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The limits to designed orders: Authority under "distributed knowledge" conditions

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Abstract We examine the argument, put forward by modern management writers and, in a somewhat different guise by Austrian economists, that authority is not a viable mechanism of coordination in the presence of "distributed knowledge" We define authority and distributed knowledge and argue that authority is compatible with distributed knowledge. Moreover, it is not clear on theoretical grounds how distributed knowledge impacts on economic organization. An implication is that the Austrian argument that designed orders are strongly constrained by the Hayekian dispersed knowledge (Hayek, Kirzner, Sautet) is less decisive than it has usually been taken to be. The positive flipside of this argument is that Austrians confront an exciting research agenda in theorizing how distributed knowledge impacts economic organization.

Keywords Knowledge · Designed orders · Distributed knowledge

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Introduction

A key tenet of Austrian economics is that Hayekian dispersed knowledge (Hayek, 1945) is a strong constraint on (the size and growth of) designed orders. While best known from its application in the socialist calculation debate (Lavoie, 1985; Boettke, 1989), the argument has been applied to "localized central planning" in the form of firm organization (Kirzner, 1992: 161–162; Minkler, 1993; Langlois, 1995; Cowen and Parker, 1997; Hodgson, 1998; Foss, 1999, 2001; Sautet, 2000). Israel Kirzner (1992: 162) nicely encapsulates this use of the Hayekian argument: "We may expect

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firms spontaneously to expand to the point where additional advantages of 'central' planning are just offset by the incremental knowledge difficulties that stem from dispersed information."

Others than Austrians and Austrian fellow-travellers have (explicitly or implicitly) applied Hayekian arguments to issues of economic organization (i.e., the size, scope and boundaries of firms). Thus, an ongoing discussion in recent management studies on the limitations of authority as a mechanism of coordination under conditions of, what is usually referred to in this literature as "distributed knowledge" almost reads like a replay of the socialist calculation debate (notably Grandori, 2002).

While the above economists apply the Hayekian argument in a rather abstract manner, the management literature adds observation to the argument. Thus, it is argued, and sometimes empirically substantiated, that firms increasingly rely on a growing number of knowledge specialists, be they employees or outside knowledge agents, such as supplier firms or universities (for evidence, Granstrand, Patel and Pavitt, 1997; Brusoni, Prencipe and Pavitt, 2001). This implies that firm management will know and understand less of the knowledge to which they somehow need to secure access. Management errors are likely to be made, the amount and severity of such errors being related to how unfamiliar the relevant knowledge is to that possessed by management. Such observation leads into a more general argument that authority is an inherently inefficient mechanism of coordination under distributed knowledge. Thus, Grandori (2002: 257) concludes that "[d]istributed knowledge causes authority (as a centralized decision-making system) to fail in all its forms." The conclusion emerges from a two-step argument. First, it is argued that authority – that is, the right to make decisions which guide the decisions of another person (Coase, 1937; Simon, 1951, 1991; Coleman, 1990) – presupposes considerable knowledge about the capabilities and action set that is available to those that are being directed. Second, the presence of distributed knowledge means that this condition cannot be fulfilled.[1]

Because of its obvious affinity to the Hayekian position in the calculation debate (Hayek, 1945), as well as its importance for the understanding of economic organization, this argument will be critically discussed in the following. The strategy is, however, not to apply Austrian insights to the argument (which already may be seen as Austrian in spirit) *per se*. Rather, we shall examine the argument in its own right, and then discuss what this may imply for Austrian economics.[2]

The design of the paper is as follows. We begin by taking a closer look at the notion of distributed knowledge, which is seldom if ever defined with much precision. We put forward a definition. Authority is then considered in the context of distributed knowledge, which leads to taking issue with the argument, put forward by some management writers as well as Austrian and Austrian-influenced economists, that authority is *necessarily* an inefficient mechanism of coordination when knowledge is distributed. We then discuss the complicated link between distributed knowledge and

[1] A further argument then suggests that alternative coordination mechanisms (Grandori, 2001) will substitute for authority to meet the need for coordination that still exists under distributed knowledge.

[2] Foss (2001) also argued that authority may co-exist with Hayekian distributed knowledge, but did not draw implications for Austrian economics of this argument.

the boundaries of the firm. Implications for Austrian economics are drawn. Fundamentally, we conclude that at the present stage of knowledge, the Austrian argument that designed orders are strongly constraind by Hayekian dispersed/distributed knowledge needs to be clarified and strengthened. The positive flipside of this argument is that Austrians confront an exciting research agenda in theorizing how exactly such knowledge conditions impact economic organization.

Distributed knowledge

During the last decade the notion of distributed knowledge has been used with increasing frequence as an apt description of the knowledge conditions in which modern firms, the argument goes, increasingly find themselves.[3] From an (Austrian) economics perspective, Cowen and Parker (1997), Foss (1999) and Sautet (2000) explicitly introduced Hayekian reasoning in order to pinpoint the management dilemmas introduced by dispersed knowledge. Introducing Austrian considerations into agency theory, Minkler (1993) argued that distributed knowledge makes authority break down. Tsoukas (1996) conceptualized the firm as a distributed knowledge system (explicitly referring to Hayek, 1945). Granstrand, Patel and Pavitt (1997) documented the increasing extent to which the knowledge bases controlled by major technology-intensive corporations are distributed. Many other similar arguments can be found (see Foss and Foss, 2003).

Apparently, the notion rings a bell in a number of diverse contexts. But what does it mean to say that knowledge is distributed? Unfortunately, the above contributions are not entirely forthcoming with respect to precise definitions of this concept. The same critique may perhaps also be directed against the Austrian literature. While suggestive, the famous and often-cited passages from Hayek (1945) hardly qualify as definitions of the notion of distributed knowledge. Moreover, it is not clear whether Austrian dispersed knowledge is identical to distributed knolwedge. The following makes an attempt to go somewhat further in the direction of definition.

Towards a definition of distributed (dispersed) knowledge

Distributed knowledge is a member of a set of concepts that relate to the different ways in which knowledge may be said to be a property of a group of agents. Two other examples of this kind of concepts are the game theory notion of "common knowledge," as well as the weaker notion of "shared knowledge." An event is common knowledge among a group of players if each player knows it, each one knows that the other players know it, each player knows that other players know that the other players know it and so on *ad infinitum* (Aumann, 1976).[4] Shared knowledge differs from common knowledge by not requiring that each agent knows that the other agents know, etc. Thus, there is shared knowledge of a fact if each agent knows this fact, but does not know that the other agents know it.

[3] To our knowledge, the term originates with Halpern and Moses (1990).

[4] Common knowledge is a core assumption in most of contemporary game theory-based microeconomics, such as agency theory (e.g., Salanié, 1997).

If common knowledge lies at one end of the spectrum, distributed knowledge lies at the other end. Loosely (and metaphorically), knowledge is distributed when a set of agents knows something no single agent (completely) knows. Thus, the notions that firms (Tsoukas, 1996) or whole economies (Hayek, 1945, 1973) are distributed knowledge systems mean that the set of agents comprising these entities collectively possesses knowledge that no single agent possesses. In this sense, distributed knowledge has the same characteristics as dispersed "knowledge in society," as discussed by Hayek (1945). Note that this does not amount to asserting the existence of mysterious supra-individual "collective minds." Knowledge still ultimately resides in the heads of individuals; however, when the various individual level knowledge sets are combined and "aggregated" in certain ways, it means that considered as a system, a set of agents possesses knowledge that they do not possess if separated. This is no more mysterious than saying, for example, that combining different persons in a team may increase individual productivities because of complementarities.

Epistemic logic (Hintikka, 1962) suggests the following definition of distributed knowledge:

Definition – Distributed Knowledge: *If $K_i p_i$ means that agent i knows proposition i, a set of n agents has distributed knowledge of a proposition q (i.e., Dq) when:* $K_1 p_1 \wedge K_2 p_2 \wedge \ldots \wedge K_n p_n \Rightarrow Dq, q \neq p_i, \forall_i$.[5]

For example, Jack knows that p is the case and Jill knows that p implies y, but neither know that y is the case. However, if Jack and Jill's information states are "added" there is a sense, which is more than metaphorical, in which they may know that y is the case (Gerbrandy, 1998: 53). The information that y is the case is present in the system comprising Jack and Jill, but in a distributed form.

The above definition is open to some interpretation. At one extreme, Jack and Jill may both be completely ignorant about the knowledge controlled by the other party. Sometimes such an interpretation is made of the "competitive equilibrium" model in economics: Although knowledge of technologies and preferences is private, all this knowledge is utilized in the best possible way, so that the knowledge of how to bring about an allocation of resources with superior welfare properties is distributed in the economy. At the other extreme, there is considerable, but not complete,[6] knowledge overlap (p_i may be close in some sense to p_j), but it is still the case that no single agent knows q. Between the extremes are different degrees of overlap between individual knowledge elements.

[5] p_i could be interpreted as a vector of propositions. Thus, we are not asserting that each agent only knows one thing. Also note that this definition does not distinguish between the situation where knowledge is not presently held by a single agent because of costs of communication and information processing, and knowledge that could not possibly be possessed by a single agent (the situation that Austrians usually identify with the Hayekian knowledge problem, e.g., Lavoie, 1945). As Boettke (1989) points out, mechanism design solutions are irrelevant for the latter kind of problem.

[6] If knowledge overlap is complete, the agents will also know or be able to infer q (if they have perfect rationality/perfect reasoning assumptions and/or the knowledge elements and how they connect is easy to comprehend).

Distributed knowledge as a challenge to authority

Simon on authority

Authority is one of the more complicated and hard-to-pin-down notions in social science. Concepts proliferate, and it is not clear how the various notions relate or even if they have shared components (compare Weber, 1947; Simon, 1951; Thompson, 1956; Coleman, 1990; Grandori, 2001 among the clear discussions). In order to meaningfully discuss authority, one often has to make an explicit choice among the many notions. For the purpose of this paper, the concept of authority offered by Herbert Simon (1951) serves as useful starting points. Also, Simon's paper is still the canonical economics treatment of authority, in spite of it being more than five decades old.

Simon (1951) defines authority 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 defined as making the set $\mathbf{A}^0$ larger or smaller.[7] Thus, to Simon (1951) authority is a right to decide that an employer acquires, because he expects to obtain only *ex post* contracting the relevant information that will make possible the picking of efficient actions, which he will then direct the employee to carry out. This notion is based on the employer picking well-defined actions from a set of discrete actions (about which the employer has perfect information). He does this on the basis of knowledge that is superior to that of the employee (Foss, 1999). [8]

Authority and the Hayekian knowledge problem

The first systematic argument that distributed knowledge represents a challenge to central planning and direction was developed by Hayek (1935, 1945) in the specific context of the interwar debate on the economic efficiency of socialism (see Lavoie, 1985). In these early works, Hayek does not directly criticize the use of authority as a mechanism of coordination; rather, his critical target is the notion that benevolent planners can draft complete contingent plans for the allocation of resources on a societal level, based on all relevant knowledge being concentrated in the hands of a central planner. Still, it is easy to see that Hayek's argument represents a challenge to authority in the sense of Simon and Coase, as central planning is indeed authority in this (narrow) sense, that is, telling people which actions to take.

[7] Simon's definition is a stepping-stone to his model of the employment relationship. This is a multi-stages game in the context of an incomplete contract with *ex post* governance where, in the first period, the prospective worker decides whether to accept employment or not. In this period, none of the parties know which actions will be optimal, given circumstances. In the next period, the relevant circumstances as well as the costs and benefits associated with the various possible tasks are revealed to the boss. The boss then directs the worker to a task, which – for the latter to accept the assignment – must lie within his or her "zone of acceptance."

[8] Simon's explanation is quite akin to Coase's (1937). In the presence of uncertainty, Coase argues, contingencies are costly to anticipate and describe in advance, and rather than negotiate on a spot market basis over each contingency as they arise, an employment contract is concluded. The latter is defined 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 contract 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).

As Hayek notes, it is only in the "... most simple kind of organization [that] it is conceivable that all the details of all activities are governed by a single mind" (Hayek, 1973: 49). Therefore, all larger or more complex firms confronts a "... problem which any attempt to bring order into complex human activities meets: the organizer must wish the individuals who are to cooperate to make use of knowledge that he himself does not possess" (Hayek, 1973: 49). This means that "... every organization must rely also on rules and not only on specific commands. The reason here is the same as that which makes it necessary for a spontaneous order to rely solely on rules: namely that by guiding the actions of individuals by rules rather than specific commands it is possible to make use of knowledge which nobody possesses as a whole" (1973: 48–49). Such rules are "rules for the performance of assigned tasks." They are therefore "necessarily subsidiary to commands" (1973: 49).

Notice that Hayek here points to a broader understanding of authority (than the Simon, 1951 understanding),[9] one that, he argues, is consistent with distributed knowledge. Thus, Hayek does not *deny* that in practice the problem of making use of distributed knowledge can be solved by firms, and that authority, the central characteristic of firm organization, is consistent with distributed knowledge. However, observe also that Hayek does not *explain* how the problem is solved: If knowledge inside the firm is indeed distributed, how can management choose good "rules for the performance of assigned tasks"? How are employees assigned to tasks and how are standards for performance chosen when these actions are partially dependent on knowledge that management does not hold itself? Given Hayek's general evolutionary outlook, it seems warranted to suggest that this is done in the same way that societies discover rules, namely by trial-and-error processes, but Hayek is not forthcoming about this (but see Langlois, 1995).

The (alleged) breakdown of authority in the face of distributed knowledge

In contrast to Hayek, some modern writers in management as well as in economics deny that authority is a viable mechanism of coordination under distributed knowledge conditions. Thus, Grandori (1997: 35) argues that

> ... whatever its basis, authority is a feasible governance mechanism only if information and competence relevant to solving economic action problems can be transferred to and handled by a single actor, a positive "zone of acceptance" exists, the actions of other supervised actors are observable, and if the system is not as large as to incur an overwhelming communication channel overload and control losses.

According to this argument, distributed knowledge challenges authority because it implies that all "information and competence" relevant to solving a problem cannot be given to a single decision-maker, actions are not generally observable, and there

[9] Note that Simon was quite aware of the narrowness of his 1951 notion of authority. As he (1991: 31) pointed out four decades after his 1951 paper on authority that "[a]uthority in organizations is not used exclusively, or even mainly, to command specific actions." Instead, he explained it is a command that takes the form of a result to be produced, a principle to be applied, or goal constraints, so that "[o]nly the end goal has been supplied by the command, and not the method of reaching it."

may be substantial "communication channel overload and control losses. These are all problems highlighted by Hayek in the context of the socialist calculation debate; in particular, the argument would seem to imply that using authority under conditions of distributed knowledge is based of the "synoptic delusion" that all relevant knowledge can be concentrated with a central decision maker.

To be more specific, we interpret the argument as follows. The challenge to authority as a "feasible governance mechanism" arises for three reasons: Under distributed knowledge, 1) 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 manager has no knowledge; 2) the employee is better informed than the employer with respect to how certain actions should (optimally) be carried out; and 3) the employer does not know which actions should optimally be chosen from the action set in response to contingencies (because he lacks information on contingencies). Conclusion: The sheer ignorance on the part of directing employers implied by 1) to 3) means that authority cannot be an efficient mechanism of coordination. Situations will arise where authority will result in the employer making the employee choose inefficient actions. Efficiency can be restored if the strict authority relationship is dis-solved, namely by delegating decision rights to the employee (Jensen and Meckling, 1992), organizing the firm as a partnership (Minkler, 1993), or even spinning the employee off as a separate firm.

It is not entirely whether those who argue that authority is not a feasible coordination mechanism in the presence of distributed knowledge actually makes the claim that authority is not *possible* under these epistemic circumstances, or simply whether it is so highly inefficient as to never be adopted. As we see it, however, the issue is not one of possibility, but whether authority is necessarily inefficient relative to its alternatives. Thus, the issue should be addressed in comparative-institutional terms by asking whether it is conceivable that authority may perform better than other mechanisms of coordination under distributed knowledge conditions.

Authority and distributed knowledge

"Narrow authority" is the view of authority associated with Simon (1951). The argument that has just been summarized holds that such authority is fundamentally compromised by distributed knowledge. However, it is not always the case that suppressing distributed knowledge is inefficient. For example, Hammond and Miller (1985: 1) argue that "... knowledge about any particular problem is seldom complete, and in a competitive or changing environment there may be advantages to making *some* decision, however imperfectly grounded on expertise, rather than none at all ... In the absence of expert knowledge some chief executive is given authority to impose his own best judgment on the matter." It is not entirely transparent what Hammond and Miller mean here, but a later treatment by Bolton and Farrell (1990) provides a clue.

Bolton and Farrell wish to identify the determinants of centralization/decentralization decisions. In order to isolate the costs and benefits of centralized and decentralized decision-making in a specific setting, they study a coordination problem with private information in the setting of a natural monopoly market. The coordination problem concerns which firm should enter the market when costs are sunk and are private information. Under decentralization, which is represented as a

two-period incomplete information game of timing (sink costs/enter or wait another period), each firm is uncertain about whether the other firm will enter. However, the incentive to enter depends on the height of a given firm's cost, low-cost firms being less worried that their rival will enter (and *vice versa*). If costs are sufficiently dispersed, the optimal outcome prevails, that is, the lowest-cost producer enters and preempts the rival(s). However, if costs are equal or are high for both, inefficiencies may obtain, since firms will then enter simultaneously (inefficient duplication) or will wait (inefficient delay). Enter a central authority whose job is to nominate a firm for entry. In the spirit of Hayek, Bolton and Farrell assume that this central authority cannot possess knowledge about costs. In their model, s/he nominates the high cost producer half of the times, which is clearly inefficient. However, this cost of centralization should be compared against the costs of decentralization (delay and duplication). Bolton and Farrell show 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 they argue is consistent with the observed tendency of firms to rely on centralized authority in cases of emergencies.

While Austrians may argue that the Bolton and Farrell set-up trivializes distributed knowledge, and exaggerates the benefits of centralization (e.g., it is assumed to not involve delays), their model does provide a rationale for authority under distributed knowledge (given their assumptions), that is, it explains why authority may be preferred rather than some decentralized arrangement. Even the narrow understanding of authority in Coase (1937) and Simon (1951) may be rendered consistent with distributed knowledge using the Bolton and Farrell argument: Although the employer may be ignorant of the efficient action, and perhaps of most of the employee action, he knows a subset of the employee's action set, so he can always tell him to "do *something*!", which in certain situations may be preferable to doing nothing.

The example suggests the more general implication that *some* overlap of knowledge may be sufficient to make coordination by means of authority work in the presence of distributed knowledge.[10] In particular, note it is not in conflict with the notion of distributed knowledge (at least as defined earlier) that some agent possesses the knowledge that – in terms of the earlier example – if Jack and Jill's knowledge sets are somehow aggregated, this will result in their having, as a "system," a knowledge that none of them possesses individually. This agent does not need to know that Jack knows that p is the case and Jill knows that p implies y. However, she does need to know that there is a set P of which p is a member and that these elements map to certain outcomes, Y, of which y is a member. Thus, she may still be ignorant in an important sense about the knowledge controlled by Jack and Jill, she does not suffer from complete ignorance[11]; there is some, possibly rather modest, knowledge

[10] In a neglected passage, Hayek (1945: 86) notes that even in the case of coordination by means of the price system, knowledge overlap is necessary: "The whole acts as one market, not because any of its members survey the whole field, but because their limited fields of vision sufficiently overlap so that through many intermediaries the relevant information is communicated to all."

[11] On the other hand, it may not be entirely correct to say that she is "asymmetrically informed." In asymmetric information models, such as agency models, an agent knows precisely what she is ignorant

overlap. She may therefore be able to pass *judgment* on the overall abilities of Jack and Jill, and, in particular, about how actions based on Jack and Jill's knowledge may be coordinated. In other words, it is possible to have knowledge of interdependencies between actions based on different knowledge elements without possessing much knowledge of these elements themselves.

Frank Knight (1921) understood very clearly that the effective exercise of authority does not require full knowledge of an employee's action set and precise knowledge of exactly which action should be picked in response to contingencies: "What we call 'control' consists mainly of selecting someone else to do the 'controlling.' Business judgment is chiefly judgment of men. We know things by knowledge of men who know them and control things in the same indirect way" (Knight, 1921: 291).[12] These principles also apply to hierarchical organization which Knights conceptualizes as layers of agents exercising judgment of subordinates' judgment and other capabilities (particularly 1921: 291–297). Delegation, Knight argues, rests on judgment. Such judgment does not require that that the principal knows the agent's entire action set.[13] Thus, when Hayek (1973) argues that authority in the sense of the delegation of decision rights, the imposition of rules on the organization, the checking of whether actions are in conformity with the rules, etc. is consistent with distributed knowledge conditions, this can be defended by invoking management judgment of subordinates.

Distributed knowledge and the size of firms

So far it has been argued that delegation combined with judgment is what makes it possible for authority relations to exist under distributed knowledge conditions. Although managers/employers may not know the full action set of an employee or what is the efficient action to take in response to a contingency, applying judgment makes it possible to delegate responsibility to employees, specifying the end goal and possible constraints, rules, etc., but leaving the rest to the employee. This is no different from how most agents interact with specialized other agents in the market place: Most of us non-plumbers usually don't know the full action set of the plumber, or what exactly to do in response to some calamity involving the plumbing of our house. Still, we rely on our judgment of the plumber, possibly supplemented with reputational mechanisms. Market transactions do not break down when there is only partial knowledge overlap. Similarly, hierarchical mechanisms, involving authority, do not break down when there is only partial knowledge overlap. Exchange is possible in the face of (partial) ignorance.

However, this reasoning immediately raises a problem that parallels the Coasian (Coase, 1937) problem of why all economic activity is not concentrated in one giant firm

about (e.g., the probability distribution associated with quality levels of a good). No such strong knowledge requirements are assumed here; only that the coordinator can pass judgment on the capacities of individual agents and on how their efforts may be aggregated into some coherent outcome.

[12] Relatedly, Minkler (1993: 18) in parts of his modeling efforts assumes that the ". . . entrepreneur can form a conjecture about the worker's possible output without contemplating *how* that output can be produced."

[13] In the incomplete contracts/property rights approach of Oliver Hart (1995), it is assumed that agents in a cooperative relation may be able to foresee (at least probabilistically) the pay-offs from their relation, although they cannot perfectly foresee all sources of these pay-offs (i.e., contracts are incomplete). This assumption is not defended in this approach, but may be justified by invoking Knightian judgment.

when there are "costs of using the price mechanism": Why exactly should judgment become increasingly ineffective as firm size increased? Kaldor (1934) argue that the "entrepreneur" is the fixed, limiting factor: Firm size will be constrained by the amount of judgment that could be derived from this factor (see also Rothbard, 1962: Chapter 7). This argument neglects delegation. Coase (1937) argues that as firm size grows, "dissimilarity of transactions" increases, and this is one reason why management commits an increasing number of mistakes as firms grow, the costs of these mistakes eventually offsetting the benefits from growth on the margin. Coase does not expand on the meaning of "dissimilarity" and why increased dissimilarity leads to more errors. Kirzner (1992: 162) mention "the incremental knowledge difficulties that stem from dispersed information." However, it is not clear why these problems cannot all be remedied by means of delegation, supported by judgment.

A rudimentary hypothesis that may be invoked in support of such arguments is that as knowledge elements become increasingly heterogeneous, the informational basis for the exercise of authority becomes increasingly undermined; Coase (1937) directly appeals to something like this, and it may underlie Kirzner's (1992) reasoning. Thus, firms will draw their boundaries around capabilities that are "similar" in the terminology of Richardson (1972). Much of contemporary management thinking on "core competencies," "capabilities," etc. and how these influence economic organization seem to reflect similar concerns (Langlois and Foss, 1999). Thus, concentration on core competencies lead firms to divest businesses, narrowing their product portfolios.

However, a number of recent studies indicate that at the same time that major multi-product firms have narrowed their product portfolios, they have actually increased their underlying technology portfolios (e.g., Granstrand, Patel and Pavitt, 1997) and the technological disciplines that constitute these portfolios have become more heterogeneous (Wang and Tunzelman, 2000). Relatedly, Brusoni, Prencipe and Pavitt (2001) argue that firms need to control knowledge in excess of what they strictly need for their productive operations. This is because such excess knowledge helps to cope with imbalances caused by uneven development in the technologies they rely on and with unpredictable interdependencies on the level of products. Thus, at least major multi-technology firms seem to control *more* and *increasingly distributed* knowledge within their boundaries, and subject to the use of the authority mechanism. Thus, it is far from clear how, if at all, distributed knowledge constrains the boundaries and size of the firm.

Implications for Austrian economics

Limits to planned orders?

The basic point that his been argued in the preceding pages is that authority relations are not necessarily compromised by conditions of distributed knowledge. Assuredly, the narrrow version of authority associated with Simon (1951) does not thrive in the presence of distributed knowledge. However, there is no inherent reason to take such a narrow view of authority. Authority involves much more than merely picking an action in an employee's action set and ordering him to carry out this action. In the context of a broader notion of authority, the employer/manager may be ignorant, perhaps quite so,

of knowledge controlled by employees, but it may still be possible to have him direct employees in various ways, such as instructing them to follow certain rules, meet certain objectives, etc. Somehow this has to be accomplised. And it is conceivable that coordination of plans by means of the exercise of authority is superior to any other coordination mechanism.[14]

While it is indeed a central tenet of Austrian economics that exchange may take place in the face of ignorance, allowing this principle to bear on hierarchical transactions has potentially subversive implications for Austrian economics because it may be interpreted as a denial of the tenet that the dispersed/distributed character of knowledge constrains authority. Problems introduced by distributed knowledge can be overcome by means of delegation and judgment. Thus, it may not matter (or matter much) for allocative outcomes if a manager does not know how exactly an agent produces an output, but can pass precise judgment on the levels and quality of that output. The right to choose the means to produce this output may be delegated to the agent, possibly backed up by some incentive mechanism that mitigates the attendant moral hazard problem (Jensen and Meckling 1992). If this is the case, it is hard to see how distributed knowledge constrains planned orders. Empirically, it is at least not obvious that this is the case of those planned orders we call firms. Clearly, the argument may be extended so that what is called into question is the whole Hayekian argument against socialism.

An austrian research agenda: Opening the black box of knowledge problems

It seems to us that to actually extend the argument in this way would be absurd. We think that the Hayekian knowledge argument makes perfect intuitive sense; a socialist planning center cannot make use of distributed knowledge as effectively as the market system can. However, our point is theoretical. We put it in this pointed way to emphasize that the foundations of the Hayekian argument that dispersed/distributed knowledge strongly constrains planned orders are not rock-solid.

For example, in the revival of the 1980s of the Austrian arguments in the calculation debate much emphasis was placed on tacit knowledge (Lavoie, 1985), which is often argued to be particularly costly to centralize (e.g., Jensen and Meckling, 1992). But as the above reasoning implies, tacit knowledge *per se* does not require either market organization or perfect centralization for it effective utilization. As Knight (1921) observed, firm hierarchies may make use of tacit knowledge. The quality of managerial judgment involves tacit knowledge (Hodgson, 1998: 191–192), and judgment is used to determine delegation of decision rights in organization so that tacit knowledge held by employees is utilized in the best possible way. In other words, the allocation of tacit knowledge requires tacit knowledge.[15] One may speculate that what ultimately constrains planned orders is how well this process is carried out; thus, the ultimate constraint is the managerial judgment of the top-management team. In a sense, we

[14] One may speculate that communication, voting, and similar mechanisms may coordinate actions under distributed knowledge. However, these mechanisms may be cumbersome relative to the authority mechanism.

[15] This Knightian idea is a key point in the very important, but neglected work of Pavel Pelikan (e.g., 1988).

come back to Kaldor's (1934) point that the ultimate constraint on firm size is the entrepreneurial fixed factor. Still, this leaves us in the dark about what are the limits to allocation of tacit knowledge (in the form of delegation) through managerial judgment.

As this line of reasoning indicates, Austrians need to open up the black box of knowledge problems in order to support the key Austrian tenet that such problems explain the limits to planned orders.[16] In their present manifestation, these arguments may not be sufficiently worked out to fully convince. They are too much like "reduced form" arguments.[17] Specifically, Austrians may look into issues such as, How exactly does increased ignorance on the part of employers/principals influence the quality of the decisions they make? Exactly what do we mean, in an economic context, by more or less ignorance? Which factors limit the efficacy of managerial judgment? Heterogeneity of the relevant knowledge inputs (e.g., delegating decision-making rights to employees with widely different disciplinary backgrounds)? If so, what does it mean that knowledge is more or less "heterogeneous"? Etc.[18]

By making the recommendation to look more closely into such epistemic matters, we are in good company: Almost seventy years ago, Hayek (1937) sketched a research program for inquiring into the knowledge and process aspects of decision-making. Only small fractions of such a program have been addressed by Hayek himself as well as later Austrians. It is time to re-open the research agenda that he sketched in 1937.[19]

Conclusions

The notion of distributed knowledge has become a prominent concept for describing the knowledge conditions in which modern firms (allegedly) more and more often find themselves. Many writers have argued that these knowledge conditions imply that authority is becoming increasingly inefficient as a mechanism of coordination, an argument that served as a critical starting point for our discussion. Similar arguments have also been put forward by Austrian economists. In a broader context, Austrians argue that distributed knowledge is a binding constraint on planned orders.

In this paper, we have discussed and rejected the more specific argument that coordination by means of authority is not viable under conditions of distributed knowledge. While it is true that authority in the narrow sense put forward by Simon (1951), that is, the picking by an employer of efficient actions from an employee's action set, does not make much sense when knowledge distributed and the employer is therefore likely to be ignorant about the employee's action set, more expansive and realistic notions of authority is consistent with distributed knowledge and employer ignorance. To

[16] That is, unless they want to drop the argument and instead invoke either incentive considerations (e.g., Williamson, 1985: chapter 6) or Misesian calculation problems (as in Klein, 1996).

[17] A related critique of working with reduced form arguments may be directed against the "control loss"-literature of the 1960s (e.g., Williamson, 1970) that also invoked "knowledge difficulties," although these were usually explained in terms of information overload rather than dispersed knowledge.

[18] Austrians may also wish to develop a complementary argument, namely that the calculation problem identified by Mises, to the extent that it is distinct from Hayek's knowledge problem, may be useful in explaining the limits to the firm. For a contribution along these lines, see Klein (1996) (building on Rothbard, 1962).

[19] Langlois (1995) and Foss (1999) may also be seen as recommending that this agenda be re-opened.

paraphrase a famous argument from Alchian and Demsetz (1972), there is no essential difference in terms of knowledge requirements between hiring a plumber in the market place and ordering the plumber-employee to fix something. We have suggested that driven to its logical extreme, this argument seems to threathen the Hayekian knowledge argument against socialism. Rather than drawing this conclusion, we prefer to advocate renewed Austrian interest into problems of distributed knowledge.

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