PRIVATE INFORMATION, CONTRACTUAL ARRANGEMENTS AND HAYEK'S KNOWLEDGE PROBLEM

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Introduction*

The increasing interest in Hayek's theory of knowledge centers mainly on his analysis of the competitive market as a mechanism for the discovery and conveyance of privately known economic facts. The most prominent instance of this is the neo-Austrian literature, which has emphasized the dynamic aspect of market co-ordination through prices as the major contribution to economic theory by Hayek (see Kirzner 1992).

The purpose of the present paper is to review Hayek's notion of knowledge in order to verify whether it might be useful for a different aim, that is for the analysis of the competitive market as an institution. It is now taken for granted that asymmetries of information are at the basis of every coherent analysis of economic institutions. There is also general agreement that the endogenous enforcement of contracts is a major problem in the description of how markets work, and that rational behavior does not exclude the emergence of conventional behavior in the aggregate (for example, see Kreps 1990: 723-4, and Milgrom and Roberts 1990). In this paper I will discuss the relevance of Hayek's analysis of co-ordination of differently informed agents for the theory of competitive markets as seen from this broader perspective.

There is a great degree of consensus in neo-Austrian literature as to the way this issue matters in Hayek's analysis. In fact, the issue has been dealt with mostly in relation to Hayek's contribution to the debate on socialist calculation. For instance, some critics have shown that one aspect of Hayek's analysis which has not been adequately appreciated is precisely the fact that his study of the market process is founded on his peculiar notion of knowledge. Since this knowledge is practical and mostly inarticulate – in other words, difficult, if not impossible, to communicate – the competitive market must be considered a better mechanism of resource allocation than those which can drive centralized economies (Lavoie 1985).

Little attention has been paid, on the other hand, to the question of whether Hayek considers competitive markets as an institution performing just an allocative function. Recent developments in microeconomic theory have shown that a comparative analysis of feasible alternative institutions cannot be confined to the comparison between market and planned economies – not only because of the existence of firms, as claimed by scholars studying the theory of organizations, but also because when information is dispersed markets may perform a number of different functions (for instance, a disciplinary function as in Bowles and Gintis 1993). In my view, it might be useful to compare some perceptive insights by Hayek on this subject with recent developments in the theory of contracts and incentives. For Hayek's notion of knowledge in fact emphasizes certain aspects of informational asymmetries in decentralized systems

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that constitute the subject for analysis of current microeconomic theory.

This paper is structured as follows. The next section reviews the unifying role performed by personal knowledge in Hayek's long standing contribution to both economic theory and social philosophy, and briefly compares the notions of private information and personal knowledge. The second section examines the perspective offered by some authors in the Austrian tradition, with specific reference to their interpretation of Hayek's so-called knowledge problem. The third section deals with the relevance of Hayek's notion of knowledge for a more thorough understanding of the functions performed by competitive markets. I will contend that, in the light of his peculiar notion of knowledge, Hayek's viewpoint can be usefully compared with current developments in microeconomic theory. Finally, in the conclusion, there is an outline of the implications of the analysis put forward.

1. The role of the notion of knowledge in Hayek's theory

There is increasing consensus in the literature on Hayek's contribution to both economic theory and social philosophy about the central role performed by his notion of knowledge. It is generally maintained that this issue was first addressed by Hayek in his 1937 essay on "Economics and Knowledge", which led some critics to argue that from then on Hayek assumed a sharply critical attitude, not only towards pure economic theory, but also towards his own previous position on the usefulness of Walrasian equilibrium. Without getting involved in the dispute about the actual significance of Hayek's changes of position (on which see Caldwell 1988), it is worth mentioning a few points which show that his concern about the problem of the diffusion of knowledge in economic systems was in fact stated well before 1937.

Firstly, Hayek's theory of the business cycle can be reinterpreted as an analysis of intertemporal disco-ordination between investments and savings, when the investment sector does not share information on technology with the credit sector (as emphasized by Hayek himself in Hayek 1935a, and reassessed by O'Driscoll 1977). Secondly, Hayek's critical remarks on the view held by the supporters of planned economies show that he was aware of the shortcomings implicit in Walrasian equilibrium analysis of "objective data" right from the start of the debate on socialist calculation, in contrast to the widespread view that he dealt with this problem only in the second phase of the debate (see, in particular Hayek 1935b: 154-5).[1] Thirdly, Hayek's first methodological essay pointed to

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[1] The most widespread interpretation of the socialist controversy up until the eighties is that, after acknowledging the logical possibility of Lange's market socialism, Hayek mainly concentrated on demonstrating its practical impossibility. In his first assessment of "the state of the debate", Hayek used the argument of the practical impossibility of finding a solution for a system of simultaneous equations by a possible planner if one accepts "the usual theoretical abstractions used in the explanation of equilibrium in a competitive system [which] include the assumption that a certain range of technical knowledge is 'given'" (Hayek 1935b: 154). But if these abstractions are not used, one is led to "another problem of even greater importance", the problem which, after the 1937 article, is identified as Hayek's knowledge problem. In fact, Hayek asserts at the outset of the debate on socialist calculation, "much of the knowledge that is actually utilized is by no means 'in existence' in this ready-made form" (Hayek 1935b: 155). On this point see Lavoie 1986. Vaughn

"the incomplete nature of our knowledge" as one of the reasons for "a presumption against interference" with the working of a decentralized economy, in what may be considered a preliminary version of his fierce opposition to rationalism and economic planning (Hayek 1933: 34).

Of course, something crucial to Hayek's fundamental purpose of assessing the way in which economics explains co-ordination between individual agents is missing in these early contributions. To be exact, it was only when he took into consideration "the knowledge of the basic fact of how the different commodities can be obtained and use" and "the knowledge of the particular circumstances of time and place" (Hayek: 1937: 51; 1945: 80), that it became in his view unquestionable that competitive markets guarantee a more efficient use of dispersed information than planned economies – a fact that he stated explicitly only in "Economics and Knowledge" and later. Furthermore, Hayek's late awareness that intertemporal equilibrium was both impossible to achieve and devoid of any Pareto-optimal property is analytically grounded in his particular notion of knowledge. In fact, since he was interested in knowledge which is not only dispersed but also mainly fragmented and inarticulate, mutual compatibility of decentralized individual plans could only be a qualitative reference point for analysis, contrary to what he might have thought in the early thirties (Hayek 1937: 53; 1948: 94). Finally, Hayek's construct of spontaneous order replaced strict equilibrium as a significant theoretical object only when he became interested in explaining the proper institutional context of a decentralized economy with differently informed agents (Hayek 1967: ch. 4, 6; 1973: ch. 2).

However, if one wants to hold the view of a substantial continuity in Hayek's thought through his whole intellectual life – which I find more appropriate than distinguishing two, or more, distinct phases (see Zappia 1993) – what must be emphasized is the unifying function performed in his long-standing contribution to social sciences by the consideration of privately known economic facts.[2] In what follows, I will use the term *personal* knowledge to denote Hayek's notion of knowledge.

Against this background, it may be interesting to analyze what kind of link can be established between the notions of private information that are used in current economic theory and the notion of personal knowledge used by Hayek. On the one hand, some of Hayek's views can be examined in the light of the main results that emerge from the economics of information. For example, it is well known that Hayek's thesis about the role performed by the price system in a decentralized economy has been widely commented on in recent years (see, in particular, Grossman 1989). I will make a comparison with certain aspects of contract theory. On the other hand, as I intend to show in what follows, some of the results achieved in the economics of information are challenged by Hayek's explanation of how the market economy actually works.

Let me make a preliminary point. In the economics of information there is a crucial distinction between private information on events which do not depend on the actions of economic agents, in other words exogenous events or moves

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(1990: 391) contends that Hayek himself did not sufficiently stress this point at first.

2 It has been convincingly maintained by critics that even Hayek's works in psychology, such as *The Sensory Order*, and in political philosophy, such as *The Constitution of Liberty*, are originated by his interest in different perspectives on the problem of the diffusion of knowledge (for example, see Moss 1994, and Vaughn 1994: 121f.).

by Nature, and private information on events whose realization may depend on them. This distinction must be taken into consideration whenever results of informational efficiency in decentralized markets are shown to hold, as in asset market models or in general equilibrium models with rational expectations (for example, see Grossman 1981, and Bray 1989). In particular, since Hayek is given the credit for arguing against the supporters of planned economies that competitive markets are more efficient than any other mechanism in the use of existing knowledge – sometimes even that competitive markets make the best possible use of it (for a recent example, see Eatwell and Milgate 1994) – this point is of great relevance for our study. It must be emphasized, then, that even in a perfectly competitive context, where agents are described by "well-behaved" functions and have rational expectations on future events, the properties of informational efficiency that may characterize market equilibria – such as the fact that equilibrium prices reveal the whole information to everybody in the system – strictly depend on the assumption that *ex ante* informational asymmetries refer to exogenous events only. Accordingly, the subject of these studies is restricted to situations where all that matters is differences of information on future states of nature. Such phenomena as moral hazard and adverse selection must be assumed away from this kind of general equilibrium analysis (Radner 1982).

The significance of this distinction, not only as regards Hayek's theory but also for economic theory in general, can be seen by examining the way in which contracts are designed in the two different cases. When informational asymmetries concern only exogenous events, individual agents make transactions by signing contracts which specify an action to be undertaken in every possible future contingency. This means that the parties to the transaction must be able to observe *ex post* the characteristics of the event on which they do not share information – or that a third party can verify them. This is the rationale under the contingent contract used in Arrow-Debreu general equilibrium models. On the other hand, when informational asymmetries concern aspects of economic activity which are not publicly observable *ex post*, the contingent implementation of contracts is no longer possible. In this case, incomplete contracts must be drawn because it turns out to be impossible to specify what actions are to be taken in all possible future contingencies. What we have here is information which individual agents have private knowledge of, and which affects how contracts are characterized – such as the intrinsic skill of a worker which is studied in adverse selection models, or the effort of a worker in moral hazard models.[3] When incomplete contracts have to be designed, the need for self-selection and incentive constraints generally bring about second-best outcomes. More generally, transactions among individual agents are now informationally complex transactions, since they may involve both monitoring costs about performances and sanctioning costs whenever performances do not

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3 In order to clarify the issue, let us consider an example from the literature on incentive contracts in which information on exogenous and endogenous events may interact (Arrow 1986). In the overly simple fire insurance example, an Arrow-Debreu contingent contract would pay the insured conditional on the occurrence of those natural events that can cause fire, whereas actual real world contracts make it dependent upon the occurrence of fire itself. This depends on the fact that it can be difficult to infer whether the fire is due to an unusual exogenous event, or to a more usual exogenous event coupled with insufficient care by the insured (hidden action) or with unfavorable privately known characteristics of the insured himself (hidden knowledge).

conform to the contract (Milgrom and Roberts 1990: 60). Moreover, the properties of general equilibrium are now difficult to define, and Pareto optimality is no longer a possible outcome. As a consequence, the entire neoclassical explanation of how competitive markets work is called into question (Bowles and Gintis 1993).[4]

Two important general points can now be made. First, the claim that the Hayekian concern about the role of prices as transmitters and conveyors of information in a general equilibrium setting has been superseded – a claim made by scholars studying the informative properties of equilibria (see in particular Grossman 1989: 1-2) – turns out to be ill founded. In fact, as is well known, Hayek's idea of personal knowledge refers to individual skills, techniques of thought, and alertness to unexploited opportunities, all of which are aspects of knowledge which both explain informational asymmetries among agents and affect economic activity endogenously. As we have just noted, these aspects cannot find adequate treatment in Grossman's general equilibrium model.[5] Therefore, if some similarities between Hayek's notion of knowledge and modern notions of private information can be found, these must apply to those notions which deal with uncertainty on "endogenous" events. I will come back to this issue in the third section.

Secondly, the results on informationally efficient equilibria are not useful for establishing the superiority of the market over forms of deliberate organization of exchange. In general equilibrium models with asymmetric information, a planner who is endowed with all the information dispersed throughout the economy can implement allocations which mimic the competitive allocations, even if he cannot implement allocations which Pareto-dominate them. Therefore, the rationale for Hayek's main argument against planned economies – that it is theoretically impossible for planned economies to deal with the diffusion of knowledge efficiently – must be looked for elsewhere.[6]

The rest of this paper examines two different ways of interpreting Hayek's theory of knowledge. First, the following section reviews the neo-Austrian treatment of the market process. It will be argued that the division of Hayek's knowledge problem into two components has restricted the interest of neo-Austrian literature to market process in disequilibrium, while Hayek's concern for the institutional context of interaction among individual agents has been substantially disregarded. Secondly, the third section presents a tentative analysis of how Hayek's notion of personal knowledge can be used to explain why markets perform functions different from the allocative one which seems to preoccupy the neo-Austrians.

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4 On this point see also the comments by Arrow (1987) and Hahn (1990).

5 For a more detailed account, see Zappia (1996). Interestingly, while the neo-Austrian literature has paid much attention to Grossman's results, it did not raise this point. In particular, see the comments by Kirzner (1984a: 112-15), O'Driscoll and Rizzo (1985: 102-3), and Thomsen (1992: ch. 3).

6 As we shall see in what follows, the argument that an equilibrium perspective is inadequate for claiming the superiority of the market mechanism over centralized mechanisms of allocation is crucial for the neo-Austrian interpretation of the socialist calculation debate.

2. Hayek's knowledge problem as seen from a neo-Austrian perspective

According to the neo-Austrian approach, Hayek's theory of the diffusion of knowledge in a market economy is clearly stated in his essays on competition. The genuine interpretation of the issues raised in his first essays on knowledge is given by Hayek himself in "The Meaning of Competition", and re-assessed in "Competition as a Discovery Procedure".

Seen from this perspective, the market process is the necessary mechanism through which two fundamental allocation functions are accomplished in decentralized economies. Firstly, during the market process, the existing knowledge, which is dispersed throughout the economy, is used by individual agents who privately possess bits of it to get a return on it. In this case, the market process refers to how (potentially incorrectly) perceived profit opportunities by individuals can be exploited, and mutual consistency of individual plans achieved. Secondly, during the market process new economic facts are discovered by individual agents. In this case, the market process shows how those agents who are more alert than others can exploit previously unperceived profit opportunities. These two functions constitute the essence of the market process. They represent the way in which competitive markets solve Hayek's so-called knowledge problem, that is "how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know" (Hayek 1945: 78, and, for the definition of the knowledge problem, Kirzner 1984b: 153).

The fact that the allocative function performed by market process is divided into two distinct components might be interpreted simply as a matter of better representation of the question at issue. Indeed, since much of the knowledge dispersed throughout the economy is in a constant state of flux – the relevant knowledge being "the knowledge which he [an individual agent] is bound to acquire in view of the position in which he originally is, and the plan he then makes" (Hayek 1937: 53) –, the market process is a disequilibrium process which cannot be understood if one looks only at the properties of attainable equilibria. It has recently been restated that "the defining characteristic of equilibrium is the absence of the knowledge problem" (Thomsen 1992: 7). Furthermore, Hayek's viewpoint can be made clearer by looking at the role performed by the price system. Since the co-ordination of individual actions which is achieved through the competitive mechanism refers mainly to the disequilibrium process, rather than to the attainable equilibrium position of the economy, then the role of market prices is not so much that of communicating to individual agents the information dispersed in the system, as that of indicating possible opportunities which have not yet been exploited. In other words, market prices are discovery devices, more than informational signals. In following this perspective, Kirzner (1984a) explicitly regards quite misleading Hayek's 1945 emphasis on market prices as conveyors of knowledge. In Kirzner's view, in the 1945 essay Hayek did not adequately distinguish between the respective role of equilibrium and disequilibrium prices, in contrast with the much clearer explanation of the function that prices perform during competition he gave later, for example in "The Meaning of Competition".

The direct consequence that stems from this way of assessing Hayek's contribution is still controversial, even among the neo-Austrians theorists (for a recent example, see Vaughn 1994). Indeed, the first function of the market process resembles something close to the adjustment process that can be assumed

as implicit in the standard neoclassical approach to equilibrium. When information is dispersed throughout the economy, individual plans may turn out to be inconsistent in the aggregate; in particular, since some opportunities may be perceived incorrectly, agents' expectations concerning the actions of others may be disappointed. As a consequence, it is maintained that in competitive economies the mutual consistency of individual plans can be guaranteed only by the market process. In following this line of argument, current analyses of adjustment processes to equilibrium seem to be well suited to address Hayek's concern about the diffusion of *existing* knowledge – when it is clearly emphasized that, while equilibration forces are at work constantly, this does not entail that equilibrium will be achieved, since *new* relevant information will be discovered in the meantime. Indeed, the knowledge problem has been divided into two potentially separate problems, as Kirzner (1990) has recently recognized. Accordingly, the solution to the first knowledge problem – or knowledge problem A, as Kirzner calls it – can be found by following mainstream economic theory, while the core of Hayek's argument is his proposed solution to the second knowledge problem – or knowledge problem B – which cannot find adequate treatment within mainstream economic theory.

The significance of focusing on the second component of Hayek's knowledge problem seems to be that, even in the light of the results offered by the economics of information in dealing with the problem of existing differences in information, the superiority of the market over centralized economies can be demonstrated only if the dynamic content of Hayek's knowledge problem is stressed. A clear attitude of this kind is shown by Kirzner himself: "It has been pointed out that emphasis on fragmented knowledge is not quite enough to dislodge mainstream welfare concepts. 'Co-ordination' (in the sense of a *state* of co-ordination), while it may refer to co-ordination of decentralized decisions made in the light of dispersed knowledge, still turns out to involve standard Paretian norms. It is only 'co-ordination' in the sense of the process of co-ordinating hitherto *un*co-ordinated activity that draws attention to the discovery norm identified through Hayek's insights" (Kirzner 1984a: 114-15). And, as far the literature on the transmission of information by prices is concerned: "the importance of prices for coping with the Hayekian knowledge problem does not lie in the accuracy of the information which equilibrium prices convey ... rather ... in the ability of disequilibrium prices to offer pure profit opportunities that can attract the notice of alert, profit-seeking entrepreneurs" (Kirzner 1984b: 160).

The puzzling element which is inherent in this perspective on Hayek's theory is that it is based on a representation of the developments of the economics of information which is questionable. Let us see, for example, how Hurwicz reacted to Kirzner's representation of Hayek's knowledge problem. Hurwicz's attitude towards the knowledge problem is that of a welfare economist well aware of the need for an "informational perspective" (Hurwicz 1984: 419). In Hurwicz's view, the claim made for the efficiency of competitive markets is not reinforced by assuming an informational perspective. On the contrary, he emphasizes that efficiency theorems are not robust in relation to the assumptions on the informational structure of the economy. Moreover, the tendency to competitive equilibrium is shown not to be general even in perfectly competitive markets. And when he mentions his own results, which show that the market mechanism minimizes the dimension of message space needed for transmitting information, he still makes it clear that they hold only if they are based on the usual assumptions about perfectly competitive markets. The rationale of

Hurwicz's remarks then appears to be the following. If Hayek's knowledge problem is examined from an equilibrium perspective, it is difficult to ascertain the superiority of the market over centralized economies, because efficiency standards lose their precise meaning in an informational setting. Moreover, if it is examined from a disequilibrium perspective, the previous argument can only become more compelling, since the stability of competitive equilibrium has not yet been proven to hold in general.[7]

A more accurate analysis of the "informational perspective" inherent in many current developments of microeconomic theory, then, would have unearthed a different point, which is relevant for Hayek's theory as well. The fact that the knowledge problem cannot be addressed properly in an equilibrium perspective is definitely true if we study the co-ordination of economic activities in the standard Walrasian equilibrium framework. But when the influence of private information on transaction activities is dealt with in detail, Walrasian equilibrium no longer constitutes a reference point for analysis. Informative equilibria are substantially different from standard Walrasian equilibria (Stiglitz 1987). To be specific: markets may not clear in equilibrium, and co-ordination of decentralized decisions does not still involve standard Paretian norms, as contended in most neo-Austrian literature.[8] Moreover, the emergence of conventional behavior and norms is now compatible with equilibria.

In so far as my assessment of the neo-Austrian viewpoint is correct, the complexity of the co-ordination process has been restricted to a specific component of the market process. This is, no doubt, a major component: markets are a relatively more efficient mechanism of resources allocation not because they can guarantee certain efficiency standards, but because they can better diffuse and discover the concrete knowledge dispersed in the system by letting individual agents use it directly – while these agents themselves may be unable to explain how they actually use it. However, the basic element which could show the superiority of the market mechanism is not so much its capacity to deal with the phenomena which explain the dynamics of economic systems, as its ability to deal with personal knowledge. I intend to show in what follows that, in considering the two elements jointly the neo-Austrian perspective is taking a questionable step: the dynamic implications of Hayek's theory are fully drawn, while the influence on economic activities of certain important aspects of the

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7 It is worth noting that even some critics who follow the Austrian approach are skeptical about the possibility of actually proving that the tendency towards intertemporal co-ordination is a direct consequence of successful dissemination of knowledge by means of prices (see for example Langlois 1985).

8 It has been recently noted from the neo-Austrian side that there seems to be no real difference between this view and that held by those scholars studying the problem of information transmission by prices in general equilibrium models with rational expectations, to which we made reference in the previous section (Thomsen 1992: 29-37). It has been contended that both of them try to address Hayek's concern about the diffusion of knowledge by choosing an equilibrium perspective. Accordingly, Hurwicz and Grossman have missed the crucial point stressed by Hayek. It is worth noting that while this interpretation catches a very important point, it fails to understand the differences as regards the welfare implications of the two analysis. Indeed, Grossman's result can be interpreted as an extension of the standard general equilibrium efficiency properties to informational efficiency, while the economics of information mainly stresses inefficiency results.

knowledge component has not been deepened.

In conclusion, it is worth emphasizing the following point. If when dealing with the informational content of Hayek's market theory it is the aspects of discovery rather than those of communication that are stressed, then one might be led to maintain that the impossibility of reaching Pareto-efficient allocations is caused solely by earning opportunities which have not been exploited by economic agents. This appears more compelling if the problem is enlarged from incorrectly perceived opportunities to unperceived opportunities, as contended by those scholars studying the market process. If this were Hayek's contribution to the analysis of the market process, one could assert that a refinement of the notion of rationality among agents, or a more thorough analysis of cognitive processes, could overcome Hayek's criticism to pure equilibrium analysis – which is the kind of objection made in the neoclassical field to all the analyses based on disequilibrium. However, what I will emphasize in the following section is that the meaning of Hayek's criticism can already be understood in the more limited context of equilibrium co-ordination, once this context is adequately re-defined to account for the Hayekian notion of personal knowledge. To be specific, this criticism is grounded in an analysis of the means through which the communication of private information takes place in decentralized economies which is peculiar to Hayek.

It should also be emphasized that the fact that I will not focus on the dynamic aspects of market co-ordination does not imply a denial of their importance in Hayek's theory, in so far as I view the analysis of the properties implicit in Hayek's notion of knowledge both preliminary to and compatible with the market process interpretation stressed by the neo-Austrians.[9]

3. Personal knowledge and private information

As we briefly noticed in the previous section, the main theoretical argument used by Hayek against centralized economies is that knowledge is not only dispersed, but also specialized and inarticulate, that is, mostly difficult to communicate. This characteristic of the kind of knowledge which is relevant for economic activity shows why, in his view, the competitive mechanism is more efficient than other possible procedures of exchange. Indeed, even if it is possible to design appropriate incentives for individual agents to reveal which knowledge they privately possess, important aspects of personal knowledge will not be transferable to a central operator. In fact, these bits of knowledge could only be used by the individual agents themselves. Hayek himself referred to Michael Polanyi in maintaining that the 'knowledge how' to do something refer mainly to skills, and can be considered tacit (Hayek 1967: 43-5).

That personal knowledge is tacit, or inarticulate, can be interpreted in two different ways. First, tacit may mean simply that it is unreportable to others, since it is difficult, or impossible, to represent it by following formal rules. Secondly, tacit may mean also that the knowledge is actually unknown to its owner, and

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9 In arguing about the logical priority in Hayek's theory between the two elements of personal knowledge and the dynamics of the system, one should notice that while in case of absence of personal knowledge Walrasian economics could still deal with the dynamics of the system, on the other hand, even if no dynamic element is taken into account, Walrasian economics is not suited to deal with the knowledge problem.

that he gains awareness of his previous ignorance only during the market process.[10] In order to distinguish between these two interpretations of tacit knowledge I will refer to unreportable knowledge and to unconsciously possessed knowledge respectively.

In their analysis of the market process, the neo-Austrians stressed mainly the second interpretation of tacit knowledge. The reason for considering knowledge as if it was mainly unconsciously possessed may be found in the argument discussed in the previous section, that is in the neo-Austrian emphasis on the dynamics of the market process as the main subject for analysis. But Hayek's emphasis on the tacit nature of knowledge is mainly intended to deny the possibility of treating market knowledge as given to an outside observer, or to a planner. The first interpretation catches precisely this question. Let us then concentrate on the first interpretation, and ask how an individual agent can get a return on unreportable knowledge. Of course, he can use his informational advantage in the competitive process by bidding up the price of certain resources he knows he can use more profitably than they are currently used. On the other hand, this kind of knowledge is essential also as regards the way transactions are designed. If it is taken into account that informationally complex transactions cannot be based on the usual Arrow-Debreu contingent contracts, then individual agents can profit from this kind of knowledge only when markets spontaneously give birth to reliable institutions, such as contracts and customary business procedure.

This problem was considered by Hayek on many occasions. As Moss (1994) has recently remarked, in his 1940 essay on socialist calculation, Hayek maintained that "without the threat of job loss and reorganization such as provided by 'take-over' mechanism in the market for corporate control", it is not clear how "organizational structures and incentive systems that encourage loyalty and hard work" could be implemented (Moss 1994: 104, and Hayek 1940: 199-203).[11] Moreover, in his 1948 essay on competition, where the main concern was the analysis of competition as a dynamic process, Hayek criticized the "explicit and complete exclusion from the theory of perfect competition of all personal relationships existing between the parties" to a transaction, as the most remarkable example of the lack of interest of contemporary mainstream economics towards "what institutional arrangements are necessary in order that the unknown person who have knowledge specially suited to a particular task are most likely to be attracted to that task" (Hayek 1948: 96-7). Other references to the question can be found in his analysis of the rules of orders and organizations (Hayek 1973: ch. 2; 1976: ch. 10).

In my view there are al least two general points which emerge from this analysis, and which are fundamental to Hayek's peculiar conception of how the market system works. Firstly, Hayek is well aware that the institutional context within which transactions take place matters. This is a truly Hayekian statement, or, more generally, an Austrian one. Needless to say, a great number of studies on Hayek's analysis of economic and social institutions have pointed to this issue

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10 I will not consider the possibility that tacit knowledge refers to knowledge which is not consciously possessed even by those individual agents who make use of it, which I find it more difficult to accept.

11 Hayek's references to incentives in competitive markets have been commented on many times, especially after the re-assessments of the socialist calculation debate by Vaughn (1980). For a recent analysis, see Streissler 1994.

(see, in particular, Vanberg 1986, Caldwell 1988, and Vaughn 1990). In spite of this, Hayek's quest for a more thorough understanding of the function performed by competitive markets has been substantially interpreted as a secondary component of the much broader problem of the development of institutions. But, following our line of argument instead, Hayek's point emerges as a consequence of his awareness that the achievement of state co-ordination does not merely require an effective price system. In order to deal with informationally complex transactions, customary rules of behavior are also necessary.[12] Secondly, in Hayek's theory the fact that the transactions which take place in competitive markets are complex, is the direct consequence of taking into account a specific kind of knowledge. Accordingly, the idea that the market mechanism can cope with the problem of complex transactions more efficiently than other mechanisms, does not simply rely on the effectiveness of the price mechanism, but it relies on its ability to spontaneously generate the appropriate incentives within contractual relationships. It is worth recalling in this contention that, in examining how competitive systems could deal with personal knowledge, Hayek (1945: 87) realized that even competitive prices could not completely aggregate the knowledge dispersed throughout the system. His appreciation of the market order then shifted from the precise notion of equilibrium – which no longer implies Pareto-optimality, or informational efficiency – to the more qualitative construct of spontaneous order (Hayek 1978; 1973: ch. 2).

We are now led to the following interpretation of Hayek's theory. Hayek's analysis of how co-ordination can be achieved through the market mechanism cannot be appreciated completely by emphasizing only its dynamic component. To understand his viewpoint the analysis of the *process* of co-ordination does not suffice. It is also relevant to study the institutional framework in which a *state* of co-ordination can be achieved. In fact, this second aspect cannot be addressed within the limits imposed by a Walrasian perspective, essentially because the market mechanism is not an impersonal mechanism driven only by market prices.

The aspect just mentioned has much in common with the clearest general suggestion that emerges from recent developments in microeconomic theory. The problem of finding optimal incentives under conditions of asymmetric information, which current literature generally refers to as the endogenous enforcement problem, is inherent to an economy in which exchanges are based on such informational asymmetries. Indeed, the study of market institutions concerns not only the way in which the price system operates, and the limits to the dimensions of deliberate organizations – as has long been taken for granted – but also the structure of contractual arrangements by means of which the actions of individual agents can be implemented in competitive markets (in particular, see Bowles and Gintis 1993: 86-89).[13]

My interpretation so far has pointed out that Hayek's consideration of the

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12 In a remarkably modern comment, Hayek (1948: 97) argues that "competition for reputation or good will" is one of the most important facts which enables agents with "inadequate knowledge" to undertake market exchanges.

13 Bowles and Gintis contend that Hayek did not realize that the endogenous evolution of institutions does not only concern changes in preferences and norms, but also rules for endogenous enforcement (Bowles and Gintis 1993: 98-9). An accurate analysis of their position would require more space, but, in so far as my viewpoint is correct, Hayek's interest in this subject seems difficult to deny (on this point see Zappia 1995).

rules through which market exchange actually takes place has not been addressed consistently by the literature which was inspired by him. No doubt this may depend on the fact that Hayek himself showed more concern for other aspects of his theory of the market. But many insights on the necessity of a more thorough analysis of contractual relationships in market have not been deepened as they deserve. The relevance of this question is increased by the fact that post-Walrasian developments have stressed the importance of those contractual structures apt to enforce market claims. The question addressed by post-Walrasian developments then shares some elements with Hayek's contention about the knowledge problem. Indeed the comparison between these two perspectives on the problem of knowledge diffusion in competitive markets is, in my view, useful not only because it may help in clarifying Hayek's role in the improvement on the Walrasian approach as seen from the post-Walrasian perspective, but also because some shortcomings of these developments can be pointed out. In order to introduce this last question, let us examine in more depth the features of Hayek's notion of knowledge.

The widespread view on this issue is that Hayek's notion of 'knowledge' cannot be subsumed under the notion of 'information', because of the way information is dealt with in modern microeconomic literature. To be exact, it has been argued that Hayek's notion of knowledge is not to be regarded as an economic commodity which could be acquired at a given cost, and therefore cannot be subject to negotiation – unlike the commodities studied in equilibrium theory to which it is usually compared in the literature (Boehm 1994). This interpretation refers specifically to those practical and concrete aspects of knowledge which are relevant for production processes, rather than to technological knowledge. Thus it refers to a representation of knowledge that does not differ from that considered in the previous sections. However, my point is that some aspects of personal knowledge can be approximated to the notion of private information used in modern contract theory; to be more specific, they can be subject to negotiation, and therefore a formal analysis of their influence on the structure of contracts can be pursued.[14]

We saw earlier that Hayek's analysis of market behavior emphasizes certain characteristics of economic agents such as specific working skills, techniques of thought, and, more generally, entrepreneurial alertness to new investment opportunities. It has been contended by neo-Austrians that these characteristics are crucial for the definition of the competitive market mechanism, as regards both agents' search for economic improvement and reaction to exogenous changes in the data. However, in order to study the influence of these elements on competitive dynamics, and on the equilibria which the economy may achieve, it is also necessary to define appropriate contractual forms through which market exchanges can take place. In other words, it remains to be explained in what way exchange between agents can be affected, for example,

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14 As I have remarked above, the kind of private information which is analyzed in contract theory should be considered qualitatively different from that used in the studies on general equilibrium. Accordingly, the Walrasian representation of the contract as a contract contingent upon the realization of exogenous events cannot be considered satisfactory. This crucial distinction is not dealt with by Boehm, who uses the definition of "information as a commodity" given by Allen (1990). On the contrary, Allen's analysis applies only to differences of information on exogenous events, and thus follows the line of research opened by Grossman we referred to above (Allen 1990: 268).

by the specific working skills of individuals.[15]

Although we do not yet have a general theory of contracts in situations of informational asymmetry, a number of specific situations have been studied where it is profitable to design a contract in which it is possible to check some of the information possessed by the agent with an informational advantage. This can occur only if the agent who possesses certain information finds it worthwhile, in the contractual relationship, to implicitly communicate the private information which is available to him. In the majority of cases, this private information bears a direct relation either to the agent's skills, or to his specific role within the production process. Furthermore, this type of information is costless for the agent who possesses it, but it contributes to defining the reward scheme, thereby proving to be subject to monetary evaluation in the drawing up of the contract. It is also worth stressing that it is not necessary to impose the condition that the agent with the informational advantage must be able to explain how he managed to do something. He only has to agree to do it within the contractual agreement; his skill will be valued on the basis of the outcomes in an uncertain environment.

Hayek's notion of personal knowledge shares all these features with the notion of private information used in modern microeconomic theory. Indeed, it remains true that some aspects of personal knowledge cannot be "reduced" to private information, specifically because it is difficult to imagine personal knowledge as if it was given completely *ex ante*. This fact is strengthened by the neo-Austrian interpretation of the tacit nature of knowledge. Being knowledge mostly unconsciously possessed, the neo-Austrians contend, it is difficult to imagine how a contractual agreement can be reached by following the approach of modern contract theory.

But my first goal here is to examine if our assessment so far needs to be emended when only unreportable knowledge is taken into account. Indeed, by following our perspective, the critical point is that the analysis developed in the study of incentive contracts still assumes that every possible contingency on which the drawing up of the contract is based can be imagined *ex ante*. As we have already noticed, the Arrow-Debreu contingent contract cannot be used in this case, but the typical incentive contract which emerges, for example, in the principal-agent literature is still to be considered a kind of complete contract, because there is no possible disagreement on which payments has to be done *ex post*, given the actions of the agents and the realization of the exogenous events (as clarified by Holmstrom and Hart 1987).[16] If this is the case, the implicit

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15 Moreover, if the conclusion that Hayekian equilibrium does not entail the full exploitation of the opportunities offered by informational differences is well founded (in particular, see O'Driscoll and Rizzo 1985: 102-9), then it is necessary to examine alternative mechanisms through which agents with an informational advantage, or more simply with personal knowledge, can get a return on it. On this point see Dardi (1990: 62-64).

16 Even if the contingencies are now defined in a way which differs from that of the Arrow-Debreu model, since they may depend on the action of the agents themselves, the contract unambiguously specifies each party's obligations in each conceivable contingency. However, in following an Hayekian perspective, the alternative of considering incomplete contracts of the type described by Holmstrom and Hart does not seem to me fruitful, since in this case the informational asymmetries between the parties to the exchange do not reveal.

assumption is that the principle knows in advance the entire set of actions the agent may undertake, or the entire set of skills he may possess. Hence the assumed informational asymmetry concerns only the specific action that the agent will undertake (or the specific skill he is endowed). Then contract theory is implicitly assuming that the principle knows in advance what may happen, and designs a contract which gives the appropriate incentives for the agent to undertake the action he, the principle, finds it worthwhile to be undertaken (for a similar viewpoint, see Minkler 1993).

This analytical procedure seems to be well suited for answering the question of informational asymmetries, when all the agents involved knows what may happen in the contractual relationships. But it does not capture a crucial aspect of Hayek's notion of knowledge, that is the fact that only the "man on the spot" knows how to do something, and that he cannot report (or he prefers not to report) on his personal knowledge. Hence, new developments in microeconomics still fail to give adequate explanation to this kind of structural uncertainty. In my view, this does not mean that we should consider the Hayekian analysis as incompatible with these developments in economic theory.[17] On the contrary, Hayek's insights indicate a fruitful direction for further research. The most prominent example of this is the possible permanence of rents in equilibrium which post-Walrasian developments stress, but which seems to be more plausible when personal knowledge is taken into account.

To sum up on this point. In discussing Hayek's notion of knowledge, I find it more convenient to start with assuming that Hayek's perspective is similar to that taken by new developments in the theory of contracts, and then pointing at those aspects which differentiate the two theories. On the one hand, to assume a similar perspective helps in better identifying Hayek's role as a contributor to the improvement over the Walrasian approach. Among a number of contemporary scholars interested in the questions of uncertainty, expectation, and information in the 1930s, Hayek was more explicit than others in stressing the question of knowledge in his critical remarks towards Walrasian economics. On the other hand, current attempts to give a formal representation to the use of private information still fail to give appropriate consideration to Hayek's emphasis on personal knowledge as the cause for rents which cannot be cleared by the market exchange.

Conclusion

This paper tries to evaluate the importance of assuming a non-Walrasian equilibrium perspective in the analysis of Hayek's theory of co-ordination in decentralized systems. By assessing Hayek's theory of knowledge in the light of new developments in microeconomic theory, I have argued that many aspects of Hayek's viewpoint about the way competitive markets work can be understood even without making direct reference to the dynamics of the market process. In fact, Hayek's notion of personal knowledge calls for a more thorough understanding of the contractual arrangements which competitive markets

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17 For instance, in the literature on decision theory one can find an increasing number of attempts to give a formal representation of "unforeseen contingencies", even if they are limited to individual choice (in particular, see Loomes and Sudgen 1986, Kreps 1992, and Modica and Rustichini 1994).

require – a line of argument which is once again the focus of interest in pure economic theory.

The paper draws on a tradition of thought which contends that Hayek never abandoned his interest in the co-ordinative features of the price system, and that his analysis was based not only on rational behavior by individual agents, but also on rules, routines, habits, and those social institutions which emerge at the aggregate level, and carry out the task of holding the system together. Accordingly, Hayek's view of co-ordination in competitive markets cannot be limited to a strictly Walrasian equilibrium perspective.[18]

Against this background, the first step towards establishing the current relevance of Hayek's theory of knowledge in a more general equilibrium perspective appears to acknowledge the following point: recognizing that Hayek has in mind a type of information which cannot be utilized, other than by directly involving the agent who possesses it, does not necessarily entail referring to knowledge which cannot be represented formally as private information, and so cannot be contracted upon. In fact, from an economic point of view, the critical point is how to verify *ex post* the actions undertaken on the basis of *ex ante* informational differences. At the same time, since the aim is to assess the influence of private information on market exchange, it becomes necessary to analyze allocation mechanisms which are alternatives to impersonal allocation through the market. To do this, it is first of all necessary to analyze the methods of contractual agreements which provide an alternative to the contingent contract. It is essential, therefore, to determine to what degree the *ex ante* informational differences are reduced, or disappear, *ex post* in a more complex, but probably more interesting context than the Walrasian one. This involves regarding the market no longer solely as an allocative mechanism, but as an institution in which exchange, both of goods and information, takes place through several contractual forms.

This outline of the interpretation of how the competitive market works may be considered an elaboration of the Hayekian view of the market as an institutional mechanism through which actions undertaken in a decentralized system are co-ordinated. For Hayek, the co-ordination of economic actions depends not only on the impersonal working of the prices system, but also on alternative exchange activities, whose emergence may bring about conventional behavior, and whose aggregate outcomes cannot be considered as the intended result of the actions undertaken by individuals alone. In his attempt to return to the original meaning of the market mechanism – the meaning introduced by Smith and obscured by Walrasian developments – Hayek emphasizes the role of the price system as the most effective means of conveying dispersed information. He also stresses the impossibility of interpreting the general equilibrium of the economy simply as the sum of individual behavior. In his view, the exchange of information is achieved through a process which is far more complex than that which is usually considered. In this process, forces which are different from those of Walrasian competition come into play: imitative behavior, rules and traditions. It is the complexity of these economic activities that led Hayek to believe that equilibrium theory was not capable of providing a convincing formal representation of the competitive market mechanism.

As I have tried to show in this paper, it is mainly for this reason that, in his

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18 This viewpoint has been held by Klausinger (1990) and Moss (1994), among others.

criticism of "pure economic theory" from the point of view of the philosophy of the social sciences, Hayek came to assert that co-ordination through the market could give rise to states of "spontaneous order" in the economy, rather than to actual general equilibria. If seen from this perspective, the approach followed by certain developments in the economics of information is probably the first partial attempt by "pure economic theory" to address Hayek's contention on this point.

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