Economic Organization in the Knowledge Economy
Some Austrian Insights

Foss, Nicolai Juul

DANISH **R**ESEARCH **U**NIT FOR **I**NDUSTRIAL **D**YNAMICS

DRUID Working Paper No 01-07

Economic Organization in the Knowledge Economy: Some Austrian Insights

by

Nicolai J. Foss

May, 2001

Economic Organization in the Knowledge Economy: Some Austrian Insights

by

Nicolai J Foss

LINK
Department of Industrial Economics and Strategy
Copenhagen Business School
Howitzvej 60; 2000 Frederiksberg; Denmark
njf.ivs@cbs.dk

Revised draft, 19 April, 2001

Prepared for the Third Annual Conference of the *Association des Historiens de la Tradition Economique Autrichienne,* Pisa – Lucca, 24 – 26 May 2001

Abstract

I critically discuss recent claims about economic organization in the emerging "knowledge economy," specifically that authority relations will tend to disappear (or at least become radically transformed), the boundaries of the firm will blur, and coordination mechanisms will be much more malleable than assumed in organizational economics, resulting in various "new organizational forms." In particular, the price mechanism will be used inside hierarchies to a much greater extent. In order to obtain an analytical focus on the knowledge economy, I assume that it may be approximated by "Hayekian settings" (after Hayek 1945), that is, settings in which knowledge is distributed and where knowledge inputs are relatively more important in production than physical capital inputs. I then argue, drawing on organizational economics as well as Mises' insights in property rights and comparative systems, that the presence of Hayekian settings does not mean that authority will disappear, etc., although economic organization will in fact be affected by the emergence of the knowledge economy. This suggests that Austrian economics has an important contribution to make to the study of economic organization.

Keywords: Economic organizations, Austrian economics
JEL Classification: D21, D23, M13

(ISBN 87-7873-106-2)

I. Introduction

To Austrian economists, much recent debate in business administration must seem like re-inventing, or re-cycling, basic Austrian insights and perspectives, usually without giving much or any credit to their Austrian progenitors.[1] This is also the case of much recent work on economic organization, particularly as this relates to organizing in the so-called "knowledge economy." Whatever we may think of this journalistic concept (cf. Leadbetter 1999), it arguably does capture real tendencies and complementary changes. These include, on the organization side, a shrinking of corporate boundaries and new ways of structuring these, falling firm sizes, and a flattening of internal organization (e.g., Mendelsson and Pillai 1999; Helper, MacDuffie and Sabel 2000)); increased differentiation of tastes on the demand side (e.g., Milgrom and Roberts 1990); acceleration of innovation and technological development on the supply side (D'Aveni 1994); and changes in the composition of labor on the input side (Tomlinson 1999).

A number of those who have addressed economic organization in the knowledge economy have drawn upon Austrian — more precisely, Hayekian — ideas on the need for decentralization fostered by the presence of dispersed knowledge (Ellig 1993, 1997; Ellig and Gable 1993; Cowen and Parker 1997; Foss 1999, 2000; Jensen and Meckling 1992; Jensen and Wruck 1994; Ghoshal, Moran and Almeida-Costa 1995; Hodgson 1998). Briefly, the overall conclusions that emerge from a number of these studies are that that hierarchy and planning methods are as problematic inside firms as they have proved to be outside firms, that firms need to harness the ability of markets to utilize, exchange and build information rapidly in response to changing contingencies, and that extensive delegation of decision rights and the use of high-powered incentives to support this are imperative. It is easy to see how this may imply a skeptical attitude to the analytical dichotomization between planned firms and unplanned markets, present not only in Coase (1937) (and most of post-Coasian organizational economics), but also in central Austrian contributions such as Mises (1936, 1944, 1949) and Hayek (1973).

The present paper link up with recent applications of Austrian ideas to issues of organizational design. In particular (but not exclusively), I focus on internal organization issues. Like a number of recent contributors, I discuss the implications for internal organization of the Hayekian notion that the dispersed and subjective character of relevant knowledge is a strongly binding constraint on the use of planned coordination (Jensen and Meckling 1992; Gable and Ellig 1993; Jensen and Wruck 1993; Ghoshal, Moran and Almeida-Costa 1995; Cowen and Parker 1997).

---

[1] For example, ideas on creative imagination (Shackle 1972), competition as rivalry (Hayek 1948; Mises 1949), tacit knowledge (Hayek 1948), and entrepreneurship (Mises 1949; Kirzner 1973) have become increasingly prevalent in firm strategy research (e.g., Hamel and Prahalad 1994; D'Aveni 1994; Hunt 2000). The recent "resource-based view" in strategy research (Foss 1997) has even been characterized as an "Austrian theory of strategy" (Jacobson 1992). (However, see Lewin and Phelan (2000) for a discussion of the presumed Austrian character of the resource-based view). Many contributions to the related "capabilities view" (Langlois 1992; Foss 1997) or the "knowledge-based view" (Nonaka and Takeuchi 1995; Grant 1996) bear a strong Austrian imprint.

However, I argue that — contrary to some of these contributors — it does *not* follow that firms should emulate markets as far as possible. In his critique of market socialism, Mises (1949) pointed to the folly of "playing markets," and I draw on his overall argument that bringing coordination mechanisms characteristic of market organization into a planned organization is inherently problematic. I also draw on Mises' (1949) related insight that the mixed economy is inherently unstable, as well as on his insights in property rights and ownership (Mises 1936, 1949; Foss 1994a). In modern parlance, Mises argued that the economic institutions of capitalism are strongly complementary so that (unhampered) capitalism is a stable system, consisting of interlocking elements, such that changes away from pure capitalism will result in serious allocative inefficiencies. I use this fundamental notion to argue that firms are also systems of complementary elements and that this fact places constraints on the extent to which firms may be made "market-like." In particular, I argue with Mises that "[t]he function of the entrepreneur cannot be separated from the direction of the employment of factors of production for the accomplishment of definite tasks. The entrepreneur controls the factors of production" (Mises 1949: 306). The "direction" and "control" undertaken by "the entrepreneur" is qualitatively different from allocation by means of the price mechanism, since it relies on authority that is backed up by the entrepreneur's ownership of the alienable (non-human) means of production. In other words, Misesian arguments are used to criticize arguments derived from Hayekian insights that firms should emulate markets to the largest possible extent. In a sense, Misesian arguments resurrect the Austrian and Coasian notion that markets and hierarchies are indeed different mechanisms for resource allocation.[2]

II. The Knowledge Economy: a Challenge to Economic Organization

The concept of the "knowledge economy" is used in a loose sense to refer to the overall tendencies that many industries become increasingly "knowledge-intensive," that an increasing share of the workforce is constituted by "knowledge workers" (Tomlinson 1999), and that commercially useful knowledge becomes increasingly distributed and needs to be accessed from several sources, many of which lie outside the boundaries of firms (Liebeskind et al. 1995; Matusik and Hill 1998). Although they have so far had little to say about it, economists should face the challenge of examining economic organization in the context of the emerging knowledge economy. A fundamental reason is that recent discussion goes right to the heart of the crucial and perennial issues in the theory of economic organization, challenging us to rethink issues such as, What are the limits to resource allocation by means of authority? What do we mean by authority? What defines the boundaries of firms? How do we distinguish an independent contractor from an employee? The need to revisit such fundamental questions is prompted by the numerous writers who claim that the knowledge economy will fundamentally change the answers we provide, and that traditional answers are no longer valid for the knowledge economy (see, e.g., contributions to Myers 1996; Prusak 1997). The following section presents a brief review of these arguments.

---

[2] Foss (1994b) argued that in many important respects, the Austrians anticipated ideas that have become prominent in the modern economics of organization. The arguments developed in the present paper go beyond those in Foss (1994b) by putting more stress on Misesian arguments. Klein (1996) is an application of the Misesian calculation argument to the issue of the boundaries of the firm, and Klein and Klein (2000) treat corporate governance issues in a Misesian manner.

Recent Claims about Economic Organization in a Knowledge Economy: Review

Although a number of fields and sub-fields are involved in the ongoing discussion of efficient organization in the context of the emerging knowledge economy, some distinct themes are discernible. Overall, a consensus seems to be emerging that tasks and activities in the knowledge economy need to be coordinated in a manner that is very different from the management of traditional manufacturing activities, with profound transforming implications for the authority relation and the internal organization and boundaries of firms. For example, Cowen and Parker (1997) explain that

> Market changes are moving manufacturing farther and farther away from steady-state, low variety, long-batch production runs, relevant to Taylorist methods, to high variety and small runs … Organizations are adopting new forms of decentralization to cope with the instability, uncertainty, and pace of change of the market-place … In cluster of network working, employees of undifferentiated rank may operate temporarily on a certain task or tasks in teams. The clusters are largely autonomous and engage in decentralized decision-making and planning … They are conducive to individual initiative ('intrapreneurship') and faster decision-taking. They facilitate organizational flexibility.

A number of writers also claim that not only the internal organization of firms but also their boundaries will be profoundly affected by the emerging knowledge economy. Specifically, because of the growing importance in knowledge-intensive industries of being able to access knowledge from multiple sources, knowledge-based networks (Harryson 2000) increasingly become the relevant dimension for understanding the organization of economic activities. Such networks typically cut across the legal boundaries of the firm. Networks, so the argument goes, are particularly useful organizational arrangements for sourcing and transferring knowledge because the costs of pricing knowledge (in a market) or transferring it (in a hierarchy) (Powell 1990: 304; Liebeskind et al. 1995: 7) often exceed the costs of transmitting knowledge within an informal network.

Furthermore, the increased reliance on knowledge networks tends to erode authority-based definitions of the boundaries of the firm, because authority increasingly shifts to expert individuals who control crucial information resources and may not be employees of the firm. As Zucker (1991: 164) argues:

> While bureaucratic authority is by definition located within the firm's boundaries, expert authority depends on the information resources available to an individual, and not on the authority of office. Thus, authority may be located within the organization … but when an external authority market can provide information that leads to greater effectiveness, then authority tends to migrate into the market.

To the extent that important knowledge assets are increasingly controlled by employees ("knowledge workers") themselves, traditional authority relations are fading into insignificance. This is partly a result of the increased bargaining power on the part of knowledge workers (stemming from the control over critical knowledge assets), and partly a result of the increasingly specialist nature of knowledge work (Hodgson 1998). The specialist nature of knowledge work implies that principals/employers become ignorant about (some of) the actions that are open to agents/employees, thus making the exercise of authority through direction increasingly inefficient. The combined effect of the increased importance of knowledge assets that are controlled by knowledge workers themselves and of the increasingly specialist nature of knowledge work is to wreck the traditional economist's

criterion of what distinguishes market transactions from hierarchical transactions (Zingales 2000). Thus, whether direction by means of order giving (Coase 1937; Simon 1951; Williamson 1985; Demsetz 1991) and backed up by the ownership of alienable assets (Hart and Moore 1990) obtains or not is increasingly irrelevant for understanding the organization of economic activities in a knowledge economy (Grandori 2001).

Finally, with respect to theories rather than phenomena, a number of writers are quite explicit that the advent of the knowledge economy increasingly questions the relevance of Coasian organizational economics, with its rather strong dichotomization between allocation of resources by means of authority and by means of prices (e.g., Boisot 1998; Helper, MacDuffie and Sabel 2000). Thus, Cowen and Parker (1997: 15; *emphasis in original*) argue that

> … firms and markets are not exactly the same, but rather they differ in empirical terms. They refer to different means of organizing economic activity, albeit means that *do not differ substantially in kind*. … This … view does not seek to find a clear-cut distinction between firms and markets. Rather the difference between the firm and the market as a resource allocator involves what might more usefully be viewed as subtle differences relating to contracting.

Much of the following is essentially an argument that, contrary to Cowen and Parker, more is involved in the choice between firms and markets than "subtle diffferences relating to contracting." However, before this argument can be presented, it is necessary to consider the Hayekian insights that lead some to conclude that there is not much of a difference between firms and markets.

III. Interpretation: Organizing in Hayekian Settings

Hayekian Knowledge Settings

It is no coincidence that so many of those who write on economic organization in the emerging knowledge economy cite Hayek's work, particularly his 1945 paper, "The Use of Knowledge in Society." This is because the basic propositions (or generalizing statement) about the role of knowledge in production that drive recent debate about organization in the knowledge economy have a strongly Hayekian flavor. It is possible to discern at least two such propositions in recent debate. When these two propositions are met, I shall say that "Hayekian settings" obtain. *The first one* is a claim that because of the increased need for diverse, specialized knowledge in production, commercially relevant knowledge is becoming increasingly distributed or dispersed in sense of Hayek (1945) (e.g., Ghoshal, Moran and Almeida-Costa 1995; Hodgson 1998; Coombs and Metcalfe 2000). "Distributed" or "dispersed" knowledge" is knowledge that is not possessed by any single mind and which may be private, fleeting, tacit and subjectively held (O'Driscoll and Rizzo 1985) — but which it may nevertheless be necessary to somehow mobilize (e.g., through a price system) for the carrying out of a productive task or a complex of such tasks, as, of course, Hayek (1945) famously argued. *The second proposition* that appears to be at the heart of much discussion of organization in the knowledge economy is that because of the increased importance of sourcing specialist knowledge, knowledge assets controlled by individual agents ("knowledge workers") are becoming increasingly important in production (e.g.,

Boisot 1998; Hodgson 1998) in the sense of accounting for a greater part of the value-added of goods.

Economic Organization in Hayekian Setting

In the interpretation adopted here, the two Hayekian propositions above drive recent debate on economic organization in the knowledge economy in the specific sense that the phenomena they describe are claimed to causally produce a host of other phenomena that relate to economic organization (Hodgson 1998). For analytical purposes, I interpret recent debate to assert that the phenomena of knowledge becoming increasingly dispersed and important in production influence authority relations, the boundaries of the firm and the ways in which various mechanisms of coordination may be combined inside firms in regular and predictable ways.

Specifically, in the emerging knowledge economy, as approximated by the two Hayekian propositions above, traditional authority relations vanish (Zucker 1991; Hodgson 1998); the boundaries of firms blur because of the increasing importance of knowledge networks that transcend those boundaries; and coordination mechanisms (i.e., authority, norms, teams, prices, etc.) will increasingly be combined in new, innovative ways — producing what is often referred as "new organizational forms." This final claim implies that organizational forms do not come in a few rigid, discrete forms, but that coordination mechanisms can be combined in a multitude of ways (e.g., Grandori 1997; Helper, MacDuffie and Sabel 2000). In particular, firms may adopt coordination mechanisms that we normally think of as characteristic of the market rather than of planned coordination, in particular pricing, entrepreneurial control over resources, and high-powered incentives (Miles et al. 1997). In the following, I present and discuss some of these arguments. It is convenient to begin with a discussion of the meaning of authority.

Authority: Coase and Simon

Although Max Weber had much interesting to offer on the topic of authority in the beginning of the twentieth century, it was not until Coase (1937) that an economics conceptualization of authority was offered. Coase's understanding, supplemented with a later contribution by Simon (1951), still provides most economists' working definition of authority. Moreover, Coase initiated the tendency to see the employment contract and the authority relation as the defining characteristic of the firm. In Coase (1937), the employment contract is explained as "… one whereby the factor, for a certain remuneration (which may be fixed or fluctuating) agrees to obey the directions of an entrepreneur *within certain limits*. The essence of the power is that it should only state the limits to the powers of the entrepreneur. Within these limits, he can therefore direct the other factors of production" (idem.: 242). This contractually agreed upon right to "direct the other factors of production" is, of course, authority. A later paper by Herbert Simon (1951) provided a formalization of Coase' notion of the employment relationship and a clarification of the notion of authority, which is defined as obtaining when a "boss" is permitted by a "worker" to select actions, $\mathbf{A}^0 \subset \mathbf{A}$, where $\mathbf{A}$ is the set of the worker's possible behaviors. More or less authority is then simply defined as making the set $\mathbf{A}^0$ larger or smaller.

Some Puzzles Relating to Authority

The notion of authority in the context of an employment contract as the defining characteristic of the firm raises several puzzles. In the present context, four such puzzles are particularly relevant:

1. What is ultimately the source of the employer's authority? In other words, why exactly is it that the employee accepts to be directed when non-alienable assets (i.e., human capital) cannot be traded?
2. What happens to the notion of authority in the sense of Coase and Simon if the employer does not possess full knowledge of the employee's action set (i.e., the actions that he can take when uncertainty is resolved), so that the employee can take actions about which the employer has no knowledge?
3. What happens to the notion of authority if the employee is better informed than the employer with respect to how certain tasks should (optimally) be carried out? In the works of Coase and Simon, there is an implicit assumption that the employer is at least as well informed, and presumably better, about the efficiency implications of alternative actions.
4. What happens to the notion of authority if employees control knowledge assets that are "within their heads" and which may give them substantial bargaining power?

The latter three questions concern the limits of authority in Hayekian settings, while the first question asks about the sources of the employer's bargaining power over the employee. Only the first question has been given extensive treatment in the economics of organization. In fact, it has been one of the classic points of contention in a long-standing debate.

The Sources of Authority

Thus, to writers such as Alchian and Demsetz (1972) and Cheung (1983), it is not meaningful to assume that an employer can force an employee to do what the employer wants in the absence of coercion. As Alchian and Demsetz (1972) argue, an implication of this view is that the distinction between the authority-based and the price-based modes of allocation emphasized by Coase (1937) is superficial; there is no economic difference between "firing" one's grocer and firing one's secretary and therefore. In fact, it does not make such sense to speak of firms as well-defined entities at all (Cheung 1983). Note that this "nexus of contracts" position is remarkably close to the position that in a knowledge-based economy, the firm/market boundary is unclear and the notion of authority elusive at best.[3]

The work of Oliver Hart and others (Hart 1995, 1996; Hart and Moore 1990) — called the incomplete-contracts literature — provides a response to the Alchian and Demsetz/Cheung view. To some extent, it does so by changing the terms of the debate: Whereas Weber, Coase, Simon, and others focused on direct authority over (non-alienable) human assets, the incomplete contracts literature rather explain authority over human assets as something that is indirectly acquired through ownership of alienable assets. Two kinds of assets are distinguished, namely alienable (i.e., non-human) and non-alienable (i.e., human) assets. The basic distinction between an independent contractor and an employee, that is, between an inter-firm and an intra-firm transaction, now turns on who owns the alienable assets that an agent (whether independent or employee) utilizes in his work. An independent

[3] And see Cowen and Parker (1997) for a statement of the Alchian and Demsetz/Cheung view in this context.

contractor owns his tools etc., while an employee does not. The importance of asset ownership derives from the fact that the willingness of an agent to undertake a *non-contractible* investment (say, exertion of effort or investment in human capital), which is specific to the asset, depends on who owns the asset. The parties to a relation — whether customer and grocer, or employer and employee — are seen as being in a bargaining situation, each having an outside option. Given this, the division of the surplus from the relation will depend on who owns the alienable assets in the relation, since the pattern of ownership will influence the parties' outside options.[4] In turn, the expectation of this division feeds back into the investments that the parties are willing to make. Efficiency considerations then suggest that authority (i.e., ownership to the alienable assets) should be allocated to the agent who makes the most important (non-contractible) relation-specific investment.

Of course, the incomplete contracts approach is a neoclassical approach, not an Austrian one. However, some interesting aspects in it make it complementary to a Misesian perspective, notably the emphasis on ownership as backing up authority, the argument that the boundaries of the firm lies where the entrepreneur's ownership of alienable assets stops, and the implication that the entrepreneur assumes his directing role because his inputs to the venture are those that matter the most for the total monetary surplus. I shall rely on these basic ideas in criticizing some of the claims put forward by writers on economic organization in the knowledge economy.

The Hayekian Challenge to Authority

However, we are still left with puzzles 2) to 4). The incomplete contracts perspective does not provide an immediate answer to these. They are of a different nature, since they do not directly concerns the issue of the sources of authority; rather, they are about the reach and efficiency of authority in Hayekian settings. In one interpretation, the planning problems posed by Hayekian distributed knowledge have become increasingly pressing for firms (see Cowen and Parker 1997). Thus, because of the increased importance of specialist workers and the increased knowledge-intensity of production, coping with the problem posed by Hayekian distributed knowledge has moved from being a problem for socialist managers and *dirigiste* bureaucrats to also being a problem confronted by managers of (at least large) firms in capitalist economies. However, the fact that firms exist is *prima facie* evidence that they can somehow cope with the problem and/or that there are offsetting benefits of firm organization.[5]

Distributed Knowledge and Delegated Rights

How may the Hayekian knowledge-problem be handled in firms? One way is to *suppress* distributed knowledge as far as possible by discouraging local initiative, indoctrinating employees harshly, and operating with rigid routines and operating procedures. In a dynamic economy, this is, however, bound to lead to disaster. Something

---

[4] For example, if the employer owns all the alienable assets, the employee can still quit if he dislikes the employer's orders (as in Alchian and Demsetz), but he cannot take the assets with him, and the employer can ensure that if the employee leaves, somebody else can take over the job.

[5] Such as the superior ability of firms to organize transactions characterized by high-levels of relation-specific investments (Williamson 1985, 1996; Grossman and Hart 1986; Hart and Moore 1990).

else must be done. As Mises (1949: 303) emphasized, "… entrepreneurs are not omnipresent. They cannot themselves attend to the manifold tasks which are incumbent upon them," so that coping with distributed knowledge leads in the direction of decentralization (cf. also Hayek 1945: 83-84), through delegation of decision rights to managers (Mises 1949: 305). Mises also recognized that delegation leads to agency problems, but argued that the system of double-entry bookkeeping and other control measures may partly cope with such problems. Thus, in the Misesian scheme, an organizational equilibrium obtains where decision rights are delegated in such a way that the benefits of delegation in terms of better utilizing local knowledge are balanced against the costs of delegation in terms of agency losses (as in Jensen and Meckling 1992). This provides a useful perspective on many of those new organizational forms that are argued to be characteristic of the knowledge economy (cf. Cowen and Parker 1997), such as team-organization, "molecular forms", and other manifestations of organizational delegation and decentralization: These are prompted by a market-driven pressure to delegate decision rights (e.g., to better serve customer preferences) and structure reward schemes in such a way that optimal tradeoffs are reached.

Hayekian Settings and Economic Organization

However, while an Austrian perspective is useful for understanding why firms adopt team-organization, etc., we are still left with the puzzle why such teams are organized *inside* firms, being subject to the exercise of authority. Moving teams out of firms would appear to yield net benefits, since incentives would be further strengthened. Adding to the puzzle is that authority in the sense of Coase or Simon appears to play at best a very limited role under Hayekian dispersed knowledge. This is because the Coase/Simon notion of authority assumes that a directing principal is at least as knowledgeable about the relevant tasks as the agent being directed. The ownership-based notion of authority developed by Hart also seems to play only a limited role under Hayekian distributed knowledge. This is because the assets that in Hart's scheme confer authority are physical assets.

However, as numerous writers have emphasized, an important aspect of the knowledge economy is precisely that physical assets are of strongly waning importance (e.g., Boisot 1998). Of course, the implication is that ownership over such assets is an increasingly ineffective source of bargaining power and that, therefore, authority must wane as bargaining power increasingly becomes more symmetrically distributed over the owners of knowledge assets. Since the boundaries of the firm are (also) defined in terms of legally recognized ownership to the firm's alienable, primarily physical, assets, and since such assets are of declining economic and commercial importance, it is obvious that the very notion of the firm's boundaries is becoming increasingly fuzzy, or perhaps even irrelevant. Finally, because authority declines in importance as knowledge becomes distributed and knowledge inputs increase in importance, resort to other coordination mechanisms is necessary. Thus, firms increasingly rely on high-powered incentives, implement employee stock-ownership programs, invest in building "corporate cultures," try to price corporate resources to the largest possible extent, etc. An outcome of this is the emergence of "new organizational forms." The theoretical implication is that various mechanisms for coordinating resources are combine to a much larger extent than hitherto assumed in, for example, organizational economics, where economic activities are normally assumed to be organized across three discrete governance structures, firms, markets, and hybrids (e.g., Williamson 1996).

In sum, arguments can be made that Hayekian settings, where knowledge is distributed and knowledge inputs are more important than knowledge inputs, present real

problems for the exercise of authority in firms, make the boundaries of firms blur, and remove many of the constraints on the malleability of coordination mechanisms. The following section discusses the reach of these arguments.

IV. Discussion

In this section, I assume that Hayekian settings obtain and discuss the implications of such settings for the Coasian themes of authority, the boundaries of the firm, and the combinability of coordination mechanisms. The underlying perspective is Misesian, in the sense that I shall throughout assume the existence of a speculating entrepreneur who is ultimately in charge of the business venture in the sense that he determines "… the general plan for the utilization of resources" (Mises 1949: 303), hires the managers and "technicians, i.e., people who have the ability and skill to perform definite kinds and quantities of work (idem.), determines "… the expansion and contraction of the size of the business and its main sections" as well as "the enterprise's financial structure" (1949: 307), and acquires ownership of the firm's alienable assets. Nobody denies that in the emerging knowledge economy, there will still be a need for such enterprising agents. On the contrary, many recent writings on the knowledge economy very strongly stress entrepreneurship (e.g., Miles et al. 1997). What is being claimed is rather that the entrepreneur will no longer be able to exercise much authority, that the boundaries of his venture will become ill-defined (if not in a formal, legal sense, then in an economic and commercial), and that his venture can rely on all sorts of combinations of coordination mechanisms, in particular that he can offer employees incentives that in terms of their strength (i.e., the way in which they link effort and rewards/punishment) are very close to the incentives provided under market contracting, effectively mimicking the effects of market pricing. I discuss the three issues of authority, boundaries and malleability of coordination mechanisms *seriatim*.

Authority in Hayekian Settings

In this section, the strategy is to examine the role of authority in Hayekian settings. Since I later discuss the importance for economic organization of the distinction between physical and knowledge assets, I here only concentrate on the distributed knowledge aspect of Hayekian settings. One way of doing is to focus on "hidden knowledge" (Minkler 1993) in relations between a principal (e.g., the Misesian entrepreneur) and an agent (e.g., a hired manager). That is, it will be assumed that the problem facing a principal is not just that he is uninformed about what state of nature has been revealed or of the realization of the agent's effort (i.e., hidden information), as in the usual agency model (Holmström 1979), but that the agent's knowledge is superior to that of the principal with respect to certain production possibilities (i.e., hidden knowledge). The principal may be ignorant about some members of the set of possible actions open to the agent, or the agent may be better informed than the employer with respect to how certain tasks should (optimally) be carried out, or both. As I shall argue, it is possible to explain the presence of authority in such a setting. I discuss them under the headings of "the need for urgent coordination," "decisive information," "economies of scale in decision-making,", and "defining incentive systems."

The Need for Urgent Coordination. While Hayek (1945) did much to identify the benefits of the price system in the context of alienable property rights in coping with distributed knowledge and unexpected disturbances, he arguably neglected those situations where efficiency requires that adaptation be "coordinated" rather than "autonomous"

(Williamson 1996). Coordinated adaptation or action may be required when actions or activities are complementary (Milgrom and Roberts 1990; Kirsten Foss 2000), for example, when it is important to make *some* urgent choice (possibly highly inefficient), because doing nothing is worse. In such cases, it may be better to have somebody pick a strategy and make everybody play this strategy, if the inefficiencies from picking a bad strategy are smaller than the inefficiencies from delaying a coordinated solution. In the context of a specific model of this trade-off, Bolton and Farrell conclude that "… the less important the private information that the planner lacks and the more essential coordination is, the more attractive the central planning solution is" (1990: 805). Moreover, the decentralized solution performs poorly if urgency is important. Centralization is assumed to not involve delay and therefore is a good mechanism for dealing with emergencies, a conclusion Bolton and Farrell argue is consistent with the observed tendencies of firms to rely on centralized authority in cases of emergencies.

Decisive Information. Even under distributed knowledge, where the centralized decision-maker per definition does not possess (at least some) local information, he may in many cases still hold the information that is *decisive*. Loosely, information is (strongly) decisive if — in a setting involving many cooperating individuals — a decision can reasonably be made on the basis of this information without involving other pieces of information (Casson 1994). According to Casson (1994), the extent to which a problem involving the knowledge of several individuals has decisiveness features and the cost at which knowledge can be communicated helps to explain the allocation of decision rights. The general principle is that decision rights will tend to be concentrated in the hands of the individual who has access to the decisive information, and particularly so the more costly it is to communicate this information. This provides a further argument for authority under hidden knowledge. If the knowledge possessed by, for example, managers is not decisive, if the knowledge possessed by the entrepreneur is decisive, and if it is costly to communicate the entrepreneur's knowledge, then overall decision rights should be concentrated in the hands of the entrepreneur, that is, he should assume ultimate authority in the firm.

Economies of Scale in Decision-Making. Demsetz (1988) argues that economies of scale in managing are a neglected factor in the explanation of the existence of firms and the understanding of authority. However, he does not explain the underlying reasoning. However, the relevant economies may relate both to managing the internal relations between agents inside the firm and managing relations to outside agents (customers, suppliers, government agencies) (Hermalin 1998). Not only may there be scale economies in such activities; there may also be substantial learning economies. Other agents may be happy to let a central agent incur the effort costs of negotiating, learning about potential suppliers, etc., and compensate him accordingly.

Defining Incentive Systems. It is hard to deny to that Hayekian settings pose special problems for the use of monitoring mechanisms and incentive pay (Minkler 1993; Aghion and Tirole 1997; Foss 1999). Minkler (1993: 23) argues that "… if the worker knows more than the entrepreneur, it is pointless for the entrepreneur to monitor the worker," which implies that to the extent that monitoring is a precondition for the exercise of direction, using the authority mechanism also seems to become "pointless." However, even under hidden knowledge, there may still be a role for authority. For example, even under hidden knowledge the principal may be able to form conjectures of the financial results that result from the agent's activities he can check whether these conjectures are actually confirmed using the control systems of the firm. Both Knight (1921), discussing business "judgment"

and Mises (1949: 303), discussing the entrepreneur delegating responsibilities to managers, clearly allowed for this possibility. None of them assumed that entrepreneurs would have full knowledge of their managers' action set; still, they did assume that the entrepreneur can rationally delegate decisions to managers and control these. Hidden knowledge does not imply that subjective performance measurement becomes impossible. In fact, it may be conjectured that the more we depart from simple settings where employees are very easily monitored, and the more complicated the control problem becomes, the more likely is it that the entrepreneur will choose to rely on multiple incentive instruments to influence employee behavior (Henderson 2000). In a dynamic economy, maintaining coherence between such instruments may be a recurrent task. Economies of scale in this task may dictate that this activity is centralized. Moreover, centralization is required to the extent that externalities arise when the instruments are controlled by separate firms and transaction costs hinder the internalization of these externalities. Both arguments point towards the centralization of decision rights

To sum up, it has been argued that it is possible to give efficiency explanations of authority in the context of Hayekian settings, approximated by hidden knowledge. This is not to say that authority relations will remain unaffected by the arguably increasing importance of Hayekian settings. To be sure, authority as understood by Coase and Simon, as a relation in which the principal has superior knowledge and can observe all contingencies that require a response by some employee, is an increasingly unrealistic conceptualization of authority. Actually, this kind of authority was already too descriptively narrow with respect to the business firms that Mises (1949) discussed. Mises clearly recognized that in many firms decision rights are allocated by the entrepreneur (and the board of directors) to lower levels, presumably in order to better cope with distributed knowledge, an insight that is not present in Coase (1937) and Simon (1951). However, Mises also understood that such rights are circumscribed in an attempt to cope with the control problem that follows from delegation.[6] Thus, decision rights are delegated in firms, but they are delegated as means to an end (Hayek 1973); their use is monitored (Jensen and Meckling 1992), and top-management reserves ultimate decision rights for itself (Baker, Gibbons, and Murphy 2000). This suggests that authority in the sense of direction and centralized decision-making — which, as Mises emphasized, does not require detailed knowledge about a subordinate's knowledge or available actions — may persist in Hayekian settings. Per implication, even in "knowledge-based" firms, there may be a need for centralized coordination. As I shall argue next, when there is such a need, it is often efficient to centralize ownership to alienable assets. In turn, this suggests that centralized coordination is a feature of firms rather than markets.

Ownership and the Boundaries of Firms

In the previous section, I did not say much about what backs up authority. I did, however, hint that ownership would play a key role; the purpose of the present section is to go more into ownership issues, and therefore the issue of the boundaries of the firm. The argument that will be critically discussed is that, as knowledge assets become relatively more important in production, the boundaries of firms will blur, at least to the extent that these are defined in terms of legally recognized ownership of the firm's alienable assets.

---

[6] For example, the right to use an asset in certain ways may be delegated; however, it is understood that that right does not entail the right to, for example, use the asset in the service of a competitor firm.

It is possible to use the incomplete contracts framework (Grossman and hart 1995; Hart and Moore 1990; Hart 1996), summarized very briefly earlier, to get an understanding of the implications of knowledge assets for the boundaries of the firm. Recall that in this approach, asset ownership is central because it provides the bargaining lever that backs up authority, and authority may have important efficiency implications, as argued earlier. I argue that when there is a need for centralized coordination, efficiency considerations often suggest a need for also concentrating asset ownership. The key to this argument is to introduce knowledge assets explicitly. In fact, it is possible to dispense entirely with physical assets, and discuss a purely knowledge-based firm.[7]

For simplicity, assume that two agents interact and that one of these, the entrepreneur, owns a knowledge asset that is "inside his head" (e.g., an entrepreneurial idea) and the other agent, the scientist, owns the only other asset in the relation which we may assume to be a patent. Both assets are necessary to the create value in the relation, and they are (strictly) complementary, so that the one is of zero value without the other. It is prohibitively costly to communicate the knowledge embodied in the entrepreneurial idea from the entrepreneur to the scientist, so it is effectively non-alienable. Moreover, it is not possible to write a comprehensive contract, governing the use of the assets in all contingencies. Given this, we may ask who should own the (alienable) patent which — in terms of incomplete contracts approach — is the same as asking who should own the firm.

In this setting, if the entrepreneur makes an effort investment, that is, elaborates on his idea and creates extra value, the scientist can effect a hold-up on the entrepreneur, since the latter needs access to the patent to create value (and the contract is incomplete). Of course, the reverse also holds, so that if the scientist makes an effort investment, for example, makes a spin-off patent, the entrepreneur can hold-up the scientist by threatening to withdraw from the relation. One can show (details in Hart and Moore 1990 and Brynjolfsson 1994) that because of the externality problem that the hold-up threat creates, every agent underinvests; specifically, each party invests to the point where the marginal cost of effort investment equals ½ of the marginal value (because they are assumed to split the extra surplus 50 : 50). Suppose now that the entrepreneur owns *both* the patent and the entrepreneurial idea. This will strengthen the entrepreneur's incentives (the scientist cannot hold him up anymore) and it will leave the scientist's incentives unaffected. Therefore, this ownership arrangement should be chosen.

The conclusion is that it *is* possible to speak of the boundaries of the firm in terms of ownership — even in a situation where all relevant productive assets are knowledge assets. However, this does not yet demonstrate the point made earlier, namely that concentration of coordination tasks produces a need for concentration of ownership. We can address this issue, however, by assuming that one of the agents, the entrepreneur, have decisive information (in the sense discussed earlier). While efficiency may require that this agent should have decision rights amounting to authority (as argued earlier), should he also be an owner?

Consider a bigger "knowledge-based" firm where there is a group of scientists who each owns a patent. The entrepreneur, who is again equipped with a non-alienable entrepreneurial idea in which he may invest further, aggregates information from the messages of the scientists and directs their efforts. His knowledge is decisive in the sense

---

[7] This is because the crucial issue is (contrary to the thrust of some contributions, e.g., Boisot 1998) not whether assets are material or immaterial, but whether they are alienable or non-alienable.

that without it, all actions of the other agents produce zero value. The entrepreneur may improve on this decisive knowledge. Each agent needs access to his own patent and to the entrepreneur's direction in order to be productive. Given these assumptions, we again have the hold-up problem: Any one of the scientists can hold up the entrepreneur on his investment, leading the entrepreneur to choose inefficient investment levels. However, if the entrepreneur is given ownership to the alienable assets, that is, the patents, the hold-up problem disappears. Thus, this ownership arrangement should be chosen.

The Combinability of Coordination Mechanisms

Earlier paragraphs have established that it is possible to give efficiency reasons for authority as well as legal/ownership-based notions of the boundaries of the firm in Hayekian settings. Moreover, it was argued that there is a connection between authority and ownership, and that this link also exists in Hayekian settings. This prompts the question of whether there are other necessary "links" between organizational elements.

At this stage, it is pertinent to turn once more to Mises' work. As he (1949: 709) explained, there are inherent contradictions involved in "playing market," that is, introducing pricing in the context of hierarchy. With reference to various socialist schemes of his day that tried to preserve some market relations while eliminating capital and financial markets, Mises argued that these schemes would be unworkable. To an important extent this is a matter of the sheer impossibility of having rational calculation when crucial markets are eliminated. But Mises also placed much emphasis on property rights and ownership issues (particularly Mises 1936). Thus, he was aware that the concentration of ultimate decision-making rights and responsibilities, and therefore ownership, in the hands of a central planning board would dilute the incentives of socialist managers. While planning authorities could (and according to the schemes of the day, should) delegate rights to make production and investment decisions to managers, these rights could not be used efficiently First, since managers couldn't be sure that they would not be overruled by the planning authorities, they were not likely to take a long view, notably in their investment decisions. Moreover, since managers were not the ultimate owners, they were not the full residual claimants of their decisions and, hence, would not make efficient decisions. Thus, in addition to his "pure" calculation argument, Mises also put forward property rights arguments why the attempt to "play market" under socialism would only lead to inefficiencies.

Firms have the great advantage relative to socialist planning boards that they may to a much larger extent rely on the prices of outside markets. Thus, the Misesian calculation problem, while constraining the efficient size of firms (Klein 1996), does not imply that firm organization is "impossible." However, some of the property rights insights into socialism also apply to firms. In particular, a good deal of recent analytical energies have been devoted to the commitment problems of delegation in firms (e.g., Williamson 1985; Miller 1992; Baker, Gibbons, and Murphy 1999). A main conclusion is that credible delegation may be very hard, since reneging on a promise to delegate will in many cases be extremely tempting and those to whom rights are delegated anticipate this.[8]

---

[8] Transaction cost economist, Oliver Williamson (1996) has referred to these kinds of problems with his concept of the "impossibility of (efficient) selective intervention." The main problem is that incentives are diluted. This is because the option to intervene "… can be exercised both for good cause (to support expected net gains) and for bad (to support the subgoals of the intervenor)" (Williamson 1996: 150-151). Promises to only intervene for good cause can never be credible, Williamson argues, because they are unenforcable.

In a recent treatment, the problem is stated in the following way (cf. Baker, Gibbons and Murphy 1999). Assume that a subordinate initiates a project.[9] Assume further that the manager has information that is necessary to perform an assessment of the project, but that he decides upfront to ratify *any* project that the subordinate proposes. Effectively, this amounts to full informal delegation of the rights to initiate and ratify projects — "informal," because the formal right to ratify is still in the hands of the manager and because that right cannot be allocated to the subordinate through a court-enforceable contract (cf. Williamson 1996). Because the subordinate values being given freedom, this will induce more effort in searching for new projects (Aghion and Tirole 1997). The expected benefits of these increased efforts may overwhelm the expected costs from bad projects that the manager has to ratify. However, the problem is that because the manager has information about the state of a project ("bad" or "good"), he may be tempted to renege on a promise to delegate decision authority, that is, intervene in a "selective" manner. But if he overrules the subordinate, the latter will lose trust in him, holding back on effort. Clearly, in this game a number of equilibria are feasible. The particular equilibrium that emerges will be determined by the discount rate of the manager, the specific trigger strategy followed by the sub-ordinate (e.g., will he lose trust in the manager for all future periods if he is overruled?), and how much the manager values his reputation for not reneging relative to the benefits of reneging on a bad project (for details and extensions, see Baker, Gibbons, and Murphy 1999).

An implication is that mixing very different coordination mechanisms may lead to efficiency losses, and may not be feasible for this reason. The basic problem is that emulating market organization inside firms amounts to "playing market. Unlike independent agents in markets, corporate employees never possess ultimate decision rights. They are not full owners. This means that those who possess ultimate decision rights can always overrule employees. Thus, there are incentive limits to the extent to which market principles can be applied inside firms. These insights suggest, on the most basic level, that coordination mechanisms are not simply combinable in an arbitrary fashion. Ultimately, this is because authority and ownership will continue to be important in the knowledge economy, and it is the inherent tension between ownership and delegated rights that create the incentive problem. In a sense, this is a sort of application on the level of the firm of Mises' demonstration that the various elements that make up the capitalist market economy are complementary ones; one cannot simply take a subset of these away, say, unhampered capital markets, and substitute them with elements that are characteristic of a different system.[10]

VI. Conclusion

The understanding of the dynamics of economic organization, such as what will happen to authority relations, the boundaries of firms and firms' use of distinct coordination mechanisms, is a task of almost forbidding complexity. Yet, a combination of organizational economics and Austrian insights, primarily represented by the works of Hayek and Mises, provides some useful insights. The approach of this paper has been to try to distill some key assumptions and propositions that characterize much of this literature, and examine these in the light of organizational economics and Austrian economics.

---

9 This should be understood in a broad sense: A "project" may refer to many different types of decisions or clusters of decisions.

10 See also Milgrom and Roberts (1990) for an important discussion of complementarities.

Thus, it has been argued that much of the recent discussion of economic organization in the knowledge economy may be distilled into a basic assertion that the kind of knowledge that Hayek (1945) talked about represent an increasingly binding constraint on the exercise of authority, makes the boundaries of firms blur, and necessitates the use of multiple coordination instruments to efficiently utilize this knowledge. To the extent that increasingly firm hierarchies do flatten, functions are spun-off in an attempt to improve incentives, delegation increases, etc., much of this may be interpreted using insights originally put forward by Hayek, as a number of writers have pointed out already (Ellig 1993; Gable and Ellig 1993; Ghoshal, Moran and Almeida-Costa 1997; Cowen and Parker 1997; Foss 1999).

On the other hand, while Austrian insights are useful for interpreting recent claims, these insights are also useful for understanding their reach. In particular, Misesian insights are helpful here, and it may be argued that there is a certain imbalance in the above writings because of their neglect of these insights. Thus, I have argued that Mises' insights in entrepreneurship, property rights and the complementarity of elements in economic systems are useful ones for claiming a role for authority and the boundaries of firms, as well as for helping to uphold the notion that there are discrete organizational forms (e.g., firms, markets, and hybrids), and that coordination mechanisms cannot be combined arbitrarily. This strongly suggests that Austrian economics (still) has an important contribution to make to the study of economic organization; in particular, that important principles of efficient organization design can be derived from Misesian foundations.

References

Aghion, Philippe and Jean Tirole. 1997. "Formal and Real Authority in Organization," *Journal of Political Economy* 105: 1-29.

Alchian, Armen A. and Harold Demsetz. 1972. "Production, Information Costs, and Economic Organization," in Armen A. Alchian. 1977. *Economic Forces at Work*. Indianapolis: Libert Press.

Baker, George, Robert Gibbons, and Kevin J. Murphy. 1999. "Informal Authority in Organizations," *Journal of Law, Economics and Organization* 15: 56-73.

Boisot, Max. 1998. *Knowledge Assets: Securing Competitive Advantage in the Information Economy*. Oxford: Oxford University Press.

Bolton, Patrick and Joseph Farrell. 1990. "Decentralization, Duplication, and Delay," *Journal of Political Economy* 98: 803-826.

Brynjolfsson, Erik. 1994. "Information Assets, Technology, and Organization," *Management Science* 40: 1645-1662.

Casson, Mark. 1994. "Why are Firms Hierarchical?," *International Journal of the Economics of Business* 1: 47-76.

Cheung, Stephen N.S. 1983. "The Contractual Nature of the Firm," *Journal of Law and Economics* 26: 1-22.

Coase, Ronald H. 1937. "The Nature of the Firm," in Nicolai J. Foss, ed. 1999. *The Theory of the Firm: Critical Perspectives in Business and Management, Vol II*. London: Routledge.

Cowen, Tyler and David Parker. 1997. *Markets in the Firm: A Market Process Approach to Management*. London: The Institute of Economic Affairs.

D'Aveni, Richard. 1994. *Hypercompetition: The Dynamics of Strategic Maneuvering*. New York: Basic Books.

Demsetz, Harold. 1988. "The Theory of the Firm Revisited," *Journal of Law, Economics, and Organization* **4**: 141-161.

Ellig, Jerry. 1993. "Internal Pricing for Corporate Services," *Working Paper in Market-Based Management*, Centre for the Study of Market Processes, George Mason University.

Ellig, Jerry. 1997. "From Austrian Economics to Market-Based Management," *Journal of Private Enterprise* 13: 133-146.

Ellig, Jerry and Wayne Gable. 1993. *Introduction to Market-Based Mangement*. Fairfax, VA: Center for Market Processes.

Fama, Eugene and Michael C. Jensen 1983. "Separation of Ownership and Control," *Journal of Law and Economics* 26: 301-325.

Foss, Kirsten. 2000. "Organizing Technological Interdependencies: A Coordination Perspective on the Firm", forthcoming in *Industrial and Corporate Change* (downloadable from http://www.cbs.dk/link/papers).

Foss, Nicolai J. 1994a. "Ludwig von Mises: Precursor of Property Rights Economics," in idem., ed. 1994. *The Austrian School and Modern Economics: Essays in Reassessment.* Copenhagen: Munksgaard.

Foss, Nicolai J. 1994b. “The Theory of the Firm: The Austrians as Precursors and Critics of Contemporary Theory”. *Review of Austrian Economics 7* (1): 31-65.

Foss, Nicolai J. 1997. *Resources, Firms and Strategies*. Oxford: Oxford University Press.

Foss, Nicolai J. 1999. ”The Use of Knowledge in Firms”, *Journal of Institutional and Theoretical Economics* 155: 458-486.

Foss, Nicolai J. 2000a. “The Costs of Internal Hybrids: The Rise and Decline of the Oticon Spaghetti Organization,” *LINK Working Paper 2000-18* (downloadable from http://www.cbs.dk/link/papers).

Ghoshal, Sumantra, Peter Moran and Luis Almeida-Costa. 1995. “The Essence of the Megacorporation: Shared Context, not Structural Hierarchy”, *Journal of Institutional and Theoretical Economics* 151: 748-759.

Grandori, Anna. 1997. “Governance Structures, Coordination Mechanisms and Cognitive Models,” *Journal of Management and Governance* 1: 29-42.

Grant, Robert M. 1996. “Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration,” *Organization Science* 7: 375-387.

Hamel, Gary and C.K. Prahalad. 1994. *Competing for the Future*. New York: Free Press.

Harryson, Sigvald J. 2000. *Managing Know-Who Based Companies*. Cheltenham: Edward Elgar.

Hart, Oliver. 1995. *Firms, Contracts, and Financial Structure*. Oxford: Oxford University Press.

Hart, Oliver. 1996. “An Economist’s View of Authority,” *Rationality and Society* 8: 371-386.

Hart, Oliver and John Moore. 1990. “Property Rights and the Nature of the Firm,” *Journal of Political Economy* 98: 1119-1158.

Hayek, Friedrich A. 1937. “Economics and Knowledge,” in idem. 1948. *Individualism and Economic Order*. Chicago: University of Chicago Press.

Hayek, Friedrich A. 1945. “The Use of Knowledge in Society,” in idem. 1948. *Individualism and Economic Order*. Chicago: University of Chicago Press.

Hayek, Friedrich A. 1946. “The Meaning of Competition,” in idem. 1948. *Individualism and Economic Order*. Chicago: University of Chicago Press.

Hayek, Friecrich A. von. 1968. “Competition as a Discovery Proceure,” in idem. 1978, *New Studies in Philosophy, Economics, Politics, and the History of Ideas*, London: Routledge and Kegan Paul.

Hayek, Friedrich A. von 1973. *Law, Legislation, and Liberty, Vol.1: Rules and Order*, Chicago: University of Chicago Press.

Helper, Susan, John Paul MacDuffie, and Charles Sabel. 2000. “Pragmatic Collaborations: Advancing Knowledge While Controlling Opportunism,” *Industrial and Corporate Change* 9: 443-487.

Henderson, Richard I. 2000. *Compensation Management in a Knowledge-Based World*. London: Prentice-Hall.

Hennart, Jean-Francois. 1993. ”Explaining the Swollen Middle: Why Most Transactions are a Mix of ”Market” and ”Hierarchy,” *Organization Science* 4: 529-544.

Hermalin, Benjamin. 1998. “The Firm as a Non-Economy: Some Comments on Holmstrom,” *Journal of Law, Economics and Organization* 15: 103-105.

Hodgson, Geoff. 1998. *Economics and Utopia*. London: Routledge.

Holmström, Bengt. 1979. “Moral Hazard and Observability,” *Bell Journal of Economics* 10: 74-91.

Holmström, Bengt and Paul Milgrom. 1994. “The Firm as an Incentive System,” *American Economic Review* 84: 972-991.

Holmström, Bengt and John Roberts. 1998. “The Boundaries of the Firm Revisited,” *Journal of Economic Perspectives* 12: 73-94.

Hunt, Shelby. 2000. *A General Theory of Competition*. London: Sage.

Jacobson, Robert. 1992. “The Austrian School of Strategy,” *Academy of Management Review* 17: 782-807.

Jensen, Michael C. and William H. Meckling. 1992. “Specific and General Knowledge and Organizational Structure,” in Lars Werin og Hans Wijkander, eds. 1992. *Contract Economics*. Oxford: Blackwell.

Jensen, Michael C. and Karen Wruck. 1994. ”Science, Specific Knowledge and Total Quality Management,” in Michael C. Jensen. 1998. *Foundations of Organizational Strategy*. Cambridge: Harvard University Press.

Kirzner, Israel M. 1997. “Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach,” *Journal of Economic Literature* 35: 60-85.

Klein, Peter. 1996. “Economic Calculation and the Limits of Organization,” *Review of Austrian Economics* 9: 3-28.

Klein, Peter and Sandra Klein. 2000. “Do Entrepreneurs Make Predictable Mistakes? Evidence from Corporate Divestitures,” *unpublished paper*.

Knight, Frank H. 1921. *Risk, Uncertainty, and Profit*. 1965 reprint. New York: Augustus M. Kelley.

Langlois, Richard N. 1992. “Transaction-Cost Economics in Real Time,” *Industrial and Corporate Change* 1: 99-127.

Leadbetter, C. 1999. *Living on Thin Air: the New Economy*. London: Viking.

Lewin, Peter and Steven E. Phelan. 2000. “An Austrian Theory of the Firm,” *Review of Austrian Economics* 13: 59-79.

Liebeskind, Julia Porter, Amalya Lumerman Oliver, Lynne G. Zucker, Marilynn B. Brewer. 1995. *Social Networks, Learning, and Flexibility: Sourcing Scientific Knowledge in New Biotechnology Firms.* Cambridge: NBER Working Paper No. W5320.

Mahnke, Volker. 2001. *Organizing Intellectual Production*. Oxford: Oxford University Press.

Matusik, Sharon F. and Charles W. L. Hill. 1998. “The Utilization of Contingent Work, Knowledge Creation, and Competitive Advantage,” *Academy of Management Review* 23: 680-697.

Mendelson, Haim and Ravindran R. Pillai. 1999. “Information Age Organizations, Dynamics, and Performance,” *Journal of Economic Behavior and Organization* 38: 253-281.

Meyer, Christopher. 1994. “How the Right Measures Help Teams Excel,” *Harvard Business Review* (May-June): 95-103.

Miles, Raymond E. and Charles C. Snow. 1992. ”Causes of Failure in Network Organizations,” *California Management Review:* 53-72.

Miles, Raymond E., Charles C. Snow, John A. Mathews, Grant Miles and Henry J. Coleman, Jr. 1997. “Organizing in the Knowledge Age: Anticipating the Cellular Form,” *Academy of Management Executive* 11: 7-20.

Milgrom, Paul. 1988. “Employment Contracts, Influence Activities and Efficient Organization Design,” *Journal of Political Economy* 96:42-60.

Milgrom, Paul and John Roberts. 1990. “The Economics of Modern Manufacturing: Technology, Strategy and Organization,” *American Economic Review* 80: 511-528.

Miller, Gary. 1992. *Managerial Dilemmas*. Cambridge: Cambridge University Press.

Minkler, Alanson P. 1993. “Knowledge and Internal Organization,” *Journal of Economic Behavior and Organization* 21: 17-30.

Mises, Ludwig von. 1936. *Socialism*. Indianapolis: Liberty Press.

Mises, Ludwig von. 1949. *Human Action*. San Francisco: Fox and Wilkes.

Myers, Paul S. 1996. *Knowledge Management and Organizational Design*. Boston: Butterworth-Heinemann.

Neef, Dale. 1998. *The Knowledge Economy.* Boston: Heinemann-Butterworth.

Nonaka, Ikujiro and Takeuchi. 1995. *The Knowledge-Creating Company*. Oxford: Oxford University Press.

O’Driscoll, Gerald P. and Mario Rizzo. 1985. *The Economics of Time and Ignorance*. Oxford: Basil Blackwell.

Powell, Walter. 1990. “Neither Market, Nor Hierarchy: Network Forms of Organization,” *Research in Organizational Behavior* 12: 295-336.

Prusak, Laurence. 1997. *Knowledge in Organizations*. Boston: Butterworth-Heinemann.

Putterman, Louis. 1995. “Markets, Hierarchies and Information: On a Paradox in the Economics of Organization,” *Journal of Economic Behavior and Organization* 26: 373-390.

Semler, Ricardo. 1989. “Managing Without Managers,” *Harvard Business Review* (Sept.-Oct.): 76-84.

Shackle, George L.S. 1972. *Epistemics and Economics*. Cambridge: Cambridge University Press.

Tomlinson, Mark. 1999. “The Learning Economy and Embodied Knowledge Flows in Great Britain,” *Journal of Evolutionary Economics* 9: 431-451.

Wernerfelt, Birger. 1997. “On the Nature and Scope of the Firm: An Adjustment Cost Theory,” *Journal of Business* 70: 489-514.

Williamson, Oliver E. 1996. *The Mechanisms of Governance*. Oxford: Oxford University Press.

Zenger, Todd and William S. Hesterly. 1997. “The Disaggregation of Corporations: Selective Intervention, High-Powered Incentives, and Molecular Units,” *Organization Science* 8: 209-222.

Zingales, Luigi. 2000. “In Search of New Foundations,” forthcoming in *Journal of Finance*.

Zucker, Lynne. 1991. “Markets for Bureaucratic Authority and Control: Information Quality in Professions and Services,” *Research in the Sociology of Organizations* 8: 157-190.

Danish Research Unit for Industrial Dynamics

The Research Programme

The DRUID-research programme is organised in 3 different research themes:

- The firm as a learning organisation
- Competence building and inter-firm dynamics
- The learning economy and the competitiveness of systems of innovation

In each of the three areas there is one strategic theoretical and one central empirical and policy oriented orientation.

Theme A: The firm as a learning organisation

The theoretical perspective confronts and combines the resource-based view (Penrose, 1959) with recent approaches where the focus is on learning and the dynamic capabilities of the firm (Dosi, Teece and Winter, 1992). The aim of this theoretical work is to develop an analytical understanding of the firm as a learning organisation.

The empirical and policy issues relate to the nexus technology, productivity, organisational change and human resources. More insight in the dynamic interplay between these factors at the level of the firm is crucial to understand international differences in performance at the macro level in terms of economic growth and employment.

Theme B: Competence building and inter-firm dynamics

The theoretical perspective relates to the dynamics of the inter-firm division of labour and the formation of network relationships between firms. An attempt will be made to develop evolutionary models with Schumpeterian innovations as the motor driving a Marshallian evolution of the division of labour.

The empirical and policy issues relate the formation of knowledge-intensive regional and sectoral networks of firms to competitiveness and structural change. Data on the structure of production will be combined with indicators of knowledge and learning. IO-matrixes which include flows of knowledge and new technologies will be developed and supplemented by data from case-studies and questionnaires.

Theme C: The learning economy and the competitiveness of systems of innovation.

The third theme aims at a stronger conceptual and theoretical base for new concepts such as 'systems of innovation' and 'the learning economy' and to link these concepts to the ecological dimension. The focus is on the interaction between institutional and technical change in a specified geographical space. An attempt will be made to synthesise theories of economic development emphasising the role of science based-sectors with those emphasising learning-by-producing and the growing knowledge-intensity of all economic activities.

The main empirical and policy issues are related to changes in the local dimensions of innovation and learning. What remains of the relative autonomy of national systems of innovation? Is there a tendency towards convergence or divergence in the specialisation in trade, production, innovation and in the knowledge base itself when we compare regions and nations?

The Ph.D.-programme

There are at present more than 10 Ph.D.-students working in close connection to the DRUID research programme. DRUID organises regularly specific Ph.D-activities such as workshops, seminars and courses, often in a co-operation with other Danish or international institutes. Also important is the role of DRUID as an environment which stimulates the Ph.D.-students to become creative and effective. This involves several elements:

- access to the international network in the form of visiting fellows and visits at the sister institutions
- participation in research projects
- access to supervision of theses
- access to databases

Each year DRUID welcomes a limited number of foreign Ph.D.-students who wants to work on subjects and project close to the core of the DRUID-research programme.

External projects

DRUID-members are involved in projects with external support. One major project which covers several of the elements of the research programme is DISKO; a comparative analysis of the Danish Innovation System; and there are several projects involving international co-operation within EU's 4th Framework Programme. DRUID is open to host other projects as far as they fall within its research profile. Special attention is given to the communication of research results from such projects to a wide set of social actors and policy makers.

DRUID Working Papers

96-1 **Lundvall, Bengt-Åke:** The Social Dimension of the Learning Economy. (ISBN 87-7873-000-7)

96-2 **Foss, Nicolai J.:** Firms, Incomplete Contracts and Organizational Learning. (ISBN 87-7873-001-5)

96-3 **Dalum, Bent and Villumsen, Gert**: Are OECD Export Specialisation Patterns Sticky?' Relations to the Convergence-Divergence Debate. (ISBN 87-7873-002-3)

96-4 **Foss, Nicolai J:** Austrian and Post-Marshallian Economics: The Bridging Work of George Richardson. (ISBN 87-7873-003-1)

96-5 **Andersen, Esben S., Jensen, Anne K., Madsen, Lars and Jørgensen, Martin:** The Nelson and Winter Models Revisited: Prototypes for Computer-Based Reconstruction of Schumpeterian Competition. (ISBN 87-7873-005-8)

96-6 **Maskell, Peter:** Learning in the village economy of Denmark. The role of institutions and policy in sustaining competitiveness. (ISBN 87-7873-006-6)

96-7 **Foss, Nicolai J. & Christensen, Jens Frøslev:** A Process Approach to Corporate Coherence. (ISBN 87-7873-007-4)

96-8 **Foss, Nicolai J.:** Capabilities and the Theory of the Firm. (ISBN 87-7873-008-2)

96-9 **Foss, Kirsten:** A transaction cost perspective on the influence of standards on product development: Examples from the fruit and vegetable market. (ISBN 87-7873-009-0)

96-10 **Richardson, George B.:** Competition, Innovation and Increasing Returns. (ISBN 87-7873-010-4)

96-11 **Maskell, Peter:** Localised low-tech learning in the furniture industry. (ISBN 87-7873-011-2)

96-12 **Laursen, Keld:** The Impact of Technological Opportunity on the Dynamics of Trade Performance. (ISBN 87-7873-012-0)

96-13 **Andersen, Esben S.:** The Evolution of an Industrial Sector with a Varying Degree of Roundaboutness of Production. (ISBN 87-7873-013-9)

96-14 **Dalum, Bent, Laursen, Keld & Villumsen, Gert**: The Long Term Development of OECD Export Specialisation Patterns: De-specialisation and "Stickiness". (ISBN 87-7873-014-7)

96-15 **Foss, Nicolai J.:** Thorstein B. Veblen: Precursor of the Competence-Based Approach to the Firm. (ISBN 87-7873-015-5)

96-16 **Gjerding, Allan Næs:** Organisational innovation in the Danish private business sector. (ISBN 87-7873-016-3)

96-17 **Lund, Reinhard & Gjerding, Allan Næs:** The flexible company Innovation, work organisation and human ressource management. (ISBN 87-7873-017-1)

97-1 **Foss, Nicolai J.:** The Resource-Based Perspective: An Assessment and Diagnosis of Problems. (ISBN 87-7873-019-8)

97-2 **Langlois, Richard N. & Foss, Nicolai J.:** Capabilities and Governance: the Rebirth of Production in the Theory of Economic Organization. (ISBN 87-7873-020-1)

97-3 **Ernst, Dieter:** Partners for the China Circle? The Asian Production Networks of Japanese Electronics Firms. (ISBN 87-7873-022-8)

97-4 **Richardson, George B.:** Economic Analysis, Public Policy and the Software Industry. (ISBN 87-7873-023-6)

97-5 **Borrus, Michael & Zysman, John:** You Don't Have to Be A Giant: How The Changing Terms of Competition in Global Markets are Creating New Possibilities For Danish Companies. (ISBN 87-7873-024-4)

97-6 **Teubal, Morris.:** Restructuring and Embeddeness of Business Enterprises-Towards an Innovation System Perspective on Diffusion Policy. (ISBN 87-7873-025-2)

97-7 **Ernst, Dieter & Guerrieri, Paolo:** International Production Networks and Changing Trade Patterns in East Asia: The case of the Electronics Industry. (ISBN 87-7873-026-0)

97-8 **Lazaric, Nathalie & Marengo, Luigi:** Towards a Characterisation of Assets and Knowledge Created in Technological Agreements: Some evidence from the automobile-robotics sector. (ISBN 87-7873-027-9)

97-9 **Ernst, Dieter.:** High-Tech Competition Puzzles. How Globalization Affects Firm Behavior and Market Structure in the Electronics Industry. (ISBN 87-7873-028-7)

97-10 **Foss, Nicolai J.:** Equilibrium vs Evolution in the Resource-Based Perspective: The Conflicting Legacies of Demsetz and Penrose. (ISBN 87-7873-029-5)

97-11 **Foss, Nicolai J.:** Incomplete Contracts and Economic Organisation: Brian Loasby and the Theory of the firm. (ISBN 87-7873-030-9)

97-12 **Ernst, Dieter & Lundvall, Bengt-Åke:** Information Technology in The Learning Economy – Challenges for Developing Countries. (ISBN 87-7873-031-7)

97-13 **Kristensen, Frank Skov (p):** A study of four organisations in different competitive environments. (ISBN 87-7873-032-5)

97-14 **Drejer, Ina, (p) Kristensen, Frank Skov (p) & Laursen, Keld (p):** Studies of Clusters as a Basis for Industrial and Technology Policy in the Danish Economy. (ISBN 87-7873-033-3)

97-15 **Laursen, Keld (p) & Drejer, Ina (p):** Do Inter-sectoral Linkages Matter for International Export Specialisation? (ISBN 87-7873-034-1)

97-16 **Lundvall, Bengt-Åke & Kristensen, Frank Skov (p):** Organisational change, innovation and human resource Development as a response to increased competition. (ISBN 87-7873-036-8)

98-1 **Præst, Mette (p):** An Empirical Model of Firm Behaviour: A dynamic Approach to Competence Accumulation and Strategic Behaviour. (ISBN 87-7873-037-6)

98-2 **Ducatel, Ken:** Learning and skills in the Knowledge Economy. (ISBN 87-7873-038-4)

98-3 **Ernst, Dieter:** What Permits Small Firms to Compete in High-Tech Industries? Inter-Organizational Knowledge Creation in the Taiwanese Computer Industry. (ISBN 87-7873-039-2)

98-4 **Christensen, Jens Frøslev:** The Dynamics of the Diversified Corporation and the Role of Central Management of Technology. (ISBN 87-7873-040-6)

98-5 **Valente, Marco (p):** Laboratory for Simulation Development. (ISBN 87-7873-041-4)

98-6 **Valente, Marco (p):** Technological Competition: a Qualitative Product Life

Cycle. (ISBN 87-7873-042-2)

98-7 **Lam, Alice:** The Social Embeddedness of Knowledege: Problems of Knowledge Sharing and Organisational Learning in International High-Technology Ventures. (ISBN 87-7873-043-0)

98-8 **Jørgensen, Kenneth M. (p):** Information Technology and Change in Danish Organizations. (ISBN 87-7873-044-9)

98-9 **Andersen, Esben Sloth:** Escaping Satiation in an Evolutionary Model of Structural economic Dynamics. (ISBN 87-7873-045-7)

98-10 **Foss, Kirsten:** Technological Interdependencies, Specialization and Coordination: A Property Rights Perspective on The Nature of the Firm. (ISBN 87-7873-046-5)

98-11 **Andersen, Poul H:** Organizing International Technological Collaboration in Subcontractor Relationships. An Investigation of the Knowledge-Stickyness Problem. (ISBN 87-7873-047-3)

98-12 **Nymark, Søren (p):** Billeder af strategi i forandringsrige organisatoriske omgivelser: 3 cases fra DISKO studierne. (ISBN 87-7873-048-1)

98-13 **Andersen, Esben Sloth:** The Evolution of the Organisation of Industry. (ISBN 87-7873-050-3)

98-14 **Foss, Kirsten & Foss, Nicolai J.:** The Market Process and The Firm: Toward a Dynamic Property Rights Perspective. (ISBN 87-7873-051-1)

98-15 **Lorenz, Edward:** Societal Effects and the Transfer of Business Practices to Britain and France. (ISBN 87-7873-053-8)

98-16 **Ernst, Dieter:** Catching-Up, Crisis and Industrial Upgrading. Evolutionary Aspects of Technological Learning in Korea's Electronics Industry. (ISBN 87-7873-054-6)

98-17 **Kaisla, Jukka (p):** The Market Process and the Emergence of the Firm: Some Indications of Entrepreneurship Under Genuine Uncertainty. (ISBN 87-7873-055-4)

98-18 **Laursen, Keld (p):** Do Export and Technological Specialisation Patterns Co-evolve in Terms of Convergence or Divergence?: Evidence from 19 OECD Countries, 1971-1991. (ISBN 87-7873-056-2)

98-19 **Foss, Nicolai J.:** Firms and the Coordination of Knowledge: Some Austrian Insights. (ISBN 87-7873-057-0)

98-20 **Mahnke, Volker (p) & Aadne, John Harald:** Process of Strategic Renewal, Competencies, and the Management of Speed. (ISBN 87-7873-058-9)

98-21 **Lorenzen, Mark (p):** Information, cost learning, and trust. Lessons form co-operation and higher-order capabilities amongst geographically proximate firms. (ISBN 87-7873-059-7)

98-22 **Lam, Alice:** Tacit Knowledge, Organisational Learning and Innovation: A Societal Perspective. (ISBN 87-7873-060-0)

98-23 **Lund, Reinhard:** Organizational and innovative flexibility mechanisms and their impact upon organizational effectiveness. (ISBN 87-7873-061-9)

98-24 **Christensen, Jesper Lindgaard & Drejer, Ina (p):** Finance and Innovation System or Chaos. (ISBN 87-7873-062-7)

98-25 **Laursen, Keld (p):** How Structural Change Differs, and Why it Matters (for Economic Growth) (ISBN 87-7873-063-5)

98-26 **Holmén, Magnus & Jacobsson, Staffan:** A method for identifying actors in a knowledge based cluser. (ISBN 87-7873-064-3)

98-27 **Richardson, G. B.:** Production, Planning and Prices. (ISBN 87-7873-065-1)

98-28 **Foss, Nicolai J.:** Austrian Economics and Game Theory: a Preliminary Methodological Stocktaking. (ISBN 87-7873-067-8)

98-29 **Foss, Nicolai J. & Mahnke, Volker (p):** Strategy Research and the Market Process Perspective. (ISBN 87-7873-068-6)

98-30 **Laursen, Keld (p):** Revealed Comparative Advantage and the Alternatives as Measures of International Specialisation. (ISBN 87-7873-069-4)

99-1 **Lorenz, E.:** Organisationaal Innovation, Governance Structure and Innovative Capacity In British and French Industry. (ISBN 87-7873-070-8)

99-2 **Ernst, Dieter:** Responses to the Crisis: Constraints to a Rapid Trade Adjustment in East Asia's Electronics Industry. (ISBN 87-7873-071-6)

99-3 **Foss, N. J. :** Understanding Leadership: A Coordination Theory. (ISBN 87-7873-072-4)

99-4 **Foss, K & Foss, N. J:** Understanding Ownership: Residual Rights of Control and Appropriable Control Rights. (ISBN 87-7873-073-2)

99-5 **Foss, K & Foss, N. J:** Organizing Economic Experiments: The role of Firms. (ISBN 87-7873-075-9)

99-6 **Jørgensen Kenneth. M. (p) :** The Meaning og Local Knowledges. (ISBN 87-7873-076-7)

99-7 **Foss, N. J.:** Capabilities, Confusion, and the Costs of Coordination: On Some Problems in Recent Research On Inter-Firm Relations. (ISBN87-7873-

077-5)

99-8 **Lund, Reinhard:** Tillidsrepræsentantsystemet og de fleksiblevirksomhedsformer. Juli 1999. (ISBN887-7873-078-3)

99-9 **Nymark, Søren:** Organisatorisk læring gennem den værdibaserede organisations fortællinger. (ISBN 87-7873-079-1)

99-10 **Laursen, K. & Meliciani, V.:** The importance of technology based inter-sectoral linkages for market share dynamics. (ISBN 87-7873-080-5)

99-11 **Laursen, K.**, **Mahnke, V., Vejrup-Hansen, P.:** Firm growth from a knowlegde structure perspective. (ISBN 87-7873-081-3)

99-12 **Lundvall, Bengt-Åke, Christensen, Jesper. L.:** Extending and Deepening the Analysis of Innovation Systems - with Emperical Illustrations from the DISCO-project. (ISBN 87-7873-082-1)

00-1 **Llerena, Patrick & Oltra, Vanessa:** Diversity of innovative strategy as a source technological performance. (ISBN 87-7873-085-6)

00-2 **Llerena, Patrick & Mireille Matt:** Technology policy and cooperation: A paradigmatic approach. (ISBN 87-7873-086-4)

00-3 **Cusmano, Lucia:** Technology Policy and Co-operative R&D: the role of relational research capacity. (ISBN 87-7873-087-2)

00-4 **Mikkola, Juliana Hsuan:** Modularization assessment of product architecture. (ISBN87-7873-088-0)

00-5 **Yvrande, Anne:** The new British railways structure: A transaction cost economics analysis. (ISBN87-7873-089-9)

00-6 **Dijk, Machiel van &Nomaler Önder:** Technological diffusion patterns and their effects on industrial dynamics. (ISBN 87-7873-090-2)

00-7 **Storper, Michael & Chen, Yun-chung with De Paolis, Fernando:** The Effects of Globalization on Location of Industries in the OECD and European Union (ISBN87-7873-091-0)

00-8 **Sanders, Mark & Weel, Bas ter :** Skill-Biased Technical Change: Theoretical Concepts, Empirical Problems and a Survey of the Evidence (ISBN87-7873-092-9)

00-9 **Tomlinson, Mark:** Innovation surveys: A researcher's perspective (ISBN87-7873-093-7)

00-10 **Nymark, Søren:** Value-based management in learning organizations through 'hard' and 'soft' managerial approaches: The case of Hewlett-Packard

(ISBN87-7873-094-5)

00-11 **Yoguel, Gabriel; Novick , Marta & Marin, Anabel:** Production Networks: Linkages, Innovation Processes and Social Management Technologies (ISBN87-7873-095-3)

00-12 **Yoguel, Gabriel & Boscherini, Fabio:** The environment in the development of firms' innovative capacities: Argentine industrial SMEs from different local systems (ISBN87-7873-096-1)

00-13 **Arocena, Rodrigo & Sutz, Judith:** Interactive Learning Spaces and Development Policies in Latin America (ISBN87-7873-098-8)

01-01 **Mathews, John A.:** Competitive Interfirm Dynamics within an Industrial Market System (ISBN87-7873-099-6)

01-02 **Giarratana, Marco & Torrisi, Salvatore:** Competence accumulation and collaborative ventures: Evidence from the largest European electronics firms and implications for the EU technological policies (ISBN 87-7873-100-3)

01-03 **Nemirovsky, Adolfo & Yoguel, Gabriel**: Dynamics of high-technology firms in the Silicon Valley (ISBN 87-7873-101-1)

01-04 **Castellacci, Fulvio**: A 'technology-gap approach to cumulative growth': toward an integrated model. Empirical evidence for Spain, 1960-1997 (ISBN 87-7873-103-8)

01-05 **Nuvolari. Alessandro**: Collective invention during the British industrial revolution: The case of the Cornish pumping engine (ISBN 87-7873-104-6)

01-06 **Costa, Ionara**: Ownership and technological capabilities in Brazil (ISBN 87-7873-105-4)

01-07 **Foss, Nicolai J**.: Economic organization in the knowledge economy: some austrian insights (ISBN 87-7873-106-2)

01-08 **Cantwell, John & Kosmopoulou, Elena**: Determinants of internationalisation on corporate technology (ISBN 87-7873-107-0)

All correspondence concerning the DRUID Working Papers should be send to:

Jonna Jacobsen
Fibigerstræde 4
DK-9220 Aalborg OE
Tel. 45 96 35 82 65
Fax. 45 98 15 60 13

E-mail: druid-wp@business.auc.dk