constraint of the economy is $b(s) \in R^m$, where $b_i(s) > 0$ is input or 'consumption' of the economy and $b_i(s) \leqslant 0$ is output. The activity of j is described by the vector $x_j(s) = (c_j(s),\ z_j(s))$, $c_j(s) = (c_{ij}(s))$, $z_j(s) = (z_{ij}(s))$, $i=1, \ldots, m$, where $c_j(s)$ is consumption vector, $c_j(s) \in R^m_+$, and $z_j(s)$ is trade vector. Here $z_{ij}(s) < 0$ is input and $z_{ij} \geqslant 0$ is output. Define $q_j(s) = c_j(s) + z_j(s)$ as supply (production) vector, $q_j(s) \in Q_j(s)$, where $Q_j(s)$ is supply (production) set assumed to be closed, convex, bounded, and with nonempty interior with the probability one.

Here the private endowment and production technology of the agent j are implicitly described by the set $Q_j(s)$. For instance, if agent j is a pure consumer the supply set $Q_j(s) = \{q_j(s) \mid q_j(s) \leqslant w_j(s)\}$, where $w_j(s)$ is the agent's j endowment. If the agent j is a pure producer the supply set is $Q_j(s) = \{z_j(s) \mid g_j(z_j(s), s) \leqslant w_j(s)\}$, where $g_j(z_j(s), s)$ is the technology function. We also make the standard assumption that $x_j(s) \in J(B_j)$, where B_j is sub-σ-field of the activity j, $B_j \subseteq C$ and $J(B_j)$ is a measurability set for the activity j. For example, if $B_j = C$, then the activity j is totally conditional on s, and if $B_j = \{S\}$, then the activity j is totally unconditional of s (deterministic).

The utility of the agent j is presented by the function $u_j(x_j(s), s)$ defined continuous and strictly monotone and strictly concave with the probability one in the arguments.

We also make the standard assumption about the measurability of the constraints $i=1, \ldots, m$ on sub-σ-fields $B_i \subseteq C$. For example, if $B_i = C$, then the constraint i must be considered for every $s \in S$, if $B_i = \{S\}$, then only the mathematical expectation E of the constraint is considered.

We assume that the objective function of the economy is the mathematical expectation of the sum of the agents' utilities. Now the initial optimal problem (the social choice correspondence) is the following. Maximize on the basis of the plan $x(s) = (x_j(s))$, $j=1, \ldots, n$ the objective function

$$E \sum_j u_j(x_j(s), s) \tag{1a}$$

subject to

$$E\left[\sum_j z_{ij}(s) + b_i(s) \mid B_i\right] \geqslant 0, \qquad i=1, \ldots, m, \tag{1b}$$

$$c_j(s) + z_j(s) = q_j(s) \in Q_j(s), \qquad j=1, \ldots, n, \tag{1c}$$

$$x_j(s) = (c_j(s), z_j(s)) \in J(B_j), \qquad j=1, \ldots, n, \tag{1d}$$

where all the stochastic constraints (here and below) hold with the probability one.

Here we should note that (1) may describe also complicated dynamic problems.

To design a mechanism for problem (1) we make a set of 'natural' assumptions which will lead to the decomposition of problem (1) into two submodels: an aggregated regulation submodel R and a detailed activity submodel A.

Assumption 1: The mechanism elaborates rolling plans. So it is 'natural' to elaborate detailed activity indicators only for the very beginning of the planning period, and further consider only aggregated regulation indicators.

Assumption 2: Only the centre has the information and capability to deal with the aggregated part of the problem, and only the activities managers have the information about their detailed indicators.

Assumption 3: No centre is technically capable of getting reliable, detailed stochastic information from the activities managers and coping computationally with it.

The reasonable conclusion from these assumptions is to design two subproblems: one for centrally elaborating the aggregated regulation indicators for the model A, and the other, the decentral submechanism, for elaborating the detailed indicators for the beginning of the period. Here we consider the first problem R to be trivial, so our interest is in the problem A. Now we shall describe and comment on the decentralized subproblems of the agents in the framework of the activity model A.

3.2. Equilibrium of decentralized activities. We shall now assume that the activity submodel A has the same initial structure as (1), where some of the values of $b_i(s)$ come from the model R. To decentralize this model we use Lagrangian relaxation. For this purpose an optimal solution $x(s)^0$ to problem (1) is assumed to exist, and the regularity conditions of (1) are met.

Now the following Lagrangian problem is obtained:

$$\min\max L(x(s), p(s)) = \min\max E\{\sum_{j=1}^{n} u_j(x_j(s), s) + \sum_{i=1}^{m} p_i(s) E(\sum_{j=1}^{n} z_{ij}(s) + b_i(s) \mid B_i)\} \quad (2a)$$

subject to

$$q_j(s) \in Q_j(s); \ (c_j(s), z_j(s)) \in J(B_j), \quad (2b)$$

$$p_i(s) \geqslant 0, \quad p_i(s) \in J(B_i), \quad (2c)$$

where $p(s) = (p_i(s))$, $i = 1, \ldots, m$, is the Lagrangian price.

Let the saddle point (optimal) price $p^0(s)$ be given. Then (2) breaks into activity subproblems or agent's problems, $j = 1, \ldots, n$. These are the following:

$$\max E\{u_j(x_j(s), s) + \sum_{i=1}^{m} p_i^0(s) E(z_{ij}(s) \mid B_i)\} \quad (3a)$$

subject to

$$q_j(s) \in Q_j(s); \ (c_j(s), z_j(s)) \in J(B_j). \quad (3b)$$

Let the optimal solution of (3) be $x_j^0(s)$, and now $x^0(s) = (x_j^0(s))$, $j = 1, \ldots, n$ is the optimal solution of (1).

We transform problem (3) of the agents $j = 1, \ldots, n$ into the equivalent Walrasian form:

$$\max EU_j(x_j(s), s, y_j) \quad (4a)$$

subject to

$$E\sum p_i^0(s)\,E(z_{ij}(s)\,|B_i)-y_j=0, \tag{4b}$$

$$(z_j(s),\,y_j)\in X_j(s);\qquad (c_j(s),\;z_j(s))\in J(B_i), \tag{4c}$$

where $U_j(x_j(s),s,y)=u_j(x_j(s),s)+y_j$, and $X_j(s)=Q_j(s)\times Y_j$ and $Y_j=(y_j|y_j\geqslant y_j^0)$, where y_j^0 is the agent's j expected lump-sum transfer (numeraire good).

The new constraint (4b) is the budget constraint of the agent, and y_j^0 is the agent's j expected optimal lump-sum transfer determined by the model R. It follows from the strict concavity of (4a) that the solution of (4) is $x_j^0(s)$.

Under the assumptions made the lump-sum transfers y_j^0 (taxes $y_j^0>0$ or subsidies $y_j^0\leqslant 0$) to satisfy $\sum y_j^0=E[\sum p^0(s)z_j^0(s)+p(s)^0b(s)]$, where $z_j^0(s)$ is the optimal value of $z_j(s)$.

According to the assumptions the determination of y^0 is an aggregated problem and the centre $j=0$ has the necessary information to solve this problem with the help of the model R.[3]

4. Benassy's stochastic mechanism

Below the economic mechanism will be described on the example of programs (4) of the agents $j=1,\ldots,n$ in a game form where the stochastic outcome functions satisfy Benassy's conditions [1]. This game leads the Nash equilibrium to Walrasian, or optimal outcomes where coordination is combined (prices and quantities).[4]

In this game the agent $j=1,\ldots,n$ sends future price and quantity (net-trade) messages to $i=1,\ldots,m$ markets. Let $\hat{p}_j(s)$ and $\hat{z}_j(s)$ be the vectors of agent's j price and quantity messages, $(\hat{p}_j(s),\hat{z}_j(s))$. We define $\hat{p}(s)=(\hat{p}_j(s))$, $j=1,\ldots,n$, and $\hat{z}(s)=(\hat{z}_j(s))$, $j=1,\ldots,n$.

The contracts of exchange $z_{ij}(s)$ and prices $p_{ij}(s)$ actually achieved by the agent j in the market i are described by the strategic outcome functions:

$$z_{ij}(s)=M_{ij}(\hat{p}(s),\,\hat{z}(s)),\qquad z_j(s)\in J(B_j), \tag{5a}$$

$$p_{ij}(s)=N_{ij}(\hat{p}(s),\,\hat{z}(s)),\qquad p_i(s)\in J(B_i). \tag{5b}$$

We shall assume that these functions satisfy Benassy's assumptions for every s, and we call this game Bayes-Benassy game. First, we assume voluntary exchange. This means that an agent can in no event be forced to make more contracts than he has planned in his quantity message and trade at prices less favourable than the ones he has quoted. Secondly, a frictionless market mechanism is assumed, i. e. agents do not miss opportunities for contracts. The third assumption is that of price priority, which says that in the market the demanders will give prefe-

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[3] Using the indirect utility functions, we can state an alternative rule for the optimal lump-sum transfer y_j^0 as follows. Let $v_j(y_j,s)=\max\{u_j(x_j(s),s)\,|$ subject to (4b) and (4c)$\}$ and $V(y,s)=\sum v_j(y_j,s)$, where $y=(y_j)$, $j=1,\ldots,n$.

Then optimal y^0 maximizes $EV(y,s)$ subject to the constraint $\sum y_j=E[\sum p^0(s)z_j^0(s)+p^0(s)b(s)]$.

[4] Note that in (4) we assume each j to have joint information s. This assumption will be renounced in the next section.

rence to the suppliers announcing the lowest prices, and conversely (this assumption automatically means that the mechanism is competitive). A consequence of this assumption is that suppliers who quote higher prices will get rationed contracts, and conversely, demanders who quote lower prices will be rationed.

Under these assumptions it was demonstrated by Benassy [1] that the deterministic Nash equilibrium of the game is also the Walrasian equilibrium or an optimal solution. So, in our case everybody announcing Walrasian prices and quantities for every event will also get Walrasian outcomes for that event. And no agent can improve his situation by changing his strategy while the other agents maintain their Walrasian strategies. Here we assume also that the maintaining of Walrasian strategy is the undominated strategy. With that assumption added to Bayes-Nash solution we avoid the problem of multiplicity of equilibria. Thus agents participate in the price and quantity setting in this market mechanism, and they are interested in setting optimal prices and quantities.

Clearly, there is no failure of incentive-compatibility in this mechanism, and it is easy to see that this is due to competition. Consequently, in this mechanism competition is a sufficient condition for truth-telling.

5. Strategic announcement problems

Now we should be interested in two informational questions connected with the formulated Benassy's mechanism. The first is about private information and joint information probability triples. The other is about the prediction of optimal prices by the agents and the necessary communication (announcement game) for that.

The first problem is actually an assumptional pseudoproblem. Namely, the agents' $j=1, \ldots, n$ problems (4) contain joint state variables s, but agent j observes only i_j and he is only able to determine s_j. The coming in of s instead of s_j (except prices) started from the formulation of initial model (1) and was used just for notational simplifications. Here we assume that the agent's private information plus the given lump-sum transfers are sufficient to formulate model (4)" except prices.

The second problem concerns prices. Here it is reasonable to make two natural assumptions. First, let us assume that initially each agent j has some non-public information about the prices in the form of priors. Secondly, if this non-public information is revealed to other agents, the priors of the other agents will change.

An agent having the opportunity to change the priors of the other agents would behave in a strategic way by revealing his information. So it is reasonable to add some subgame to a given Bayes-Benassy game. We call it according to Okuno-Fujiwara et al. [2] a first stage announcement game. Under these assumptions we can determine the equilibrium revelation of information according to [2], and consider our model as an example where revelation occurs and the sufficient condition for revelation is that the subgame equilibrium payoff is positive-monotone in beliefs [2].

Agents' probability beliefs about prices are modelled in the standard way of assigning a different prior to each agent (asymmetric information). Agents are allowed to announce their priors to the others simultaneously, and after that revise their priors according to the Bayes rule. With these revised beliefs the second stage Bayes-Benassy subgame is played. According to [2] we associate the unique equilibrium payoff of the Bayes-Benassy game to each set of beliefs. In this way the first-stage announcement game is an asymmetric information game as well.

6. Model of the two-stage game

The game is played in two consecutive stages. In stage 1 the announcement or information exchange takes place, and in stage 2 the Bayes-Benassy game is played with the information that results from stage 1.

At the beginning of stage 1 each agent j is informed of the equilibrium price of a certain commodity j. The other agents are less informed about this price. Their probability distribution of price j is q_j and it is assumed to be common knowledge.

We shall now make and comment on a natural set of assumptions which are a complement to Benassy's assumptions for a competitive mechanism [1] and which will lead to complete revelation of the relevant information. These assumptions are about the precision of announcements and precision priority.

In the setting like Benassy's where agents act as price setters, it is reasonable to assume that the suppliers have more precise information about equilibrium values than the demanders, and so they are able to make more precise and truthful announcements about the commodities they are selling. We also assume that the suppliers are able to make more precise and truthful announcements if their beliefs about their suppliers' announcements are more precise.

Here we should note that an immediate consequence of these precision assumptions is that the iterative exchange of information between suppliers and demanders will lead to making the announcements more precise (in the case the agents are interested in it).

Our main assumption of precision priority says that the demanders will address themselves preferably to suppliers (*ceteris paribus*) about whom their beliefs are more precise. The first consequence of this assumption is that demanders will address these suppliers who make more precise announcements and whose announcements are considered truthful. The second consequence is that the announced quantities of the seller j who quotes more precisely and truthfully[5] than another seller k will not be rationed.

The mathematical expression of these assumptions is not complicated, the only important thing to note is the discontinuity connected with rationing and the problem of considering the truthfulness of the announcements. In [2] the last problem is solved with the help of an exogenously given set of certifiable reports.

After the information exchange in the first stage, the agents have a revised belief about the price q'_j, this revised belief is common to all agents (this means that all other agents interprete the statement by j in the same way).

At the second stage the Bayes-Benassy game is played by the agent j with his beliefs about the prices q'_{-j} of all the other agents. His expected payoff (4a) is consequently conditional upon the belief profile q': $E[U_j(x_j(s_j), s_j, y_j) \mid q']$.

The second-stage subgame equilibrium is said to be positive-monotone in beliefs [2] if for any belief profile q' which stochastically dominates q'' for each j: $E[U_j(x_j(s_j), s_j, y_j) \mid q'] \geqslant E[U_j(x_j(s_j), s_j, y_j) \mid q'']$.

If the subgame equilibrium payoff is positive-monotone in beliefs, then the only sequential equilibrium of the two-stage game is complete revelation. Consequently, this is the sufficient condition for truth-telling.

Now it is easy to see that this sufficient condition is met in the Bayes-Benassy game. Indeed, the Walrasian strategy was the undominated strategy and this can be determined only on the basis of complete revelation.

[5] The definition of the inference function in which only a truthful report is certifiable is found in [2].

7. Conclusion

We have provided an example of a market-like implementation where asymmetric information is fully revealed in a sequential equilibrium. In this competitive market environment the information sharing solves two nontrivial problems. First, the agents' initial beliefs about the strategies of the others may not be correct and in this case they may end the game with disequilibrium. Secondly, agents may select an inefficient equilibrium (payoff-dominated) with many equilibria. In this example the announcement programme based on repeated announcements allows the agents to avoid these dangers.

The sufficient condition for revelation in this competitive environment is quite natural: the priority of the precision of announcements. But to achieve competition, we had to introduce regulation, although in a very simple form of lump-sum transfers.

It is not in all economic examples that competitiveness is natural and this upsets the conclusions that asymmetric information will be revealed as easily as in our example. Important applications are contract or bargaining two-agent models [9] and also conglomerate models [8]. In these cases there may still exist implementing mechanisms, but the necessary and sufficient conditions for these mechanisms and the necessary regulatory policy may be quite complicated [12—15]. A robust implementing mechanism which is efficient in complicated economic environment (competition and noncompetitive agents) has to combine elements of different implementation theories.

A central problem in the design of an economic mechanism is to develop procedures that are effective and natural or market-like. As Forges [16] puts it: "Such a trading game becomes interesting (and natural) once the players can talk together before making decisions. . ." Here we have shown under which particular conditions this natural game can accomplish implementation.

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Ülo ENNUSTE

TURUTAOLINE RAKENDUSNÄIDE

Artiklis on selgitatud sotsiaalset optimumi rakendavate reguleeritavate turumehhanismide lähte-eeldusi ja omadusi ebasümmeetrilise vaegteabe abstraktses segamajanduses.
Sotsiaalse optimumi kirjeldamine toimub stohhastilise matemaatilise programmeerimise mudeli abil. Selles segamajanduse mudelis kuulub osa ressursse keskusele (sotsiaalne omand) ja osa tegutsejatele (eraomand). Mudel on püstitatud mittetäieliku ühisinformatsiooni alusel, kusjuures viimane on saadud kõigi tegutsejate mittetäielike asümmeetriliste informatsioonide ühendamisel. Veel on eeldatud, et keskusel on majanduse kohta tarvilik agregeeritud informatsioon.
Mudel dekomponeeritakse esmalt keskuse agregeeritud ülesandeks ja edasi tegutsejate ülesanneteks. Keskuse ülesanne määrab optimaalse tulude ümberjaotuse tegutsejate vahel (tsentraalne reguleerimine). Nimetatud ümberjaotuse alusel on saadud tegutsejate mudelite eelarvekitsendused. Lõpptulemuseks on tegutsejate reguleeritud stohhastiline Walrasi majandus.
Viimase lahendamiseks on kasutatud teatavate eeldustega mittetäieliku sümmeetrilise informatsiooniga mittekooperatiivset mängu ehk Benassy (1986) konkurentse turumehhanismi Bayesi modifikatsiooni. Osutub, et selles mehhanismis tegutsejate optimaalseks strateegiaks on Walrasi tasakaalu stohhastiliste tehingute teadustamine (tõeräākimine). Selle strateegia optimaalsuse tarvilikuks tingimuseks on konkurentsi olemasolu. Seejuures on näidatud, et optimaalsete strateegiate väljatöötamiseks piisab tegutsejatel üldiselt isiklikust informatsioonist ja Walrasi hindade teadmisest. Viimaste täpsustamiseks on lisatud põhimehhanismile nn. teadustamise alamehhanism. On esitatud tingimused, mille puhul õige teadustamine on kasulik ja kogu mehhanism töötab efektiivselt.

Юло ЭННУСТЕ

ПРИМЕР ЭФФЕКТИВНОГО СТОХАСТИЧЕСКОГО МЕХАНИЗМА

В статье проанализированы проблемы эффективного стохастического механизма для абстрактной оптимизационной экономики. Механизм охватывает два периода (информационный и основной), а также комбинированную координацию (цены и лимиты). Обсуждаются основные необходимые предпосылки для эффективной работы механизма.