ON THE CONTRIBUTION OF
NEW KEYNESIAN ECONOMICS

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I. INTRODUCTION

In a preceding paper in this issue of the *Eastern Economic Journal*, David Colander has provided a classification scheme for macroeconomic thought including a definition of New Keynesian economics as an alternative to that given by Mankiw and Romer [1991], Gordon [1990] and Grossman [1991], for example. He claims that, although Mankiw and Romer et al. may have met the New Classical theoretical challenge of the 1970s [Mankiw and Romer, 1991, 16], their approach is neither new nor Keynesian [Colander, 1992a]. His distinction between New Keynesian economics and the New Neo-Keynesian economics of Mankiw and Romer, for example, is motivated by the observation that the latter is simply a reconstruction of Neo-Keynesian economics in terms of an optimizing framework.

In Colander's as well as in our conception of Keynesian economics, the essential feature of Keynesian economics is coordination failures. Any New Keynesian model must include the possibility of multiple equilibria so that the economy may get stuck in a less than full-employment equilibrium although a superior full-employment equilibrium exists.[1] The real issue is to explain aggregate inefficiencies. New Keynesian economics is a serious attempt in that direction since the aim is to show that coordination failures are inherent to the functioning of a decentralized economy, even if prices are flexible (or sometimes *because* prices are flexible). On the other hand, in Neo-Keynesian economics and in New Neo-Keynesian economics the existence of equilibria with inefficiently low levels of economic activity can only be attributed to the *ad hoc* introduction of wage and price rigidities into an otherwise classical framework.

In this paper we consider whether the literature that fits Colander's classification of New Keynesian economics provides a meaningful alternative framework for the analysis of the coordination problem in economic society. In comparison with the New Classical framework, New Keynesian economics essentially challenges the hypothesis of a unique natural rate of production. From an analytical point of view, the distinguishing characteristic is the application of an optimizing framework in order to explain Keynesian features such as underemployment equilibria. In particular, the introduction of price and wage rigidities is not characteristic of New Keynesian economics. Taken together these features lead to the conclusion that the assumptions of rational behavior and expectations and flexible prices can be perfectly compatible with the existence of multiple bootstrap equilibria with low levels of economic activity. New Keynesian

models allow for indeterminacy of equilibria, self-fulfilling expectations and path-dependent equilibria.

In our opinion, the New Keynesian economics incorporates a potentially important contribution to macroeconomic theory. However, this paper also illustrates that a coherent framework has yet to be developed. In this respect, the New Keynesian analysis may benefit from the insights developed outside the scope of mainstream economics.

II. THE MAIN FEATURES OF NEW KEYNESIAN ECONOMICS

A General Framework of Coordination Failures

New Keynesian economics starts from the recognition that individuals have to organize their own trading activities themselves. If a coordinating device like the Walrasian auctioneer is not present to establish (by assumption) equilibrium prices and exchange arrangements, not all the available information is revealed to the market. A restricted dissemination of relevant information affects all economic interactions: be-tween agents, between sectors and between periods.[2] Coordination failures may arise as agents now have to act upon their beliefs about the mutual interdependence of their trading activities. Thus, the perception of possible trades defines the actual scope for trade. In equilibrium these perceptions are self-fulfilling.

As a result, it is possible that individually rational behavior causes an economy, with identical amounts of labor and capital, to have fundamentally different amounts of effective labor and capital. Hence, the economy may end up in an equilibrium with low levels of output and employment, although equilibria with higher levels of output and employment do exist. The flavor of a coordination failure is nicely illustrated by the following example [Fudenberg and Tirole, 1991, 21]. Consider the following 2x2 game of complete information. The payoff matrix is illustrated in Diagram 1.

DIAGRAM 1

	L	R
U	9,9	0,8
D	8,0	7,7

In the payoff matrix, the first number of a matrix element denotes the payoff of player 1, the second number the payoff of player 2. The game has three equilibria: (9,9,); (7,7); and a mixed strategy equilibrium with lower payoffs in which the players random-ize, with probability 7/8 that player 1 plays U and player 2 plays L. The Nash equilibri-um (9,9) is clearly superior. However, will this Nash equilibrium be played? If the players do not communicate before the game the answer to this question is not necessar-ily in the affirmative. The reason is that playing D is much safer for player 1 since it guarantees at least 7 regardless of the strategy of player 2. A similar argument holds for

strategy R of player 2. Hence, the inferior equilibrium (7,7,) may be realized depending on the players' beliefs about the behavior of the other players. In this straightforward game it is rather easy to achieve the Pareto superior equilibrium if communication is allowed. However, reality is much more complex, which may imply that coordination failures easily arise.

Cooper and John [1988] provide a general and abstract game-theoretic framework for the analysis of macroeconomic coordination failures, with application to models of imperfect competition, with or without flexible prices [Bryant, 1983; Blanchard and Kiyotaki, 1987; Hart, 1982; Startz, 1984; and Weitzman, 1982] and to models of competi-tive general equilibrium search [Diamond, 1982].

In the game-theoretic framework of Cooper and John, "Keynesian results" such as multiple equilibria and multiplier processes "are generated from the inability of agents to coordinate their activities successfully in a many-person, decentralized economy" [Cooper and John, 1988, 442], characterized by imperfect information. The analysis centers around two concepts: externalities and strategic complementarity. Externalities arise if an increase in the effort of one agent affects the pay-offs of other agents. A similar argument is made by Laidler [1990] when he argues that holding positive non-interest-bearing money balances has positive externalities. The higher a person's liquid-ity, the lower the chance the person will require immediate and unanticipated payment from his debtors, the more the latter are able to economize on their level of liquidities and the lower their total opportunity costs of holding money. Alternatively, the increa-sed search for trading opportunities by some agents *ceteris paribus* raises the profitabil-ity of production for other agents since they can sell their products at lower transaction costs. In case of strategic complementarity, an increase in effort of an agent increases optimal efforts of other agents — i.e., reaction functions are upward sloping. [Bulow, Geanakoplos and Klemperer, 1985]. For instance, the higher the level of economic activity, the easier it is to find trading partners and the higher is the optimal level of production for each producer. The interdependency between (expected aggregate) de-mand and supply represents another classic example of strategic complementarity. With strategic complementarity, multiple equilibria — i.e., the multiple intersections of reaction functions — may arise, which is characteristic for Keynesian-type analyses. Furthermore, the resulting (symmetric) Nash equilibria, although always inefficient,[3] can be Pareto-ranked according to their level of aggregate economic activity and employment. Finally, in the context of the present framework, multiplier effects may arise in case an exogenous shift stimulates an increase in individual activities. With strategic complementarity, the aggregate response to the shift will dominate the indi-vidual initial response to the shift — i.e., the multiplier exceeds one. Relatively small changes in parameters may be able to induce large shocks in the aggregate variables. Contrary to the arguments in (New) Neo-Keynesian economics the existence of rigid prices or wages is neither necessary nor sufficient to achieve the aforementioned effects. They simply arise from the absence of a central coordinating institution in a decentral-ized market economy.

Examples of Coordination Failures: Imperfect Competition and General Equilibrium Search Models

Startz [1990] provides a simple example of a coordination failure in models with imperfect competition.[4] Coordination failures may arise through the impact of positive

profits on expenditures. An increase in spending increases aggregate profits, which feeds back on aggregate expenditures. However, the feedback route is not taken into account in advance because the level of profits, or more generally income, is taken as given in the "economy's" spending decisions. Note that this description of the economy only applies to the short run. In the long run, entry drives profits down to zero. Hence the feedback effect disappears.

In general equilibrium search models, aggregate demand externalities are an important characteristic. By the latter we denote a situation in which, as the choice of a particular strategy becomes increasingly more attractive, the number of other agents following the same strategy becomes larger. Coordination failures arise in general equilibrium search models because, given prices, the absence of the Walrasian auctioneer prohibits the establishment of optimal exchange arrangements. In the framework of Diamond [1982] trade externalities arise because agents have to make up their own exchange arrangements [Howitt, 1990].[5] The bootstrap nature of the search equilibria arises since the probability of finding a trading partner increases with the search efforts of other agents — the aggregate demand externality. In addition, there exists positive feedback as increased search increases the profitability of production. Thus, as in the coordination-failure literature, the self-fulfilling nature of equilibria, and hence of expectations, is a consequence of the fact that the level of activity is positively dependent on the efforts of all other agents but this positive interdependence cannot be effectively communicated.[6]

Indeterminacies and Self-fulfilling Expectations

An alternative method of analyzing the existence of socially inefficient equilibria in an otherwise standard flexprice general equilibrium model is to allow for an infinite number of goods as well as for an infinite number of agents in order to introduce the indeterminacy of one or more variables [Kehoe, 1989]. Because of this double infinity, the model solution requires the arbitrary fixation of one or more variables. If this principle is applied to expectations, it can be shown that any perfect-foresight expectation in period t about the level of variables in period $t+1$ will be self-fulfilling. Furthermore, the period t equilibrium can be shown to be uniquely determined by the arbitrary choice of expectations, which provides a natural link with the coordination-failure literature. Within any Keynesian-type overlapping generations (OLG) model, these indeterminacies are present [Geanakoplos and Polemarchakis, 1986].[7] As is shown in John [1988] and Chatterjee and Cooper [1989], for instance, the OLG model can be used to amend the coordination-failure argument which is essentially static and devoid of expectations.

The static OLG framework does not deal with the analysis of the state variables over time. This characteristic forecloses the analysis of what might be called expectations-driven business cycles and thus of the theory of chaos and sunspots [Grandmont, 1985; 1989]. Let us briefly consider the dynamics of the OLG model.[8] In a standard OLG model, with money as the only asset, the offer curve gives all utility maximizing combinations of consumption when young in period t and consumption when old in period $t+1$, when the slope of the intertemporal budget constraint $(-p_t/p_{t+1})$ changes. The slope of the budget constraint represents the (gross) rate of return on money and hence the return on savings. Changes in the rate of return on savings have an income and a substitution effect. The relative size of these two effects determines the slope of the offer curve and is the prime mover in the analysis of expectations-driven business cycles in

FIGURE 1
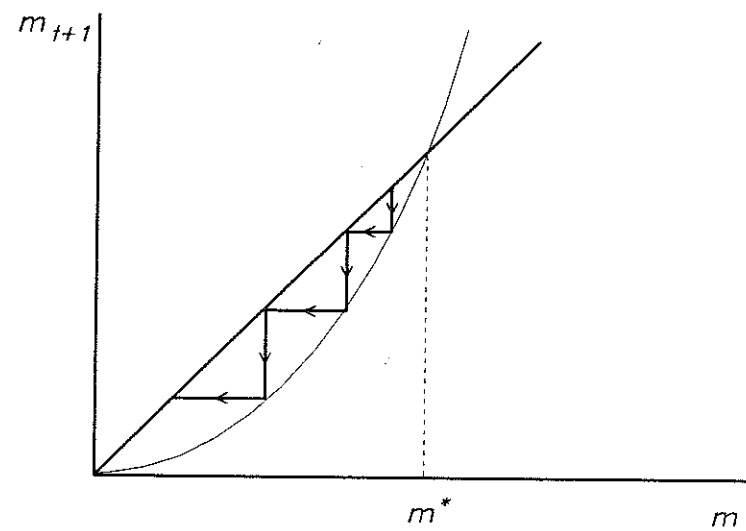
the context of the OLG model. The standard assumption is that the substitution effect dominates the income effect. In that situation, the monetary steady state, with positive real money balances, is unstable. Indeterminacy arises because starting points can be chosen arbitrarily. For any arbitrary starting point in the interval $(0-m^*)$, where m denotes real balances there exists a perfect foresight equilibrium on the offer curve, as is illustrated in Figure 1.

Thus, infinitely many equilibria exist [Woodford, 1984, 8-9]. In order to arrive at expectations-driven cycles, the income effect has to dominate the substitution effect. In that situation an increase in the rate of return on savings leads to a decrease in savings which may imply that the offer curve is backward bending (see Figure 2). In this case, the monetary steady state is stable.

If the income effect is sufficiently strong so that the slope of the offer curve is less than 1 in absolute value at a stable monetary steady state equilibrium, cycles of any periodicity are possible and even cycles with aperiodic behavior can exist. The latter denotes a situation of deterministic chaos; the time path of the economy never replicates itself.

Thus the assumptions on the shape of the offer curve create the scope for chaos in OLG models.[9] In these models it is possible that an economy never converges to a steady state. If this were the case, prediction of relevant economic variables would become virtually impossible. Furthermore, with chaos, economic variables are very sensitive to initial conditions, which means that very small changes in the parameters may lead to a very different time path for the economy.

A second example of expectations-driven business cycles is the theory of sunspots. Sunspot equilibria are characterized by self-fulfilling prophecies. The theory of sunspots extends the indeterminacy result assuming that a random variable (sunspot) can affect

FIGURE 2
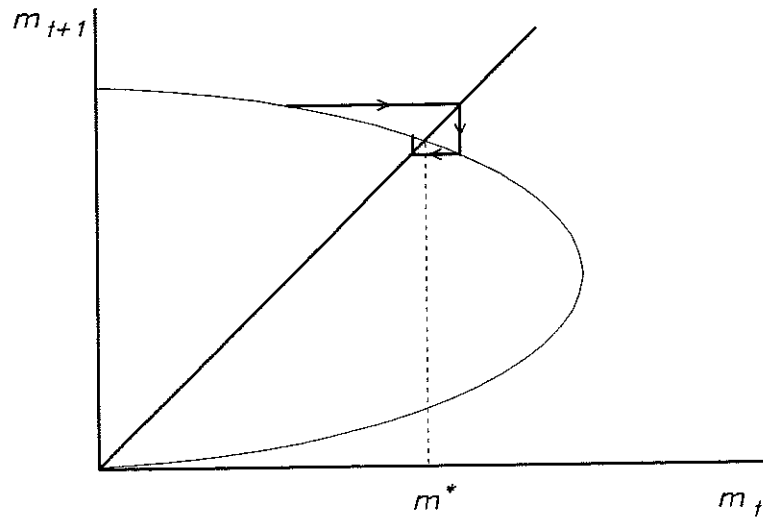
the equilibrium conditions of the economy resulting in the existence of multiple stochastic equilibria.[10] In a sunspot equilibrium, the sunspot affects the characteristics of the equilibrium because every agent believes that other agents believe that the sunspot is important for the behavior of the economy [Grandmont, 1989, 282-3]. The sunspot (a random variable) will be part of everybody's information set at time t and will thus influence the equilibrium condition.[11] As in the coordination-failure literature, the characteristics of the equilibria arise because agents must act upon their beliefs concerning the expectations of other agents; that is, agents behave in a world in which the problem of higher-order expectations exists.

III. A FEW FIRST STEPS TO EMPIRICAL RESEARCH

The empirical research in New Keynesian economics is complicated by the fact that these theories rely on concepts that are not directly observable, like self-fulfilling expectations.[12] This is not to say that these theories are not important for an understanding of the working of a decentralized economy. The possibility of multiple equilibria is increasingly used to explain that the development of economies, industries or individual firms over time is determined (partly) by the fact that many equilibria could have been realized but that path-dependency (history) or self-fulfilling expectations determine which equilibrium actually is established. In international economics, the concept of path-dependency of equilibria is used to explain why location matters in the determination of (international) trade patterns [Krugman, 1991]. In industrial economics, path-dependency and self-fulfilling expectations can be used to show why relatively inefficient products can dominate the market [Arthur, 1990; and David, 1985]. Cooper and Haltiwanger [1992] is a recent attempt to apply the coordination-failure approach to

sales patterns in the U.S. Automobile Industry. In his survey of price and wage setting practices, Blinder [1991] also finds evidence that the coordination-failure argument is important. Another area of empirical research which addresses the issue of equilibrium selection in case of multiple equilibria is experimental economics [Cooper et al., 1990; and Van Huijck et al., 1990; 1992].

IV. SOME CRITICAL OBSERVATIONS

At present the most significant contribution of the New Keynesian literature is the recognition that there does not necessarily exist a unique market-clearing equilibrium in which both coordination is perfect and the socially efficient situation does not differ from the individually efficient situation. New Keynesian theories do not take for granted that the exchange process achieves the coordination of individual activities and therefore does not need a separate theoretical treatment. As such, the analysis of multiple equilibria does not cast macroeconomic problems in terms of micro analogies as in New Neo-Keynesian and New Classical economics.

The coordination-failure models discussed in Section II, however, do not really analyze the exchange process. It is only emphasized that the absence of the assumption of perfect coordination implies the possibility of the exchange process leading to non-cooperative outcomes. But the question how a particular equilibrium should come about is left unanswered. It is simply assumed that an individual agent knows that all other agents know which equilibrium is actually chosen. So far, the equilibrium nature of the coordination-failure models has foreclosed an analysis of equilibrium selection. In this respect there is a fundamental difference between the concept of coordination failures in the work of Leijonhufvud and Hayek and the concept of coordination failures as discussed in this section. Leijonhufvud, for instance, explicitly refers to the question of how a coherent outcome (whether cooperative or non-cooperative) may be achieved.

> The only thing which Keynes removed from the foundations of classical theory was the deus ex machina — the auctioneer which is assumed to furnish, without charge, all the information needed to obtain the perfect coordination of the activities of all traders in the present and through the future. [Leijonhufvud, 1981, 15]

Hayek [1937] convincingly argued that the analysis of the coordination problem is at odds with the standard equilibrium assumption. But, as is well known, the writings of Hayek display a fundamental duality with respect to the coordination problem. Although the problem of coordination is recognized, it is merely assumed that the price mechanism and the dynamic forces of competition solve the coordination problem. It is ambiguous how the process, which gives the agents the knowledge for a general equilibrium, should be conceived. The price mechanism is the coordinating device that is imposed on the market process without making clear how the price mechanism disseminates private knowledge [Hahn, 1984]. In this respect the assumption in the recent New Keynesian literature that the agents know the structure of the economic model or game is to the same extent *ad hoc* as Hayek's assumptions about the alleged superiority of the market to solve the coordination problem.

Still, despite this criticism, it can be argued that emergence of coordination failures, indeterminacy, as well as multiplicity of equilibria represent valuable extensions of

economic theory. On the other hand, the strength of a theory with these features represents a serious weakness at the same time as long as the standard equilibrium assumption is maintained.

Notwithstanding the non-uniqueness or Pareto-inefficiency of equilibria in New Keynesian economics, the Walrasian auctioneer still needs to establish any type of equilibrium. In the absence of such an arbitrary coordinating device, the New Keynesian proposition that agents set their own prices and make inferences about the actions of other agents implies analytical difficulties because it requires the analysis of out-of-equilibrium trade[13] and subsequently equilibrium selection. Particularly, if multiple equilibria exist, the inability to deal with the selection of equilibria represents a severe drawback of the analysis. Theories of multiple or even of a continuum of equilibria do provide conditions "for the existence of multiple equilibria but do not provide insights into the question which of the equilibria is more or less likely to be observed" [Cooper, 1987, 2]. A similar argument applies with respect to indeterminacies.[14] Schelling's [1960] theory of focal points can, for instance, be considered as an attempt to shed some light on the issue of equilibrium selection. A focal point denotes a situation in which the players are able to coordinate to a particular equilibrium by using information that is not explicitly incorporated in the game itself. Usually this information depends on the institutions that set the stage for the game, to the agents' culture and experience: the institutions that set the stage for the game, to some extent determine the outcome of the game. A non-economic example of the latter is the solution to the game on which side of the road to drive (left or right), which may vary across countries. Others have suggested that theoretical developments in biology, focusing on the evolution of species (a game-theoretic interpretation of Darwinism), can be fruitfully applied to problems of learning and evolutionary stability in economics [Sugden, 1986]. Another related solution to the selection problem is to allow for path-dependence in economic variables (see Section III). The following quotation from Hahn's own contribution to Hahn illustrates this argument.

> Current economic theory by and large avoids dynamics. This has the virtue of allowing orderly argument and conclusion...dynamics should be viewed as a learning process, both about demand conditions and about the strategies of near competitors. Once again, when an equilibrium is defined relatively to such processes, it seems that they are indeterminate unless history — that is information — is explicitly modeled and known. The path of history is the outcome of individual decisions and in turn helps to fix the latter. This is really the main message: the information available to agents at any time is determined by the particular path followed. The economy could have followed a different path and generated quite different information. There is something essentially historical in a proper definition of equilibrium and of course in the dynamics itself. [1989, 125-6]

We agree with Hahn that a reconciliation of fundamental economic theory with a more historical approach to theory may represent an important challenge for future research. On the other hand, the current state of the art in New Keynesian economics hardly provides any clue how to proceed. In our view [Colander, 1992c] a first step may be the careful specification and description of the channels through which coordination may affect (aggregate) economic activity. In this respect, we believe that more inductive

approach, focusing on the description of coordinating institutions, on the one hand, and the deductive (game-theoretic) approach, on the other, can go hand in hand.

Another drawback of the recent coordination-failure literature (and in fact of all general equilibrium theories) is that it is essentially concerned with real economies; money has no proper place of its own in these models [Davidson, 1992]. The existence of strategic complementarities or spill-over effects does not depend on the presence of money. Though equilibria may be characterized by a low level of economic activity, Say's Law is still assumed to hold. The problem is that in general equilibrium theories like the New Classical and the New Keynesian theories, money is inessential. In these models the demand for money is not explained but simply assumed by putting money into the utility function or by some cash-in-advance constraint. As a result the monetary economy is not fundamentally different from a barter economy. We have already argued that as a possible restriction to the number of alternative equilibria, it is necessary to incorporate the role of institutions and conventions into the New Keynesian theories. Money can be considered a convention that reduces uncertainty. In this line of reasoning the Post-Keynesian contribution to the micro foundations debate, which by focusing on the relationship between money and uncertainty aims to provide a macroeconomic (or better monetary) foundation for microeconomic theory, offers some interesting starting points. In a related New Keynesian analysis, Colander [1992b], by emphasizing money as unit of account, starts from the notion that the use of money improves the technology of trade and allows society to allocate more resources to production. Hence, money can be considered an element in the aggregate production function. Additionally, the (anticipated) quantity of money may improve the ability to coordinate aggregate-price expectations and individual price-setting behavior. In the absence of such a coordination device, classical price-setting procedures are inherently unstable in a monetary economy. In a monetary economy the institutions to coordinate economic activities are fundamentally different from those in a barter economy.[15]

In fact, the crucial New Keynesian observations that the assumption of a unique natural rate should be dismissed and that demand and supply are interdependent for the economy as a whole are also very much at home in Post-Keynesian economics.[16] The interdependency of demand and supply decisions can already be found in Post-Keynesian macro theories that build upon the work of Davidson and Smolensky [1964] and Weintraub [1958]. Changes in nominal wages or expectations affect both demand and supply, which implies that the independence assumption that is at home in New Classical and New Neo-Keynesian economics does not apply. In our view the Keynesian content of New Keynesian economics and the similarity with Post-Keynesian theory are enlarged if the theoretical implications of multiple equilibria or self-fulfilling expectations, for example, are taken into account [Colander, 1992b]. Again, the necessary next step in extending the New Keynesian approach is to incorporate concepts that can reduce the degree of indeterminacy which characterizes current New Keynesian theorizing. The aim of New Keynesian economics should not only be the explanation of fluctuations in economic activity but more precisely, the observation that fluctuations in economic activity are surprisingly small, given the multiplicity of equilibria in theory. In doing so it is inevitable that New Keynesian economics faces analytical questions that are at the heart of Post-Keynesian economics. First of all, the degree of indeterminacy may be diminished by allowing equilibria to be path-dependent. This is just another way of saying that history matters in the sense of Robinson [1974] or Kaldor [1972; 1985]. Secondly, a more elaborate analysis of expectations formation (and thus of information dissemination) is required, which also means that the issue of learning behavior should

be addressed. The Post-Keynesian criticism of the Neo-Classical theory of individual behavior comes to the fore in that case. Especially the distinction between unconstrained individual choices, on the one hand, and rule following or conventional behavior, on the other, offers an interesting starting point for an extension of the New Keynesian models with multiple equilibria. Thirdly, the allowance for all kinds of conventions and institutions not only may help to reduce the degree of indeterminacy but also may lead to a better understanding of real world conventions and institutions like money and nominal contracts that at present are difficult to rationalize in New Keynesian theory [Davidson, 1978; and Kregel, 1980].

In this respect it is important to consider the interdependency between coordinating factors, like conventions and institutions, and the production structure of the economy. As David Colander emphasized in a preceding paper, a natural way to focus on this interdependency is to incorporate the impact of coordinating institutions into the aggregate production function in order to bring to the fore the importance of these factors for the level of economic activity.

To conclude, by allowing for multiple equilibria in a world in which expectations are the driving force, the coordination problem is no longer assumed away and the fundamental Keynesian question as to how agents (imperfectly) seek to coordinate their activities stares New Keynesian economics in the face. The challenge is to develop theories that go beyond the analysis of equilibrium coordination of the New Keynesian approaches of Section II and explicitly take the process nature of the coordination problem into account.

V. CONCLUSION

At this stage, the coordination-failure framework raises more questions than it provides answers. However, the questions that are raised are extremely relevant for both economic theory as well as economic reality, whereas the answers do justify the expectation that New Keynesian economics has the potential to develop into an independent and important area of macroeconomic research. However, in order to meet David Colander's description, New Keynesian economics needs to be extended in a number of directions to incorporate more (institutional) characteristics of modern economies. In this respect, formal theory as well as a careful description of actual institutional developments is useful. The general equilibrium framework, in which the theories discussed in Section II are cast, cannot be considered the most appropriate starting point for the analysis, simply because it assumes rather than explains perfect coordination. What is needed is a framework that takes the process of disequilibrium adjustment into account. A truly new and Keynesian theory has to focus on the process of interaction and change instead of the description of arbitrary situations of rest. In this respect the analysis of coordination failures may benefit from insights that have been developed outside the scope of general equilibrium theory.

NOTES

1. The following quote of Leijonhufvud nicely illustrates our position. "Coordination because macroeconomics, in this book at least, is the study of the coordination of economic activities in large complex economic systems" [Leijonhufvud, 1981, v]. See also, van Ees and Garretsen [1990] and Weintraub [1979].
2. The bulk of New Neo-Keynesian economics solely emphasizes the consequences of imperfect information for price formation. It is obvious that the implications of imperfect information extend beyond the formation of prices.
3. The concept of non-cooperative Nash behavior by definition implies that the positive interaction of individual activities (on the payoffs or optimal levels of agents) is never taken into account — hence the inefficiency.
4. Startz uses the expression market failure to denote what we call a coordination failure. We prefer to use the expression coordination failures since they are not necessarily confined to economic interactions through markets.
5. In search models the problem of the establishment of exchange arrangements arises because there does not exist an organized market. Only bilateral exchanges are possible.
6. Recently, Kiyotaki and Wright [1988; 1989] have extended the general equilibrium search framework to provide a microeconomic foundation for the use of indirect exchange arrangements and the emergence of a generally accepted medium of exchange (money).
7. In New Classical OLG models, indeterminacy is excluded by assuming an infinite intergenerational bequest motive [Barro, 1974].
8. For extensive analyses the reader is referred to Woodford [1984], Grandmont [1985; 1989], and Kehoe [1989], for example.
9. See, for example, the survey of Baumol and Benhabib [1989] who simply start with the following difference equation: $y_{t+1} = a\, y_t(1-y_t)$ in which a is a parameter. This non-linear relation between y_t and y_{t+1} may give rise to chaotic behavior for $a>3$ [Baumol and Benhabib, 1989, 82-83]. For the same reason as in our example, it crosses the 45° ray with a slope that in absolute value is less than one. For an in-depth analysis of the relevance of the theory of chaos for economic theory see Rosser [1991].
10. Sunspots are not necessarily linked to OLG models. Any dynamic model may generate bubbles and sunspots. However, in OLG models sunspots are consistent with non-explosive paths.
11. In case of sunspots the condition on the slope of the offer curve is not as strict as in case of chaos. See Woodford [1988] for an example of sunspot equilibria in which the slope is greater than 1 in absolute value.
12. This is especially true for the theories of chaos and sunspots which turn out to be virtually "untestable".
13. This point was, of course, first raised by Arrow [1959].
14. This argument is particularly relevant for policy analysis. The mere existence of multiple equilibria does not imply that there is any scope for policy since it is ambiguous whether the authorities are able to relieve the limitations on information in the economy. Subsequent research should be directed towards the analysis of these issues and should therefore be directed especially towards the development of theories that shed some light on the question what equilibrium (or what class of equilibria) is more likely to occur. See, for instance, Cooper [1987] for an attempt in this direction.
15. For some preliminary market solutions to this problem, see for example, Iwai [1981], Lerner and Colander [1980] and Colander [1992b]. Van Ees and Garretsen [1992] is a preliminary analysis of this issue in a more general institutional framework.
16. It should be noted that with respect to New Neo-Keynesian economics (the microfoundation of price and wage rigidities) not only must the Keynesian content be questioned but also the novelty of the New Neo-Keynesian theories is rather limited from a Post-Keynesian perspective. The introduction of imperfect competition through the assumption of informational deficiencies in order to give a foundation for price and wage rigidities is the distinguishing feature of New Keynesian economics. Ever since Kalecki [1969], Post-Keynesians have, however, recognized how imperfect competition and the principle of effective demand may interact.

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