

political economy *Studies in the Surplus Approach*

volume 5, number 1, 1989

- 3 **Kumaraswamy Velupillai**, The Existence of the Standard System: Sraffa's Constructive Proof
- 13 **Fabio Ravagnani**, On Conflicting Expectations in Temporary Equilibrium Models
- 37 **Vladimir Brailovsky**, The Macroeconomic Implications of Paying: Policy Responses to the Debt 'Crisis' in Mexico, 1982-88
- 59 **Massimo Egidi** and **Giorgio Gilibert**, The Objective Theory of Prices
- 75 **Renzo Bianchi**, On the Object and Method of Analysis: the General X-Efficiency Theory

On Conflicting Expectations in Temporary Equilibrium Models

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In recent years the hypotheses on agents' expectations that ensure the existence of a temporary equilibrium in pure exchange economies have been investigated and thoroughly defined.¹ This essay is an attempt to point out some difficulties that the consideration of subjective expectations may induce in the more general case of economies with production. In particular, we try to show how in a temporary equilibrium framework the divergency of agents' expectations may prevent an acceptable representation of the interplay between "firms" and "households" on the saving-investment market so that a satisfactory definition of the state of equilibrium becomes itself problematic. The argument is developed with reference to the most representative models in the literature, which share the assumption that the plans of production are selected by the managers of the firms according to their own expectations of future prices. In the concluding remarks, we point out that this assumption loses most of its plausibility when the behaviour of savers is properly taken into account.

I. INTRODUCTORY NOTES: COMPLETE FORWARD MARKETS AND THE INTERPLAY BETWEEN HOUSEHOLDS AND FIRMS IN THE MODEL OF DEBREU (1959)

In the intertemporal model of Debreu² agents are subdivided into two categories which correspond to the two main kinds of decision that are

* I wish to thank P. Garegnani, V. Guidi, F. Hahn, G. Harcourt, M. Lippi and P. Tani for encouragement and expert advice; my friends S. Burnell, G. Ciccarone and D. Terlizzese for useful and pleasant discussions in Cambridge; R. Ciccone and two anonymous referees of this Journal for valuable comments on an earlier draft of the essay. Remaining mistakes and confusion are mine alone. Financial support by Istituto Bancario S. Paolo di Torino and by Ente L. Einaudi of Rome is gratefully acknowledged.

¹ For an overall discussion see J. M. GRANDMONT, "Temporary general equilibrium theory", in K. ARROW and M. INTRILIGATOR (eds.), *Handbook of Mathematical Economics*, vol. II, Amsterdam-Oxford, North Holland, 1982.

² G. DEBREU, *Theory of Value*, New York, Wiley, 1959.

to be taken in an economic system: namely, the author refers to a given group of "consumers" and to a given group of "producers"; in what follows, however, we prefer to name these groups "households" and "firms" respectively.

Households own the resources and the ownership of the existing firms is subdivided among them in the form of holdings of "shares". Each household capitalizes present and future incomes at the initial date and distributes the expenditure of its wealth over goods to be delivered at different dates in order to attain an utility-maximizing stream of consumption. Firms, on the other hand, select the intertemporal plans of production in such a way as to maximize the stream of profits; they finance the chosen plans by exchanging contracts for the future delivery of outputs against contracts for the current and future delivery of the required inputs.

Let us focus on the interrelation between decisions on production and decisions on consumption. The wealth of households partially depends — via the shares of profits — on the choices made in the productive sector. It is reasonable to suppose that households are interested in the first place in the maximization of their wealth and then in the selection of the plans of consumption that yield the highest utility; thus one may wonder why the theory entirely attributes the choice of production plans to an independent group of agents, the firms. The answer is simple: the prices of current and future commodities are quoted on the existing markets and therefore each household would certainly approve projects that are objectively associated with the highest possible amount of profits. In other words, it is the unanimous evaluation of profits entailed by the structure of markets that ensures the absence of conflicts between utility-maximizing households and profit-maximizing firms.³

We can now understand the consequences of the abandonment of Debreu's assumption on the structure of markets. If complete forward markets do not exist, the managers of the firms are no longer able to exchange future outputs against current and future inputs: the financing of production plans must accordingly be reformulated, for instance by assuming that firms borrow on a capital market. On the other hand, if we assume with Debreu that the storage of goods is to be included among *productive* activities,⁴ then, in the absence of forward markets, households must save by holding some kind of financial asset. Finally, and more importantly, future prices will be *guessed at* by agents, that is, agents' expectations will have to be taken into account. An immediate consequence is that, in general, the expected intertemporal profits will not be unanimously evaluated in the economy; thus, if one maintains the assumption that

³ A more detailed formulation of this line of reasoning can be found in J. HIRSCHLEIFER, *Investment, Interest and Capital*, Englewood Cliffs, Prentice Hall, 1970, pp. 59-64.

⁴ G. DEBREU, *op. cit.*, p. 51.

production plans are independently selected by the managers of the firms, conflicts may arise between managers and households on the saving-investment market. In the following sections we try to show that the occurrence of those conflicts has been underestimated by the main temporary equilibrium models and that this fact reduces the plausibility of their description of the saving-investment market.

2. SUBJECTIVE EXPECTATIONS, DECISIONS ON SAVING AND DECISIONS ON PRODUCTION IN ARROW AND HAHN'S TEMPORARY EQUILIBRIUM MODEL

(a) A simple recapitulation of the model.

We begin our argument with a concise sketch of the economy depicted in the temporary equilibrium model of Arrow and Hahn (henceforth AH).⁵

The authors analyze a system in which economic activity extends over two periods of time: period 1 (the "present") and period 2 (the "future"). Supposing that time is measured in "years", we can regard period 1 as the current year and aggregate in period 2 the years that go from the end of the current year to the moment when economic activity comes to an end. Here we interpret AH's model as describing an economic system in which the productive processes activated in period 1 take place in cycles;⁶ we can suppose that these cycles last one year. This implies that the outputs deriving from current productive activity will be ready for delivery only at the beginning of period 2 and that, as far as future production is concerned, the employment of inputs and the availability of the corresponding outputs will necessarily take place within period 2.⁷

Due to the cyclical nature of production, at the beginning of period 1 the economy is endowed with given stocks of goods including "labour", natural resources and commodities stemming from previous production;

⁵ K. ARROW and F. HAHN, *General Competitive Analysis*, San Francisco, Holden Day, 1971, pp. 136-151.

⁶ This interpretation can be justified on the following grounds. In the first place, all the assumptions made by AH about the firms' production sets appear to be compatible with it and acquire a precise meaning. In particular Ass. 7(a) (p. 139), which states that in period 1 the productive sector cannot supply positive amounts of goods without employing inputs, in the presence of production in cycles formalizes the hypothesis that the initial endowments of goods are in the hands of households: otherwise firms could supply the goods produced *in the past*. Furthermore, Ass. 6 (p. 138) in its final part includes the possibility that in period 2 a generic firm may supply positive amounts of goods without employing inputs and this only makes sense in the presence of cyclical production.

⁷ An unsatisfactory consequence of the division into two periods is that the outputs available in period 2 derive from the processes activated in period 1 and from those activated in period 2. Our criticism of the model, however, would still hold if it were assumed that no production takes place in period 2 or if a third period with no production were introduced.

we can suppose that those endowments are entirely in the hands of households.⁸ Also the ownership of firms is entirely subdivided among households. Each household is in fact endowed, at the beginning of period 1, with a non-negative amount of "ownership shares" in each firm. As it will be clear later on, the holding of "ownership shares", whose initial allocation is given, is a claim to a corresponding fraction of the profits of enterprise realized by the productive sector.

In period 1 only spot markets for commodities exist. However, the authors assume that both firms and households can freely trade on a market for bonds; the unit bond is defined as a "promise to pay one unit of the currency of account in the next period".⁹ The existence of a market for bonds allows agents to borrow against anticipated future receipts; in particular, it allows firms to borrow in order to finance the current purchases of inputs. Moreover, the bond market performs a less evident function in the model: that of trying to rule out difficulties in the interaction between firms and households that may arise because of the subjective nature of expectations. This function will be discussed in the comment on the model.

Since no forward market for commodities exists, agents take their choices, at the beginning of period 1, in accordance with their expectations of future prices. Expectations are individual and therefore, in general, they are not uniform among agents. Furthermore, AH assume expectations to be "subjectively certain"; in other words, each agent, having observed the current prices, expects a definite price system to rule in period 2 "with probability 1".

Let us consider now the relevant features of the formation of the plans of consumption and of production described by the authors.

At the beginning of period 1 each firm must select a plan of production, specifying the inputs to be employed in period 1, the corresponding outputs ready for delivery at the beginning of the subsequent period and the processes to operate in period 2. AH suppose that in each firm the manager observes the current prices for commodities and bonds and on that basis forms his expectations of future prices; then he selects a plan that maximizes the discounted value of intertemporal profits¹⁰ evaluated according to his expectations. Furthermore, AH assume that each firm issues bonds in period 1 for an amount equal to the value of its expected future receipts. For precision's sake, suppose that in the economy a number F of firms are active, ordered by an index $f = 1, \dots, F$; denote by $y_{f\beta}$ the number of bonds issued by the generic firm f , by y_f^2 the vector of net outputs planned by that firm for period 2 and by p_f^2 the vector of prices expected by its manager. Then

⁸ See the reference to Ass. 7(a) of AH in footnote 6 above.

⁹ K. ARROW and F. HAHN, *op. cit.*, p. 136.

¹⁰ Profits are discounted at the rate of interest ruling on the market for bonds.

AH's assumption on the supply of bonds by firms can be formally expressed as follows:

Assumption 1: the supply of bonds by firm f ($f = 1, \dots, F$) is

$$y_{fb} = p_b^2 y_f^2. \quad (1)$$

Ass. 1 implies that, in equilibrium, the generic firm currently realizes the whole discounted value of the profits expected by its manager; AH assume that those profits are entirely distributed in period 1 to the households which acquire (or confirm) the ownership of firm f at the beginning of the period. Note that the value of the bonds issued in conformity with equation (1) may well be greater than the cost of planned inputs; Ass. 1 is formulated in this way in order to provide a representation of the intertemporal production plans on current markets.

We turn now to the behaviour of households. Each household observes period 1 prices and derives from them its "subjectively certain" expectations of future prices. Given its preferences and endowments, its expectations and the current prices, at the beginning of period 1 each household chooses a plan of present and future consumption which maximizes its utility within period 1 and period 2 budget constraints. However, the existence of a market for bonds and of a market for "ownership shares" allows the transfer of purchasing power from one period to the other. For this reason, the decisions on future consumption will in general determine decisions on saving in the present that manifest themselves in the form of demands for bonds and for "shares".¹¹ In order to analyze the formation of the plans of consumption and of saving in period 1 we need therefore to account for AH's description of financial markets.

Let us start with the market for "shares". At the beginning of period 1 firms announce their plans of production and each household values those plans according to its private expectations of future prices. Formally we have:

Definition 1: the capital value of firm f ($f = 1, \dots, F$)
according to household h ($h = 1, \dots, H$)
is

$$K_{hf} = p^1 y_f^1 + p_b (p_b^2 y_f^2) \quad (2)$$

where H denotes the number of existing households, p^1 is the vector of current prices for commodities, p_b is the unit price for bonds, p_b^2 is the vector of the future prices expected by household h , y_f^1 is the vector of the inputs planned by firm f for period 1 (inputs are denoted by negative

¹¹ The restriction to two periods rules out the possibility of speculative purchases of assets. On the problems that speculation may induce in temporary equilibrium models, see e.g. C. BLISS, *Capital Theory and the Distribution of Income*, Amsterdam-Oxford, North Holland, 1975, pp. 332-334 and 340-341.

numbers) and y_f^2 is the vector of net outputs planned for period 2. Note that the term $p_b(p_b^2 y_f^2)$ in the right-hand side of (2) denotes the present value of firm f 's future net receipts *as forecasted by household b* .

The authors then assume that the market value of each firm is equal to the highest evaluation of its plan made among all households in the economy:

Assumption 2: the market value of firm f ($f = 1, \dots, F$) is

$$K_f = \max_b K_{bf}, \quad b = 1, \dots, H. \quad (3)$$

Ass. 2 implies that the ownership of each firm shifts in period 1 to the household (or group of households) which values the firm most highly, at a price exactly equal to that evaluation.

Further, AH assume that for each firm there is always one household that values the announced plan at least as highly as the firm itself:

Assumption 3:
$$K_f \geq p^1 y_f^1 + p_b(p_b^2 y_f^2), \quad f = 1, \dots, F \quad (4)$$

where the vector p_f^2 denotes the future prices expected by firm f , so that the term $p_b(p_b^2 y_f^2)$ in the right-hand side of (4) denotes in turn the present value of the net receipts that *firm f* expects for period 2. Ass. 3 is justified on the grounds that "the firm's manager is presumably himself the head of a household".¹²

An example can make the features of AH's market for "ownership shares" clearer. Suppose for simplicity that in the economy a single firm and two households, which we distinguish as household A and household B , operate. Suppose that the rate of interest implicit in the price of bonds is 10%, that the firm plans a current expenditure for inputs of 500 units of account and finally that the plan of production and expectations are such as to originate the following table:

	<i>Cost of period 1 inputs</i>	<i>Expected net receipts</i>	<i>Discounted expected profits</i>
FIRM	500	1100	500
Household A	500	1320	700
Household B	500	440	-100

Suppose now that all the firm's "shares" are initially held by household B . The latter expects losses from the announced plan and therefore would happily sell the "shares". According to AH's assumptions, the ownership of the firm will be purchased by household A at a price of 700 units of

¹² K. ARROW and F. HAHN, *op. cit.*, p. 142.

account.¹³ On the other hand, since the firm distributes entirely in period 1 the profits it expects, household *A* will currently receive 500 units of account: the net expenditure for “shares” by household *A* will therefore be 200 units of account. Household *A* expects future net receipts to the amount of 1320 units of account from the production plan and will have to repay the sum borrowed by the firm,¹⁴ plus a 10% interest, for a total amount of 1100 units of account. We can thus conclude that household *A*, when purchasing the “shares”, reckons to exchange 200 units of account in period 1 against 220 units in period 2: from its point of view, this is equivalent to a current purchase of *bonds* for 200 units of account. It is also clear that the mainspring of the trading of “shares” lies in the balance between the profits expected by each household and the profits expected by the firm: in our example, the exchange is originated by the positive value of that balance in the opinion of household *A* and by the corresponding negative value for household *B*.

We now move to the market for bonds. The supply of bonds by firms was already defined by Ass. 1; AH make the further assumption that each household issues in period 1 an amount of bonds equal to the net revenues it expects for period 2¹⁵ (“net” here means that the repayment of the bonds issued by firms is taken into account). Denoting by d_{bf} , a number between 0 and 1, the “ownership share” of firm *f* held by household *b* at the beginning of period 2 and by $p_b^2 \bar{x}_b^2$ the value that household *b* anticipates for its future endowments, we formally have:

Assumption 4: each household *b* ($b = 1, \dots, H$) supplies in period 1 an amount of bonds \bar{x}_{bb} equal to its anticipated net revenues for period 2; hence

$$\bar{x}_{bb} = p_b^2 \bar{x}_b^2 + \sum_f d_{bf} (p_b^2 y_f^2 - p_f^2 y_f^2). \quad (5)$$

Ass. 4 states that in equilibrium each household currently receives the whole amount of the wealth it expects over the two periods. Under this aspect, therefore, households are in the same initial position as they would be in an economy with complete forward markets. It is also important to realize that Ass. 4 makes feasible the purchase of “shares” according to Ass. 2 of p. 18.

AH finally define the households’ objective in period 1. As already mentioned, the existence of financial markets implies that the decisions on future consumption manifest themselves in the form of a current demand for assets. AH show that the maximization of utility under period 1 and

¹³ Due to Ass. 2 of p. 18.

¹⁴ According to Ass. 1 of p. 17.

¹⁵ Paying a tribute to formalism Arrow and Hahn call the bonds supplied by households “endowments of bonds” (*op. cit.*, p. 141).

period 2 budget constraints is equivalent to the maximization of a "derived utility function", defined on an appropriate set of consumer goods and bonds, subject to the first period budget constraint.¹⁶

As an implication of the above assumptions, the intertemporal choices by households and firms are reduced to the maximization of functions entirely defined on current markets. The authors can then prove the existence of a temporary equilibrium by means of a procedure similar to that adopted for an economy with complete forward markets.¹⁷ We propose now to discuss the economic significance of that equilibrium.

(b) A critical comment on the model.

From the above exposition it should be clear that AH's model treats the decisions on production and investment¹⁸ and the decisions on saving as the result of the maximizing behaviour of two independent groups of agents. Within the interpretation of the model followed so far, the proof of existence shows how the decisions on saving by households can sustain, via the market for bonds, the financial requirements of the plans selected by managers according to their own expectations. However, the description of the interplay between households and firms provided by AH does not seem satisfactory. In order to understand this weak point of AH's contribution it is convenient to reconsider the functioning of financial markets.

At the beginning of period 1 each manager announces a plan which maximizes profits according to his own expectations of future prices. However, in the context of our interpretation of the model, each announced plan will actually be carried out only if two conditions are simultaneously satisfied:

- a) each firm must succeed in selling the whole amount of bonds issued according to Ass. 1;

¹⁶ *Ibid.*, pp. 144-146.

¹⁷ While a price equal to zero for some goods is compatible with the state of equilibrium, the structure of the model requires that the bond market clears at a positive price. This requirement is fulfilled because bonds are "always desired" in period 1 for the purpose of future consumption (*ibid.*, p. 145). Such a property of bonds in turn relies on the assumptions that households are never satiated with the future consumption of goods, whatever the level of present consumption may be (*ibid.*, p. 141, last part of Ass. 8) and that no household forecasts future prices equal to zero for all consumer goods (as is implicit in Ass. 10 of p. 144).

¹⁸ It might be thought that the capital goods available at the beginning of period 1 are simply "rented" by households to the productive sector, so that the latter does not take investment decisions. If that were the case, however, capital goods would provide an additional means of saving and it would then be natural to consider exchanges of those goods among households favoured by the divergency of expectations. Since AH attribute to households only demands for goods that have a direct utility, i.e. consumer goods, the demand by the productive sector must necessarily be directed to capital goods and not just to their services.

b) for each firm, there must be at least one household which is willing to hold the corresponding "shares" from period 1 to period 2 and which therefore takes the responsibility for the bonds issued by the firm.

Let us have a closer look at the mechanism that ensure the fulfilment of condition b). A problem seems to be introduced here by agents' expectations. Since expectations are subjective, it may well happen that the plan announced by the generic firm f is considered a source of losses by the firm's initial owners, that is, by the households which hold "shares" in that firm when the markets open in period 1. Since by assumption the initial owners cannot modify the manager's choices, they will try to sell those "shares" on the market. How can one be sure that they will succeed? The answer is simple. On the one hand, Ass. 3 (p. 18) ensures that there will always be a household with expectations at least as optimistic as those of the manager of firm f and prepared to buy the "shares". Ass. 4 (p. 19), on the other hand, implies that in equilibrium the optimistic household will manage to borrow a sufficient amount to carry out the purchase. Taken together, therefore, the two assumptions imply that when the market for "shares" closes in period 1 each firm is owned by households that regard their holdings of "shares" as an optimal means of saving, given their expectations and the plans announced.¹⁹ Thus Assumptions 3 and 4 ensure that condition b) will be fulfilled in equilibrium. However, since the evaluation of production plans is subjective, the amount of bonds that a generic household must issue in order to buy "shares" according to AH's rules may be extremely large.²⁰ Thus AH are really assuming that each household can borrow on the bond market whatever amount it thinks it can repay in the future;²¹ in other words, the model ultimately relies on the existence of a perfect market for capital.

The assumption of the existence of a perfect capital market in a temporary equilibrium framework has been criticized in the literature for its lack of realism.²² A further objection has been raised by Bliss. He claimed that in a temporary equilibrium analysis the bonds issued by different firms and households cannot be assumed to be homogeneous goods since the subjective riskiness that agents attach to them depends on their own

¹⁹ This implies that, even if managers select the plans without taking into account the expectations of the initial owners of the firms, still they serve the interest of those households which come to own the firms *during* period 1.

²⁰ Think for instance of a situation in which a single household expects an amount of future receipts from the plan of a given firm much higher than that expected by the manager of the firm.

²¹ The same faculty is attributed to firms by Ass. 1 of p. 17.

²² See e.g. M. KING, *Public Policy and the Corporation*, London, Chapman and Hall, 1977, pp. 89-90; C. BLISS, "Capital theory in the short run", in M. BROWN, K. SATO and P. ZAREMBKA (eds.), *Essays in Modern Capital Theory*, Amsterdam-Oxford, North Holland, 1976, p. 196.

expectations and therefore may not be uniform.²³ The serious limitation to Bliss' objection is that he does not clarify at all how savers can form opinions about the riskiness of the bonds supplied on the capital market. This seems far from obvious: in the AH model, for instance, a potential saver has no means of evaluating either the future wealth of the owners of "shares" (who are responsible for the repayment of the bonds issued by firms) or the future wealth of the households who intend to borrow. However, we will show how an argument similar to that sketched by Bliss can be rigorously set up to criticize the representation of the capital market provided by AH.

For this purpose, suppose that the generic firm f announces a plan and each household, except that of firm f 's manager, anticipates that the future receipts obtainable from the plan will not be sufficient to repay the cost of current inputs. Suppose also that all households expect positive profits from the other plans announced. In these conditions the plan of firm f , and only that plan, will be regarded as a source of losses by all potential savers in the economy with the exception of the manager of firm f . The latter agent, accordingly, will become the only owner of firm f in period 1. In order to carry out the purchase of firm f 's "shares", the manager will have to pay a price equal to the discounted value of the intertemporal profits he expects from the announced plan; on the other hand, he will simultaneously receive the same amount since all firms raise the discounted net receipts they expect for period 2 on the bond market and distribute the discounted expected profits to their owners. Let us now ask: is it plausible to suppose that the very savers who refused to hold "shares" in firm f for the fear of financial losses will be willing to purchase *the bonds* supplied by firm f on a market such as that described by AH?

We are therefore moving towards the consideration of the fulfilment of condition *a*) of p. 20. AH seem to confront us here with an unsatisfactory representation of the behaviour of savers. The households that regard firm f 's plan as a source of losses must hold for sure that firm f will not be able to repay directly the debt contracted on the bond market. Furthermore, at the moment of taking their decisions, those households are not aware of who the owners of firm f will be at the beginning of period 2 and could not evaluate their future wealth anyway: therefore they have no guarantee that the wealth of the future owners will be sufficient to repay the debt. On the other hand, under our assumptions all households hold for sure that each firm other than firm f will be able to repay the bonds supplied. In this situation the existence of a perfect market for bonds appears scarcely

²³ C. BLISS, *Capital Theory, op. cit.*, p. 326; "Consistent temporary equilibrium", in J. P. FITOUSSI (ed.), *Modern Macroeconomic Theory*, Oxford, Basil Blackwell, 1983, p. 142. The most explicit formulation of Bliss' objection is however in C. BLISS and R. CIPPÀ, "Temporary Equilibrium with Rationed Borrowing", in M. BARANZINI (ed.), *Advances in Economic Theory*, Oxford, Basil Blackwell, 1982, p. 55: in the text we refer to this formulation.

tenable. Since the valuation of production plans would signal to all households²⁴ the coexistence in the total supply of "risky" bonds and bonds whose repayment is beyond doubt, the potential savers could not consider the bonds supplied to be perfect substitutes and so ought not be willing to purchase bonds on a market such as that depicted by AH, in which they appear as undifferentiated assets. In order to describe savers who use all the information provided by the observation of markets, therefore, the model should allow different degrees of riskiness to be attached to the bonds of different firms.²⁵ This could be done by introducing a separate market for the bonds issued by each firm: the authors themselves, however, point out that then the capital markets could not be assumed to be perfect.²⁶

An objection could be raised against the above criticism. Suppose that the model is so reformulated that firms are not allowed to issue bonds and the financing of production plans relies on those households who agree to hold "shares" in firms. In these conditions households will in general have to issue bonds against future receipts; however, since they would be the only actors on the bond market, one may think that the difficulty pointed out before would disappear: how could a household form the opinion that some bonds are "risky"?

We show now that this rearrangement would not eliminate the problem. Suppose for instance that the plan announced by a generic firm f involves the production of a single commodity in the present and in the future and a positive current expenditure for inputs. Suppose also that each household, with the exception of that of firm f 's manager, anticipates a future price equal to zero for the single good produced by firm f and finally that all households expect positive profits from the other plans of production announced. Let us now focus on the initial owners of firm f . At the opening of the market for "shares" in period 1, each initial owner will sell its "shares" in firm f and will accordingly become aware that whoever is buying the "shares" has more optimistic expectations of firm f 's future receipts. Moreover, each initial owner knows that whoever is buying the "shares" must pay a total price equal to the discounted value of the expected profits from firm f and must pay for the current inputs required by the plan. The initial owners cannot exclude the possibility that those expenditures are financed by issuing bonds; furthermore, they hold for sure that the future receipts of firm f would not allow the repayment of those bonds and are

²⁴ With the exception of the household of firm f 's new owner.

²⁵ Thus AH seem to be wrong when they write: "... we are neglecting [subjective] uncertainty. This is a more serious problem than we might think, for in the presence of uncertainty it is unreasonable to assume that bonds of different firms... are perfect substitutes" (R. ARROW and F. HAHN, *op. cit.*, p. 151). The divergence of individual expectations, even if the latter are subjectively certain, seems in fact sufficient to bring about the serious problem mentioned by the authors.

²⁶ "... if a given firm is the only supplier of a commodity (its bonds) for which there are no perfect substitutes, the capital markets cannot be assumed perfect" (*ibid.*, p. 151).

unable to form an opinion about the future wealth of the new owners of the firm. At the same time the bonds supplied in order to purchase the ownership of all the other firms and to implement their plans appear to them to be perfectly safe. The functioning of the market for "shares" would thus signal to the initial owners of firm *f* the possibility that in the total supply of bonds "risky" securities may coexist with safe ones²⁷ and it hardly seems acceptable to suppose that this group of potential savers will be disposed to buy bonds on a market in which the risky securities could not be identified.²⁸ On the other hand, the initial ownership of firm *f* may well be considerably spread among households so that this unsatisfactory aspect of the theory would extend to a relevant fraction of the complex of savers.²⁹ The reader should note that the substance of the previous argument is independent of AH's assumption on the determination of the market values of firms. Suppose Ass. 2 of p. 18 is abandoned. In a situation like the one depicted above, only the manager of firm *f* may be disposed to hold "shares" in that firm: the price of those "shares" may accordingly reach such a low level as to appear negligible. In that case, however, the initial owners of the firm would still know that whoever is buying "shares" in firm *f* might issue bonds to finance the purchase of inputs and those bonds would be regarded as "risky" ones.

The consequences of what is said can be serious. The divergency of subjective expectations suggests in fact the opportunity of re-writing the model in such a way as to allow savers to find out who the agents that intend to borrow are and how they plan to repay the debt. It would then become problematic, however, to retain the assumption that the plans of production are selected by managers according to their own price expectations. To understand why, we can again suppose that the plan of firm *f* is associated with losses by all households except that of firm *f*'s manager and that at the same time everybody expects the other firms' plans to be profitable. Suppose that the market for "shares" assigned the entire ownership of firm *f* to its manager: at that point sufficient funds will have

²⁷ The signal would be the more intense the higher is the price of firms *f*'s "shares".

²⁸ The reader may note that our criticism of Arrow and Hahn's model does not exactly coincide with that sketched by Bliss (see above, p. 12). When the model is so rearranged that only households act on the bond market, savers cannot evaluate the riskiness of the bonds supplied by borrowers. For particular sets of expectations, however, savers would come to perceive that some bonds *might* be riskier than some of the others. This limited perception seems sufficient to prevent them from trading on a capital market such as that considered by Arrow and Hahn.

²⁹ We could also imagine constellations of expectations for which *in a relevant number of firms* the initial owners expect losses from the plans announced by the respective managers and simultaneously positive profits from the projects of the firms in which they hold no "share". Furthermore, because of the peculiar features of the market for "shares", after the announcement of the plan by firm *f* all the potential savers might realize that the manager of that firm will himself compete for the purchase of "shares" so that the ownership of firm *f* will necessarily shift to agents which are at least as optimistic as the manager. The market for "shares" would then signal to *all* households the possibility that risky bonds may be floated in the system.

to be provided in order to finance the plan of production. Suppose now that all households are decidedly risk-averse. The only household prepared to buy firm f 's bonds at a positive price would then be that of the manager himself, since everyone else would prefer the safe bonds issued by the other firms. Thus the financing of firm f 's plan would entirely rely on firm f 's manager, who in general will have to raise capital by issuing bonds in his own name and by making clear how the debt will be repaid. However, if the future wealth of the manager were not considered, in the opinion of savers, sufficient to repay the bonds supplied for financing the current purchase of inputs, those securities would not be subscribed and firm f 's plan would have to be abandoned or revised.

3. AN ATTEMPT TO SOLVE THE PROBLEM OF ARROW AND HAHN'S DESCRIPTION OF THE SAVING-INVESTMENT MARKET: THE "CONSTRAINED TEMPORARY EQUILIBRIUM" OF C. BLISS

In the opinion of Bliss, the hypothesis according to which, in temporary equilibrium analysis, firms "have personalities of their own" and follow their own price expectations, is a correct "specification of where the control of the firm resides".³⁰ On the other hand, he perceived that the existence of a perfect capital market should not be assumed a priori in a context of subjective expectations. For this reason Bliss proposed a "constrained" temporary equilibrium model that tries to develop acceptable conditions under which the obligations of different operators can be regarded as equally safe by lenders;³¹ in this section we examine his contribution.

Bliss deals with a two-period economy with no forward markets for goods, but endowed with a market for bonds in period 1. Expectations are subjective and the firms' managers choose the plans of production that maximize the stream of intertemporal profits evaluated according to their private forecasts of future prices. Again, we can suppose that production takes place in cycles so that the outputs deriving from the productive activity of period 1 are ready for delivery only at the beginning of period 2. The economic system considered by Bliss is therefore essentially the same as that described by Arrow and Hahn. However, there are some differences. The first one, of no particular relevance for the present argument, lies in the assumption that firms distribute profits in the future and not in the present period. The second one is that Bliss does not consider the exchange of "ownership shares" among households; it is interesting to note that in

³⁰ C. BLISS, *Capital theory in the short run*, *op. cit.*, pp. 194-195. See also C. BLISS, *Capital Theory*, *op. cit.*, p. 59.

³¹ The "constrained" temporary equilibrium model was put forward for the first time in C. BLISS, *Capital theory in the short run*, *op. cit.*, pp. 188-201, and subsequently in C. BLISS and R. CIPPA, *op. cit.*, pp. 54-57 and in C. BLISS, *Consistent temporary equilibrium*, *op. cit.*, pp. 147-149.

such conditions the mechanism described in the comment on Arrow and Hahn's model, which may signal to savers the existence of "risky" bonds, cannot operate. However, to assume that the market for "shares" is not active seems rather inadequate in the presence of subjective expectations:³² we will therefore treat this feature of the model as a simplifying assumption. The third and most important difference lies in the description of the bond market: in what follows we will focus on this element of the model to see whether Bliss manages to provide a satisfactory basis for the existence of a perfect capital market.

Bliss' idea is simple. He assumes that the bond market operates on the basis of a system of "reference prices" for commodities to be delivered in period 2, denoted in what follows by the vector p_2 , which is used to check the solvency of the agents who issue bonds (borrow) in period 1. Suppose that the generic household b had selected its optimal consumption plan. Suppose furthermore that the plan includes the future consumption of a bundle of goods x_b^2 and a positive supply of bonds in period 1, so that an amount m_b^2 of units of account has to be repaid in period 2. Finally denote by $D^b(\bar{p}_2)$ household b 's future income evaluated in terms of the reference prices.³³ Bliss assumes that the bond market will credit (and finance) only those plans which satisfy the constraint

$$\bar{p}_2 x_b^2 + m_b^2 \leq D^b(\bar{p}_2). \quad (6)$$

That is, lenders will accept only the bonds issued by the households who have an expected future income (reckoned at the reference prices) sufficient to guarantee in full the repayment of the debt. In the same way Bliss imposes constraints on firms. Suppose that the manager of the generic firm f had selected a plan $y_f^{12} = (y_f^1, y_f^2)$, where again y_f^1 denotes the inputs to be employed in period 1 and y_f^2 the period 2 net outputs. Suppose also that, to enforce the plan, firm f must currently issue an amount of bonds such that m_f^2 units of account have to be repaid in period 2. Bliss assumes that lenders will approve and finance only the plans for which

$$\bar{p}_2 y_f^2 \geq m_f^2 \quad (7)$$

Bliss finally shows that when constraints (6) and (7) are imposed on agents' choices the existence of a temporary equilibrium for the economy can still be proved.³⁴ Such a constrained version of Arrow and Hahn's model, Bliss

³² Such an assumption would imply, in fact, that the firms' owners had decided renounce the only form of reaction open to them after the announcement of plans that they consider unprofitable: the sale of their "shares" on the market.

³³ $D^b(\bar{p}_2)$ denotes the value of household b 's future endowments plus its share of profits from the productive sector.

³⁴ This is because the sets of choices left open to agents, when constraints (6) and (7) are added to the usual budget constraints and technological limitations, are still convex so that the supply and demand correspondances remain upper hemicontinuous and convex-valued.

observes, "offers the possibility of a more reasonable equilibrium in which, at least, agents with absurdly optimistic expectations concerning future prices are constrained not to make their optimism the basis for borrowing that the market would regard as unsound".³⁵

So far we have not explained what the reference prices represent. Bliss offers two interpretations. Initially he proposed that the reference prices should be regarded as the prices expected by a particular agent, named "the Financier", who is "so well endowed that his credit is beyond question, i.e., the subjective probability that he will default on any obligation is zero".³⁶ The Financier would guarantee the repayment of the bonds issued by the agents he considers solvent on the basis of his own expectations; as a consequence all lenders would consider as equally safe any bond rubber-stamped by the Financier. This interpretation, however, is subject to a variety of objections. Bliss himself pointed out that the model cannot incorporate more than one Financier, because the divergency of individual expectations might prevent the definition of a single system of reference prices.³⁷ On the other hand, it has been pointed out that a single Financier would actually be "a kind of perfect monopolist turned a benign dictator", since he dominates the capital market but still leaves some room to managers in the selection of productive plans. In other words, the persistence of competition in the system would be due to the "benevolence" of the powerful Financier.³⁸ Another problem of this interpretation is that the wealth of the Financier would be endogenously determined in the same way as that of any agent. Thus to be sure that a Financier exists with sufficient wealth to guarantee the issues of bonds, one should introduce ad hoc assumptions about the volume of his initial endowments and further assumptions apt to ensure a positive value for those endowments.

The drawbacks mentioned above may explain why Bliss abandoned this interpretation in his more recent writings. "As [the reference price system] plays the role of a set of prices that the market regards as reasonable ones on which to count in borrowing money", he recently wrote, "one would naturally think of it as some kind of average".³⁹ Thus Bliss seems to be thinking of a "market view" about future prices which would operate on the market for bonds. But not even this second interpretation seems immune from objections. Bliss in fact does not explain which process (or set of conceivable processes) may lead from the initial constellation of individual expectations to the formation of a definite system of reference prices. This is not surprising, since a convincing description of such a process does not seem easy in the absence of forces capable of gradually reducing the

³⁵ C. BLISS, *Consistent temporary equilibrium*, *op. cit.*, p. 148.

³⁶ C. BLISS, *Capital theory in the short run*, *op. cit.*, p. 197.

³⁷ *Ibid.*, pp. 199-200.

³⁸ K. SATO, "Discussion", in BROWN-SATO-ZAREMBKA (eds.), *op. cit.*, pp. 203-204.

³⁹ C. BLISS, *Consistent temporary equilibrium*, *op. cit.*, p. 149.

differences between individual forecasts:⁴⁰ for instance, what relative weights should be attached to the various households? On the other hand, without a definite account of the formation of the reference prices, it is not even clear how the difficulties connected with the existence of a perfect market for bonds can be ruled out, since the reference prices coexist with the subjective beliefs of agents. Suppose that a group of households holds for sure that the only output that a firm f intends to produce, say a new kind of wine, will have no value in the future. Suppose also that all the remaining households are more optimistic so that each of them considers the production of a positive amount of that wine to be profitable. Finally suppose that every saver in the economy regards as profitable the plans announced by all the firms other than firm f . In this situation, will the reference price for the new wine be such as to allow its production for a positive amount? And if this is the case, why should the pessimistic group of households behave as if they considered the bonds issued by firm f as safe as those issued by the other firms? Even if the "average view" about the future price of the new wine were more optimistic, the households that expect a future price equal to zero ought still to regard the bonds issued by firm f as "risky" ones and it is not clear why they should be willing to lend on a market in which the risky securities cannot be held apart from the safe ones.

We can therefore conclude that Bliss does not provide a clear basis for the reconciliation of divergent expectations with the existence of a perfect capital market.

4. THE DESCRIPTION OF THE SAVING-INVESTMENT MARKET IN TEMPORARY EQUILIBRIUM MODEL BY D. SONDERMANN

The considerations developed so far lead us to wonder whether there may be an alternative representation of the saving-investment market that does without the assumption of the existence of perfect capital markets. An attempt in this direction has been made D. Sondermann in a temporary equilibrium model of 1974⁴¹ that we will discuss in this section.

Sondermann also assumes that economic activity extends over two periods of time, the "present" and the "future". The object of trade is a fixed number of commodities and two assets: "money" and shares in firms. "Money" is a safe asset yielding no return and is available in the system in a positive amount that does not vary over time. Shares, on the other

⁴⁰ Bliss himself admitted that "... it is somewhat artificial to assume a market view concerning prices, which suggests accord, when in fact the assumption on which the theory is founded is that agents disagree concerning prices" (C. BLISS, *Consistent temporary equilibrium*, *op. cit.*, p. 149).

⁴¹ D. SONDERMANN, "Temporary Competitive Equilibrium under Uncertainty", in J. DRÉZE (ed.), *Allocation under Uncertainty: Equilibrium and Optimality*, London, Macmillan, 1974.

hand, are to be regarded in a slightly different way from Arrow and Hahn's model: as we will see later, they resemble more closely the securities that are traded on real stock-exchanges.

As in Arrow and Hahn's model, no forward market for commodities exists and agents select their plans at the beginning of period 1 on the basis of their individual expectations of future prices.⁴² However, in Sondermann's contribution agents' expectations take the form of subjective probability distributions defined on the set of possible future prices; in other words, expected prices are defined as random variables that in general differ among agents. The consideration of "subjective uncertainty" makes the description of the processes of decision-making by agents more complicated than that proposed by Arrow and Hahn; however, this aspect of the model has little relevance for our discussion and will not be considered in detail.

Let us turn to the description of agents' behaviour, starting from the productive sector of the economy. Sondermann assumes that each firm is endowed, at the beginning of period 1, with given stocks of commodities which are the result of its productive activity in the past period; furthermore, each firm initially owns a given portfolio of assets including non-negative amounts of shares in the other firms and a positive amount of money.⁴³ At the beginning of period 1 firms select the production plans, that specify period 1 inputs and period 2 outputs. Moreover, firms "may trade assets and money on the capital markets";⁴⁴ accordingly, each firm chooses, in addition to its plan of production, a financial plan that specifies its current demands for, and supplies of, assets.

How are the plans of the firms financed? Here Sondermann's model significantly differs from the Arrow and Hahn contribution. The author in fact supposes that each firm finances the purchases of inputs and of assets out of its initial wealth, given by the market value of its initial endowments of commodities and assets. This assumption can formally be expressed in the following way. Denote as before the production plan of a generic firm f by $y_f^{12} = (y_f^1, y_f^2)$; then denote the firm's demands for financial assets by the non-negative vector A_f^1 . Sondermann assumes that the firm must choose a production and financial plan such that

$$-p^1 y_f^1 + r^1 A_f^1 \leq p^1 e_f^1 + r^1 A_f^0 \quad (8)$$

⁴² For simplicity we will neglect the uncertainty of households about their future endowments (D. SONDERMANN, *op. cit.*, p. 236).

⁴³ D. SONDERMANN, *op. cit.*, pp. 236 and 247-248. As a matter of fact, Sondermann assumes that "... a firm may initially own some of its own stock and... may sell that stock on the market" in period 1; in this way the model allows for a limited possibility of equity-financing by firms (D. SONDERMANN, *op. cit.*, p. 247). We ignored this feature of the model since it has aroused some criticism (J. M. GRANDMONT, "Temporary general equilibrium theory", *Econometrica*, vol. 45, April 1977, p. 554) and has no relevance for our argument.

⁴⁴ D. SONDERMANN, *op. cit.*, p. 246.

where p^1 is the vector of current prices for commodities, y_j^1 is the vector of current inputs (denoted by negative numbers), r^1 is the vector of current prices for assets, e_j^1 and A_j^0 are respectively the vector of the firm's initial endowments of commodities and the vector of its initial endowments of assets.

Sondermann then assumes that within each firm the production and financial plan is selected by the manager only on the basis of his individual expectations of future prices. Furthermore, each manager chooses the plan in such a way as to try to achieve the highest future market value for his firm, defined as the market value of the firm's stocks of commodities and assets at the beginning of period 2.

The process of selection of the plan by the manager of a generic firm can be sketched as follows. Since the manager's expectations take the form of a subjective probability distribution defined on the set of future prices, for each given plan both the expected receipts from the sale of outputs and the expected value of the firm's portfolio of assets at the beginning of period 2 are random variables. Thus the manager subjectively associates with each plan a random prospect of period 2 market values for his firm; this in turn reduces the manager's choice among alternative plans to a choice among the corresponding random prospects of future market values. In accordance with the modern theory of choice under uncertainty,⁴⁵ Sondermann assumes that the manager's "preference" among alternative random prospects can be expressed by means of an "expected utility function" and then supposes that the manager selects the plan that maximizes his expected utility under the budget constraint (8).⁴⁶

An important consequence of the above assumptions is that each manager, in the attempt to achieve the highest future market value for his firm, uses the whole initial wealth of the firm to purchase means of production and financial assets⁴⁷ so that no dividend is distributed in period 1. The holding of shares in a firm during period 1, therefore, constitutes a claim to a proportional fraction of the firm's future market value; that is, a claim to a fraction of the total value of the firm's stocks of commodities and assets at the beginning of period 2.

We turn now to the behaviour of households. Each household is initially endowed with given stocks of commodities,⁴⁸ with non-negative amounts

⁴⁵ For an introductory exposition of the theory, see e.g. E. MALINVAUD, *Lectures on Microeconomic Theory*, Amsterdam-Oxford, North Holland, 1972, ch. II.

⁴⁶ D. SONDERMANN, *op. cit.*, pp. 246-249.

⁴⁷ Formally this implies that constraint (8) holds with the equality sign.

⁴⁸ The composition of households' initial endowments does not seem to be clearly stated by the model. Since households cannot store goods (D. SONDERMANN, *op. cit.*, p. 239) one is induced to think that their endowments do not include produced goods. Sondermann's proof of existence, however, relies on the assumption that households' endowments, in the aggregate, include strictly positive quantities of every commodity available in the economy (D. SONDERMANN, *op. cit.*, p. 250, condition 9.1).

of shares in firms and with a positive amount of money.⁴⁹ At the beginning of period 1 households observe the current prices and form their expectations of future prices; then they select the optimal plans of present and future consumption according to their expectations, tastes and endowments. For our purposes, Sondermann's description of the selection of the plans of consumption can be regarded as similar to that proposed by Arrow and Hahn; in particular, also in Sondermann's model the decisions on future consumption determine decisions on saving in period 1 that entirely manifest themselves as current demands for financial assets. However, since expectations are probabilistic, Sondermann represents the "preferences" of the generic household among alternative plans of consumption and of saving for period 1 by means of an "expected utility function" that reflects the household's tastes, expectations and attitude toward risk. The choice of the optimal plan is accordingly described in terms of the maximization of expected utility subject to period 1 budget constraint;⁵⁰ by means of this procedure, Sondermann is able to determine the household's demands for commodities and assets in period 1.

The relevant features of the saving-investment market implicit in Sondermann's model should now be clear. Firms finance the chosen plans of production out of their initial wealth. This implies that the households which hold shares in firms during period 1 are directly "saving" part of their potential wealth (namely, the value of the firms' initial stocks of commodities and assets) in order to sustain the expenditure for inputs by the productive sector. Under this assumption on the financing of firms' plans, no perfect capital market is needed, so that the difficulty of Arrow and Hahn's model does not arise; on the other hand, the proof of the existence of a temporary equilibrium given by Sondermann seems to demonstrate the possibility of compatible decisions on saving and on investment in spite of the divergencies in individual expectations. However, some aspects of Sondermann's account of the behaviour of agents do not seem to have an acceptable economic meaning. To show this we will follow a line of reasoning similar to that adopted in section 3.

Sondermann assumes that the firms' managers select the plans according to their individual forecasts. Each plan, however, will be privately evaluated by households at the beginning of period 1 and the fact that expectations are probabilistic does not rule out the possibility that households may expect some of the announced plans to bring about losses "with probability 1».

⁴⁹ This assumption is needed, together with the condition that money has a positive value in period 1, to rule out discontinuities in households' demand correspondences. A positive value of money in period 1 is in turn ensured by the assumption that households expect money to have a positive value in the future (D. SONDERMANN, *op. cit.*, p. 240, condition P.3).

⁵⁰ D. SONDERMANN, *op. cit.*, pp. 240-242.

This would be the case if, given the plan chosen by a generic firm f , households attached a positive probability only to the period 2 prices for outputs which are not sufficient to repay the current expenditure for inputs and regarded as unprofitable the plans of those firms whose shares are included in firm f 's desired portfolio. If such pessimistic expectations come to effect the initial shareholders of the firm, we may again suppose that they will try to sell their shares at the ruling price. With regard to this eventuality, we note that Sondermann's definition of equilibrium presents a surprising feature: the possibility of an equilibrium price equal to zero for some firms' shares is not ruled out.⁵¹ Thus Sondermann's "equilibrium" includes situations in which some firms announce plans that receive so little credit that nobody in the economy would pay a positive price to hold their shares.⁵² If this happens, however, it is dubious to suppose that the initial shareholders of the uncredited firms would passively accept the announced plans to be carried out, since those plans imply a reduction in the amount of wealth potentially in their hands at the beginning of the period. Even if in general shareholders entertain different views about future prices and may therefore disagree on the selection of the optimal plan, in the eventuality depicted above they should unanimously prefer a feasible alternative to the announced plan: namely, that of closing down the firm and getting back the value of the firm's initial endowments (which would be positive in any case, because of the assumption about the initial stocks of money).⁵³ The reader will easily realize that this criticism applies to all the situations in which the initial shareholders of a generic firm are convinced that the announced plan is bound to bring about losses and simultaneously the market value of the firm, although positive, will have fallen considerably below the value of the firm's initial stocks of commodities and assets.

⁵¹ D. SONDERMANN, *op. cit.*, p. 250, definition 9.1; see also p. 252.

⁵² Negative prices for shares are ruled out by assuming that shareholders have limited liability so that "in the worst case they can lose all the money invested... but they do not have to cover losses" (D. SONDERMANN, *op. cit.*, p. 238). It can be noticed, incidentally, that the possibility of equilibrium prices for shares equal to zero contrasts with the hypothesis that the decisions on production are taken by managers at the head of firms. For prices sufficiently close to zero, in fact, the managers themselves would find it convenient to purchase the whole ownership of the firms in which they work. Thus we are forced to think that Sondermann conceives firms as "impersonal" entities: this exposes the model to the criticism of Drèze, who appropriately observed that to assign "preferences" between alternative random prospects to an abstract entity is rather artificial [J. DRÈZE, "(Uncertainty and) the firm in general equilibrium theory", *Economic Journal*, December 1985 (supplement), p. 5].

⁵³ Drèze recently observed that "[i]t seems natural to require that business firms should at least respect *unanimous* wishes of their shareholders" [J. DRÈZE, "(Uncertainty and) the firm...", *op. cit.*, p. 6; italics in the original]. Sondermann's model does not seem capable of fulfilling such a reasonable requirement for all the conceivable sets of expectations.

The above considerations suggest that the assumption that production plans are financed out of the value of the firms' initial endowments should be avoided in temporary equilibrium models in which the plans are independently selected by managers. For plausible sets of expectations, such an assumption may in fact lead to situations such as that depicted in the previous paragraph, in which the owners of firms accept that their wealth is reduced by managers whose projects they unanimously consider unprofitable. Situations of this kind look paradoxical, since the owners of firms, like any other household, are interested in the achievement of the highest amount of wealth over time.

5. CONCLUSIONS

In the previous sections we discussed a representative group of temporary equilibrium models with production, which share the assumption that production plans are selected by the managers of the firms only on the basis of their individual expectations; we pointed out how under such an assumption the divergency of agents' forecasts may lead to unacceptable representations of the interaction between firms and households on the saving-investment market.

The discussion was developed with reference to different hypotheses about the financing of the firms' plans. In section 2 we examined the Arrow and Hahn model, where it is assumed that production plans are entirely financed by borrowing on a perfect capital market, so that managers can always implement the chosen plans. We showed that the existence of such a perfect market is scarcely tenable in a context in which savers privately evaluate the plans of production and that a proper account of the behaviour of savers forces the theory to suppose that firms borrow on capital markets that are not perfect. If this is done, however, the plans independently selected by managers may be blocked by a negative evaluation on the saving-investment market, as we pointed out at the end of the section.

In section 3 we discussed the attempt by Bliss to reconcile subjective expectations with the existence of a perfect capital market within a model similar to that of Arrow and Hahn. For this purpose Bliss assumes that the solvency of the firms that intend to borrow is tested on the capital market against a set of "reference prices" which reflect the "average opinion" of savers about future prices. We observed that it is problematic to explain how an "average opinion" may be formed from the individual expectations of savers and concluded that Bliss' attempt does not seem to rely on sufficiently clear foundations.

Finally in section 4 we examined a model by Sondermann where it is

assumed that firms have initial endowments of commodities and assets and that managers finance the chosen plans out of the value of those endowments. We argued that such a representation of the financing of firms' plans does not seem acceptable when the plans are independently selected by managers. In the presence of diverging expectations, in fact, it may originate paradoxical situations in which production plans are carried out even when the owners of the firms regard them as a source of losses and would unanimously prefer not to engage in production.

The critique developed in the previous sections should enable the reader to appreciate the limits of the assumption that managers independently select the plans of production. In the presence of diverging expectations, it is dubious either to suppose that managers can freely borrow on the capital markets or to suppose that they are free to finance the chosen plan out of the value of the firms' endowments. Temporary equilibrium theory seems on the contrary forced to admit that the plans selected by managers are subject to the decisive judgement of savers, who may give a negative evaluation of those plans and refuse to finance them. In this situation, it would seem more natural to suppose that managers will not just follow their private expectations but will rather strive to announce plans that are likely to be credited by savers.

However, when the assumption that managers select the plans according to their private beliefs is dropped, it is not easy to give a satisfactory account of the formation of the decisions on production in the presence of diverging expectations: here we can only mention some of the complications that arise. Consider a firm that, in a given period of time, must choose its production plan. The households which share the ownership of the firm at the beginning of the period will in general have different expectations and therefore conflicting opinions about the optimal process to put into operation. In such conditions, the manager of the firm cannot simultaneously serve the interest of each owner: will the opinion of some owner then prevail or will a compromise have to be stipulated? The theory should introduce some institutional rule that regulates the process of decision-making by the initial owners. Moreover, once a decision has been taken, exchanges of shares of ownership among households will take place: so the theory should also take into account the opinions of the new owners, who may propose revisions of the plans previously announced. Finally, a proper model should consider all the strategies that households may pursue in order to *impose* the favoured plans of production; for instance, if the firms' plans are selected by majority vote at regular owners' meetings, households might try to purchase enough shares of ownership to dominate those meetings and have the preferred plans approved.

With so many complications to be faced, it is not surprising that general

equilibrium theory, at the present state of its development, has not managed to provide a satisfactory alternative to the doubtful assumption that the plans of production are chosen by the managers of the firms according to their individual forecasts.⁵⁴

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⁵⁴ Some eminent general equilibrium theorists appear to be fully conscious of the difficulties that the divergency of expectations induces in the description of the formation of the decisions on production; see e.g. the considerations developed in F. HAHN, *Equilibrium and Macroeconomics*, Oxford, Basil Blackwell, 1984, pp. 81-83. Nevertheless, in the available literature complications are often ruled out by means of ad hoc assumptions and sometimes simply ignored. Thus e.g. GROSSMAN, and HART, in their essay "A theory of competitive equilibrium in stock market economies", *Econometrica*, vol. 47, March 1979, assume that the plans of production are selected by the initial owners of the firms and that the new owners cannot revise those plans (for an accurate criticism of other relevant assumptions of the model, see F. HAHN, "A Theory of Competitive Equilibrium in Stock Market Economies: Some Remarks", Economic Theory Discussion Paper, No. 11, Department of Applied Economics, University of Cambridge, 1979); And J. Drèze, in a model in which production plans are chosen by majority voting at shareholders' meetings, does not consider the possibility that households may operate portfolio choices aimed at participation in the control of firms [J. DRÈZE, "(Uncertainty and) the firm...", *op. cit.*, pp. 9-16].