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Planning and Know-How: the Relationship between Knowledge and Calculation in Hayek's Case for Markets

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ABSTRACT Ludwig von Mises' calculation argument against socialism is of fundamental importance to the modern-day case for the market. Yet it is to Hayek that some Austrian-influenced theorists turn when responding to the computational models for non-market price fixing proposed by some socialists. Their reading of Hayek's epistemological argument for markets as distinct from Mises' calculation argument needs to be questioned. Hayek's emphasis upon the dispersal of knowledge across space and time is consistent with Mises' position. In spite of his philosophical critique of rationalist constructivism and his treatment of tacit knowledge, Hayek's case for the market ultimately relies upon the Misesian calculation argument. Hayek's work is therefore best understood as a shift in emphasis rather than as a philosophical departure from Mises' position.

1. Introduction

The work of the two Austrian economists, Ludwig von Mises and Friedrich Hayek, is of defining importance for the modern-day case for the market. In his seminal contribution to what is now known as the 'socialist calculation debate,' Mises (1920) developed what is referred to as the 'economic calculation argument' against socialism. Mises' thesis strongly influenced his pupil Hayek, who further developed the Austrian position. Their work has been the subject of revived interest since the 1980s. One notable reason for this interest is that, as is to be further explored here, the

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Austrian critique of socialism raises profound problems for the neoclassical model of economic calculation, from which some notable socialist proposals originated. Furthermore, the Austrians' work helps to explain some of the problems that plagued attempts at central planning during the 20th century such as in the Soviet Union and Eastern Europe (Boettke, 1993). Proposals for the replacement of the market with a system of non-market planning are now widely viewed as doomed to inevitable failure. There seems to be an absence of a satisfactory response from the left to the 'calculation problem' raised by Mises and Hayek, and their case for the indispensability of markets is generally viewed as having been vindicated.

Still, the socialist calculation debate continues to this day. Cockshott & Cottrell (1993) argue that rapid developments in information technology give cause for revisiting the question of the feasibility of non-market planning. Their computational planning model calculates the cost of all goods in terms of the minimum labour time required to produce them. The view that computation can replace markets can be traced back to Oskar Lange (1967, p. 158) who stated that markets are 'a computing device of the pre-electronic age.'

Drawing from the work of Hayek, certain writers emphasise that the essential function of markets is not computational but epistemological (Horwitz, 1996; Boettke, 1993, pp. 52–53; Hodgson, 1998). The epistemological emphasis of Hayek's case for the market is sometimes read as being distinct from Mises' calculation argument. Important clarification of Mises and Hayek on socialist calculation has been achieved by previous commentaries, correctly emphasising the common ground that they share. Yet there remain different views on the relationship between the Hayekian 'knowledge argument' and Mises' calculation argument. As Parsons (1997, p. 63).

comments, ‘there is no general agreement concerning the nature of the argument Hayek is advancing.’

This paper revisits the work of Mises and Hayek in order to explore the source of these disagreements. Section 2 introduces Mises’ calculation argument against socialism and the proposals of the socialists Lange and Dickinson towards whom Hayek’s knowledge argument was particularly directed. Section 3 offers a preliminary suggestion as to the relationship between Hayek’s knowledge argument and Mises’ calculation argument. Sections 4–7 then each discuss different aspects of Hayek’s treatment of knowledge. Section 4 details the core themes of economic change and the spatial dispersion of knowledge. Section 5 outlines the two functions of markets identified by Hayek, those of knowledge encapsulation and discovery. Section 6 considers Hayek’s discussion of the limitations of rationalism. Section 7 analyses a further epistemological theme, that of ‘tacit knowledge’. The reading of Hayek offered here has important implications for the contemporary debate about the feasibility of a computational model of non-market calculation, as is explained in Section 8.

2. The Socialist Calculation Debate

2.1. Mises’ Calculation Argument

The economic calculation argument was formulated by Ludwig von Mises in a paper on ‘Economic Calculation in the Socialist Commonwealth’(1920).¹ Mises argues that the process of market exchange is a necessary condition of rational economy because

¹ A little known, early version of the argument had been offered by Pierson in 1902 and versions by Weber and Brutzkus were published contemporaneously to Mises’. Yet Mises’ paper is generally agreed to be the most comprehensive statement of the ‘economic calculation argument’ against socialism (Lavoie, 1985, p. 2n).

it generates prices that allow economic actors to compare the value of goods in terms of a commensurable unit. The essential problem for socialism, Mises contends, lies in the absence of markets for factors of production, i.e. the natural resources, human labour and manufactured goods that are used in the production process. In all but the very simplest economies, producers would have no means of evaluating these factors of production. For Mises and later for Hayek, the problem is insoluble.

2.2. The Neoclassical Model

Mises' argument was considered by some to have been refuted in advance by the mathematical model of socialist pricing formulated by Enrico Barone (1908). Firmly in the neoclassical tradition, Barone's model demonstrated that it is possible, in principle, for a socialist ministry of production to establish a set of 'prices' that are analogous to market equilibrium. The upshot of Barone's paper, as Schumpeter (1954, p. 988–989) summarises, 'is that there exists for any centrally controlled socialism a system of equations that possess a uniquely determined set of solutions, in the same sense and with the same qualifications as does perfectly competitive capitalism, and that this set enjoys similar maximum properties.'

Drawing from Barone's 1908 paper, Oskar Lange (1937, p. 55) considered such an a priori model of socialist pricing to be sufficient to refute Mises' calculation argument. A number of Lange's contemporaries, such as Dobb (1937, p. 274) and Dahl & Lindblom (1953, p. 211) accepted this interpretation of Mises as having denied the logical, a priori possibility of socialism (Bergson, 1948, pp. 445–446; Rothbard, 1991, pp. 53–54). However, the more recent literature on Mises and Hayek highlights that their critique of the neoclassical model focused upon the unrealistic set

of assumptions upon which it is based (see Lavoie, 1985, pp. 117–124); Murrell, 1983; Vaughn, 1980; Boettke, 2000, pp. 14–18).

As Barone himself made clear, his ‘a priori’ model of socialist pricing assumes the availability to the ministry of the following three sets of knowledge:

- The quantities of fixed capital.
- The production functions (or ‘productive coefficients’) for producing goods.
- The level of social welfare produced by any given level of production.

Each assumption requires the ministry to assemble a vast amount of data and it is perhaps for this reason that there are doubts as to whether Barone himself saw equation solving to be a practicable procedure for central planning (Lavoie, 1985, pp. 83-85).

Nevertheless, this neoclassical model led socialists, notably Henry Dickinson (1933) to propose that such a mathematical model could be used by the central planning board to calculate prices in socialism. For Oskar Lange, the significance of the neoclassical model was that it showed there to be no necessary connection between equilibrium prices and market exchange. Unlike Dickinson, Lange (1937, p. 67) dismissed the need for centralised, non-market price fixing to be based upon the solution of ‘hundreds of thousands of equations.’ Instead, he suggests that, through a process of trial and error adjustment, the central planning board could ensure that equilibrium is reached.² This procedure would involve raising prices for those factors

² It is important to note however that Dickinson’s proposals for socialist calculation were never entirely reliant upon the equation-solving approach. He also suggests that there would be a role for marginal price adjustment (Dickinson, 1939, pp. 99–105).

of production that fall short and lowered for those that accumulate (ibid., p. 66).

The trial and error method was the subject of strong criticism from Hayek (1940) in particular, for whom it reflected the flawed assumptions of the equilibrium model. The assumption that the planning board ‘will possess at least as much knowledge as the individual entrepreneurs’ in a market economy ‘and will therefore be in a position to make the decisions at least as good if not better than that in which the entrepreneurs are now’ (ibid., pp. 201–202) is said to neglect the spatially dispersed and ever changing nature of knowledge which makes indispensable the decentralisation that only markets can achieve.

Hayek’s ‘knowledge argument’ for the market has been suggested to be distinct from the Misesian calculation problem. This view has recently been put by Ioannides (2000, p. 59):

For Hayek... the problem of knowledge is not reducible to knowing the prices of the means of production. Consequently, and in contrast to Mises, his case against central planning does not rest on the system’s ability to calculate rationally on the basis of freely formed prices but, instead, on its ability to utilise the knowledge possessed by all market agents.

It is this question of the relationship of the calculation and knowledge arguments that we shall now introduce before proceeding with a detailed analysis of Hayek’s treatment of the concept of knowledge.

3. A Separate Knowledge Problem?

There is a sense in which the knowledge and calculation arguments are logically independent of one another, as is indicated by Joseph Salerno (1990) in his commentary on Mises. He draws from a thought experiment discussed by Mises,

imagining that, for a given moment in time, central planners in a non-market economy are in possession of the full range of knowledge of production possibilities. Even if such an assumption is made, argues Salerno, planners would still face a calculation problem due to the absence of market prices and therefore of any means of comparing the complex plethora of production possibilities. The calculation argument is in this sense logically separable from the knowledge problem.

Yet we might also ask if the converse is possible—i.e. whether a solution to the calculation problem could be conceived that does not presuppose a solution of the knowledge problem. A solution to the calculation problem requires that some basis for calculation, such as shadow prices, is available to planners. This itself is dependent upon a prior solution to the knowledge problem, for the means of calculation would need to encapsulate the required knowledge in order to count as a solution to the calculation problem. A solution to the knowledge problem is thus a necessary condition for a solution to the calculation problem, even if Salerno is right that it is not sufficient. In this sense, the knowledge problem is a *part* of the calculation problem, rather than being logically distinct from it. It will be argued here that Hayek's discussion of knowledge is quite consistent with this point.

4. Two Dimensions of Knowledge

The assessment offered here of Hayek's knowledge argument explores two important themes in his work: the spatial dispersion of knowledge and economic change. These themes, together referred to as 'the particular circumstances of time and place,' (Hayek, 1935a, p. 80) constitute the core of his treatment of knowledge.

4.1. The Spatial Dimension

Hayek (1937, p. 50) describes the ‘problem of the division of knowledge’ as ‘the really central problem of economics as a social science.’ Knowledge, as Hayek puts it ‘is not given to anyone in its totality’ but is ‘dispersed among many people’ (ibid., p.85). The knowledge required for economic decision-making ‘never exists in concentrated or integrated form but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess’ (ibid., p.77). The division of labour amplifies this dispersion of knowledge amongst individuals. A further form of knowledge dispersion arises from the particular characteristics of goods and services such as their spatial location, age and other attributes: ‘Two technically similar goods in different places or in different packings or of a different age cannot possibly be treated as equal in usefulness for most purposes if even a minimum of efficient use is to be secured’ (Hayek, 1935b, p. 154). Often, certain products ‘are produced on individual orders, perhaps after invitation for tenders,’ or ‘are rarely produced twice in short intervals’ (Hayek, 1940, pp. 188–189). All of this means that human skills and material factors of production have many more spatially particular, economically relevant characteristics than might first appear to be the case. The result of this spatial dispersion is that, for planning to be effective, ‘a staggering amount of information’ is required (Shapiro, 1989, p. 141).

4.2. The Temporal Dimension

As well as the dispersion of knowledge across space, Hayek also emphasises ‘continual and continuous change’, what might be referred to as the temporal dispersion of knowledge. The importance of this second feature of knowledge is summarised in ‘The Use of Knowledge in Society’ when Hayek (1935a, p. 82) states

that ‘economic problems arise always and only in consequence of change.’ He makes clear that he considers continual economic change to be inevitable in any economy, including a non-market one. In a planned, socialist system, he suggests, ‘change will be quite as frequent as under capitalism; it will also be quite as unpredictable. All action will have to be based on anticipation of future events, and the expectations on the part of different entrepreneurs will naturally differ’ (Hayek, 1935b, p. 173).

4.3. Comparing Mises and Hayek on Knowledge

As explained above, a standard interpretation is that Mises denied the logical possibility of socialism. From this it follows that Hayek’s thesis, by denying only the practicality of socialism, was a retreat from Mises. However, it is now widely recognised that Mises does not deny the logical validity of mathematical models of socialist pricing. His argument is rather that such models could not be applied in the real world. The themes of economic change and the division of knowledge are present in Mises’ elucidation of this view, with the former being quite explicit: ‘the problem of economic calculation is of economic dynamics: it is no problem of economic statics’ (Mises, 1922, p. 139). Mises also emphasises the importance of the dynamic activity of entrepreneurs in the market in response to continual change.

While he does not place the same emphasis upon the spatial dispersal of knowledge, Mises’ discussion of the complex array of production possibilities does allude to the vast amount of information embodied in market prices. This is evident, for example, in his discussion of the complex array of production possibilities that is faced in a choice between numerous possible energy projects: ‘Here the roundabout processes of production are many and each is very lengthy’ (Mises, 1920, p. 96). The heterogeneity of the knowledge that would be required by planners is emphasised, for

example in his discussion of the valuation of labour: ‘it is certain that there exist among men varying degrees of capacity and dexterity, which cause the products and services of labour to have varying qualities’ (ibid., p. 114). The spatial dispersion of knowledge is, at least implicitly, a theme in Mises.

Hayek follows Mises in regarding the temporal dimension to be of fundamental importance:

If in the real world we had to deal with approximately constant data, that is, if the problem were to find a price system which then could be left more or less unchanged for long periods, then the proposal under consideration would not be so entirely unreasonable. With given and constant data such a state of equilibrium could indeed be approached by the method of trial and error. But this is far from being the situation in the real world, where constant change is the rule. Whether and how far anything approaching the desirable equilibrium is ever reached depends entirely on the speed with which the adjustments are made. (Hayek, 1940, p. 188)

This allowance for the feasibility of socialist calculation once an approximately static economy is assumed (Hayek, 1935a, p. 82), suggests that, for Hayek, the spatial dispersion of knowledge does not, in itself, constitute a decisive argument against non-market planning. As Hayek had previously put it, ‘economic problems arise always and only in consequence of change.’³

Neither Mises nor Hayek considers the opposite scenario of an economy where there is only very limited spatial dispersion of knowledge but very rapid change. To adapt an example used by Mises, this might be a Robinson Crusoe

³ Essentially the same point is made in ‘The Use of Knowledge in Society’ when he states that ‘as long as things continue as before, or at least as they were expected to, there arise no new problems requiring a decision, no need to form a new plan’ (Hayek, 1935a, 82) . The point is also made in ‘The Meaning of Competition’ (1946, p. 101).

economy where there are rapid changes in the natural environment. We can only speculate whether Mises and Hayek would consider Crusoe to face a calculation problem in such a scenario and whether they would differ in their views on this question. We cannot, therefore, reach any conclusive verdict on whether they view economic change to be more decisive for their argument than the undoubtedly profound implications of the spatial dispersion of knowledge. This philosophical point was perhaps not especially important to them, for their emphasis was upon the compound effects of spatio-temporal dispersion in real economies. We can only conclude that there are no clear grounds for distinguishing Mises and Hayek in terms of the relative importance they attach to the spatial and temporal dimensions of knowledge in the case for markets.

The only sense in which Hayek clearly differs is in placing a more explicit emphasis upon the nature of knowledge. An important reason for this difference is that Hayek, whose writings came later than Mises' opening contributions, was responding to the neoclassical models of socialist calculation offered by Lange and Dickinson (Lavoie, 1985, p. 158). Their work was published in the 1930s and as we have seen, made some explicit assumptions about the knowledge that planners would have available to them.

5. Market Prices and Knowledge

Hayek's discussion of the spatio-temporal dispersion of knowledge thus supports the Misesian thesis. The Misesian position is also strengthened by Hayek's identification of two knowledge-related functions of market prices, each of which is now outlined. The first is the encapsulation of knowledge and the second is the facilitation of knowledge discovery.

5.1. Knowledge Encapsulation

Firstly, prices encapsulate a great deal of information about particular events and circumstances, saving the need for economic actors to acquire this knowledge directly (Hayek 1935a). They therefore perform a communicative function, serving as a necessary guide to economic actors. This is a development of the point made by Mises (1920, p. 102) when he refers to prices as ‘aids to the mind.’ Furthermore, Hayek, like Mises before him, recognises that prices can quickly absorb new information. As Hayek points out: ‘where only a few know yet of an important new fact, the much maligned speculators will see to it that the relevant information will rapidly be spread by an appropriate change of prices’ (Hayek, 1976a, p. 116; cf. Mises, 1949, pp.218–220). Both recognised that such adaptations of the market are an imperfect reflection of the continual shifts in supply and demand. Nonetheless, market prices are indispensable guides to economic actors in the decision-making process.

5.2. Knowledge Discovery

The second important function of market prices is the facilitation of a process of knowledge discovery. Hayek (1968, p. 181) puts the point as follows: ‘which goods are scarce goods, or which things are goods, and how scarce or valuable they are—these are precisely the things which competition has to discover.’ In the market economy ‘we do not know in advance the facts that determine the actions of competitors’ and so we need to consider ‘competition as a procedure for the discovery of such facts as, without resort to it, would not be known to anyone, or at least would not be utilised’ (ibid., p. 179). This competitive process is facilitated by the conveying of information through the price system: ‘Provisional results from the market process at each stage alone tell individuals what to look for.... Prices direct their attention to

what is worth finding out about market offers for various things and services' (ibid., p. 181–182). The knowledge discovery process of competition is, as had been emphasised by Mises, spurred by the incentive of monetary reward for producers and entrepreneurs who discover more efficient ways of satisfying the preferences of consumers: 'we rely on self-interest because only through it can we induce producers to use knowledge which we do not possess, and to take actions the effects of which only they can determine' (Hayek, 1979, p. 70).

This knowledge discovery function of markets is the source of Hayek's objection to neoclassical models of socialist calculation such as those offered by Dickinson and Lange. Their assumptions concerning the availability of knowledge overlook the question of how knowledge is discovered. Hayek (1976a, p. 69) takes issue with the neoclassical assumption that production costs 'are an objectively given fact ascertainable by inspection, and not something which can be determined only on the basis of his knowledge and judgment—a knowledge which will be wholly different when he acts in a highly competitive market from what it would be if he were the sole producer or one of a very few.' Hayek also questions the neoclassical assumption concerning knowledge of the preferences of buyers in the market:

In the traditional treatment of equilibrium analysis part of this difficulty is apparently avoided by the assumption that the data, in the form of demand schedules representing individual tastes and technical facts, are equally given to all individuals and that their acting on the same premises will somehow lead to their plans becoming adapted to each other. (Hayek, 1937, p. 38)

Hayek's discussion of market competition as a discovery procedure intimates that it is questionable whether economic knowledge exists at all, prior to its discovery. For example, he suggests that knowledge can be defined as a capacity: 'The knowledge of

which I speak consists rather of a capacity to find out particular circumstances, which becomes effective only if possessors of this knowledge are informed by the market which kinds of things or services are wanted, and how urgently they are wanted' (Hayek, 1968, p. 182).

Thus Hayek might be read as calling into question the objectivity of the economic knowledge that is continually discovered. 'Knowledge discovery' might best be referred to as 'knowledge generation'. Yet, however we define the epistemological status of undiscovered knowledge, the important point to emphasise here is that the process of market exchange is, for Hayek, an indispensable aid in the quest for new knowledge.

5.3. The Case against Planning

The flip side of this view of economic information as the product of competition is that planning is deficient as a substitute for the market. For Hayek, once the nature of knowledge is understood, planning as a form of resource allocation can be seen to suffer from fundamental difficulties. In contrast to the decentralised market mechanism, planning institutions must gather knowledge prior to undertaking economic calculation. For Hayek, this separation of knowledge gathering and calculation is an inherent weakness of planning. This weakness becomes evident through consideration of the six stages of planning that, while not explicitly defined by Hayek, can be inferred from his critique. It should of course be borne in mind that in practice these stages might overlap and might need to be reiterated. They are as follows:

1. Specification of knowledge requirements

2. Knowledge acquisition
3. Aggregation of knowledge into a communicable form
4. Communication of knowledge to planners
5. Plan formulation
6. Plan implementation

The spatial dispersal of knowledge means that each stage of planning would need to manage a large volume of information. The problems of planning would be further compounded by economic change. The knowledge requirements specified in stage 1 might have changed before stages 6, 5, or even stages 4 or 3 of the planning process are complete. The unpredictability of economic change causes significant problems for economic planning proposals:

The alternative of having all the individual managers of businesses convey to a central planning authority the knowledge of particular facts which they possess is clearly impossible—simply because they never can know beforehand which of the many concrete circumstances about which they have knowledge or could find out might be of importance to the central planning authority. (Hayek, 1976b, p. 236)

5.4. Summary

To summarise, the need for knowledge discovery is considered by Hayek to constitute a decisive case for the decentralised market system and against economic planning. In the market system, the process of price formation incorporates the multitude of decisions made by locally situated actors. These prices enable economic actors to effectively grasp and discover spatio-temporally dispersed knowledge and to understand and contribute to processes of economic change. Knowledge discovery

and economic decision-making are therefore performed simultaneously. It is in this sense that the problem of knowledge is presented by Hayek as part of the calculation problem.

In a planning system, in contrast to the market, knowledge discovery and economic calculation functions are two distinct processes. Whether meant as a partial or complete substitute for markets, planning requires an initial phase in which knowledge is assimilated to a central location. This is the case regardless of the geographical scale of the exercise and of the number of decision-makers involved. Hayek's point is that this separation of knowledge gathering and calculation makes planning institutions vulnerable to the problem of information loss. In the case of centrally planned economies this vulnerability becomes a fundamental inadequacy in the face of spatio-temporally dispersed knowledge.

An important qualification must be made to this account of the Hayekian knowledge argument. For Hayek does not entirely reject the possibility of centralised institutions having access to economically relevant knowledge. In calling for a shift of emphasis away from the present day prominence of centrally organised bodies of scientific experts to the local knowledge of the 'man on the spot' (Hayek, 1935a, p. 83), he is still allowing a role for the former. Hayek's discussion of the spatio-temporal dispersion of knowledge certainly implies a strong scepticism about the capacity of planning institutions to gather knowledge through non-market processes, though it is not a complete rejection.

6. Abstraction and Knowledge

As we have seen, the dispersion of knowledge across time and space lies at the root of the argument for markets given by both Mises and Hayek. A further aspect of

Hayek's work with an epistemological flavour appears in the opening chapter of the first volume of *Law, Legislation and Liberty*. He offers a critique of what he refers to as 'rationalist constructivism,' the view that 'human institutions will serve human purposes, only if they have been deliberately designed for these purposes' (Hayek, 1973, p. 8). He points out that while completely rational deliberation 'demands complete knowledge of all the relevant facts' (ibid., p. 12), such complete knowledge is impossible because of the inherent limitations of the abstract concepts in terms of which we define knowledge. As Parsons (1997, p. 70) puts it, abstract concepts cannot precisely reflect the 'concrete' actuality that is epistemologically prior to them. Abstractions are therefore an incomplete, albeit indispensable, 'means to cope with the complexity of the concrete' (Hayek, 1973, p. 29).

Here, Hayek's epistemology is reminiscent of Karl Popper, whose work shares with Hayek a general theme of the limitations of rationality.

The reason why all description is selective is, roughly speaking, the infinite wealth and variety of the possible aspects of the facts of our world. In order to describe this infinite wealth, we have at our disposal only a finite number of finite series of words. Thus we may describe as long as we like: our description will always be incomplete, a mere selection, and a small one at that, of the facts which present themselves for description. (Popper, 1945, p. 261)

Hayek does not explicitly relate this point to the problem of planning, though it clearly does have implications for the feasibility of the different stages of the planning process at which knowledge needs to be consciously specified and communicated. Some commentators have inferred that, for Hayek, the limitations of abstraction mean that it would be logically impossible for the knowledge required for central planning

to be assimilated (Parsons, 1997; Gray, 1986, p. 25). Here, clarification is needed. The ‘limitations of abstraction’ argument is not, *in itself*, decisive as an argument against planning and it is not clear that Hayek intended it to be such. For rather than applying to any specific kind of knowledge, the argument applies to knowledge in general. All abstract concepts, including market prices, are necessarily imperfect reflections of concrete actuality. Prices reflect the institutions through which they are formed and the question therefore remains of which types of prices are the best guides, those provided by market or non-market institutions? As discussed above, Hayek himself acknowledges the imperfection of market prices in his critique of neoclassical economics. His argument for the superiority of the decentralised mechanism of the market as opposed to centralised planning is therefore substantiated by his discussion of the encapsulation and discovery functions of market prices in the face of spatio-temporally dispersed knowledge.

7. Tacit knowledge

Closely related to the ‘limitations of abstraction’ argument is the point drawn by numerous commentators from Hayek that much knowledge is ‘tacit’ in nature. This is the main argument offered by Hodgson (1998, 2005), for example, in his Hayekian critique of some contemporary proposals for non-market planning. The phrase ‘tacit knowledge’ is not used by Hayek himself. It is drawn from the work of Michael Polanyi who uses it to refer to knowledge that cannot be explicitly specified and so is ‘more than we can tell.’ While Hayek makes only a brief reference to Polanyi (Hayek, 1962, p. 44n), he does use Ryle’s closely related concept of ‘knowing how’ (Ryle 1945–46) in *The Sensory Order* (Hayek, 1952) and in ‘Rules, Perception and Intelligibility’ (Hayek, 1962). Knowing how is distinguished from knowing that. The

latter can be articulated whereas the former refers to abilities and skills that are inarticulable, though they can be taught and learnt.

In considering Hayek's illustrations of 'knowing how', it is useful to consider another distinction that he had previously made, between 'knowledge as a skill' and 'knowledge of processes in society' (Hayek, 1937, p. 51n). In the later writings where Hayek explicitly introduces the concept of 'knowing how,' the examples he gives are of the former kind: 'to carve, to ride a bicycle, to ski, or to tie a knot' or play billiards (Hayek, 1962, pp. 43–44). The ability to anticipate other people's behaviour is another example that is knowledge as a skill. It involves judging whether 'an approach of another person is friendly or hostile, that he is playing a game or willing to sell us some commodity or intends to make love, we recognize without knowing what we recognize it from' (ibid., p. 55).

Knowledge of 'processes in society', Hayek explains, includes knowledge 'of how the different commodities can be obtained and used' (Hayek, 1937, p. 51). In other words, it includes *economic* knowledge. It is such economic knowledge that Hayek discusses in his contributions to the calculation debate, starting in the 1930s—the knowledge of '[t]he shipper who earns his living from using otherwise empty or half-filled journeys of tramp-steamers, or the estate agent whose whole knowledge is almost exclusively one of temporary opportunities, or the arbitrageur who gains from local differences of commodity prices' (Hayek, 1935a, p. 80). Much of this economic knowledge is communicable 'knowledge that,' such as the knowledge of the shipper in the passage above (Fleetwood, 1997, p. 166). Yet some elements of economic knowledge are not fully communicable, such as the negotiating skills of the estate agent or the arbitrageur. These abilities involve adapting to a multiplicity of particular situations in various ways that could not all be fully specified in advance of them

being exercised. They are examples of what might be referred to as ‘economic know-how.’

Such economic know-how can be distinguished from skills that are non-economic in nature, on the grounds that it is concerned with ‘processes in society’. Hayek’s thesis that markets are an indispensable means of knowledge discovery is meant only to refer to know-how of the economic sort. The existence of non-economic know-how, such as the ability to ride a bike or play snooker, has no such dependence upon markets. The use of the concept of ‘tacit knowledge’ in the literature on Hayek tends not to make this distinction between economic and non-economic know-how.

The existence of tacit knowledge constitutes an argument for the market only in so far as it is know-how of the economic kind. The existence of economic know-how is dependent upon the ‘knowing that’ provided by market prices as a means of calculation. The entrepreneurs exercising economic know-how act, as Horwitz (1996, p. 72) puts it, ‘within a set of institutions, namely markets with money prices, that provide them with information about what to do and how to do it.’ Just as prices are a necessary precondition for knowledge discovery (see Section 5.2 above), they are also a prerequisite for the exercising of economic know-how. Hence the tacit knowledge argument for markets is inextricably connected to the Misesian calculation argument.

In response to Hayek, it might be asked whether other, non-market, economic indicators could facilitate the discovery and tacit utilisation of knowledge. Ultimately, the Austrian argument is based upon the premise that there could be no such indicator. Once again, the argument comes back to the Misesian problem of economic calculation.

8. Conclusion

The essence of Hayek's case is that the knowledge encapsulation and discovery functions of markets are indispensable in the face of the spatio-temporal dispersion of knowledge. This is quite consistent with Mises' position and Hayek's more explicit discussion of knowledge is therefore best considered, as Horwitz (1998, p. 443) puts it, to be a 'shift in emphasis' rather than a departure from Mises: 'Hayek simply took for granted that Mises' original claim in the 1920 article was correct and clear, so that Hayek no longer needed to make the point.' As Lavoie (1985, p. 145) puts it, Hayek's knowledge argument was an expansion of the Misesian argument rather than a new argument in itself. Indeed, there is no evidence that Hayek himself meant for his knowledge argument to be taken as distinct.

So does Hayek's epistemological stance refute the possibility of computational solutions to the problem of socialist planning? It certainly does emphasise that computational approaches face a profound challenge of how to facilitate the utilisation of locally situated, often tacit, knowledge in a dynamically changing environment. For these reasons, we might agree with Hodgson and Horwitz that the Cockshott & Cottrell model does not answer the Austrian case.⁴ Still, as the analysis here shows, Hayek's argument ultimately hinges upon the contingent claim that the spatio-temporal dispersion of knowledge is too complex for any computational system to address. There might be grounds for challenging this premise, in view of the recent, rapid developments in computational technology. Techniques designed for addressing complex problems in dynamically changing domains, have been developed even since

4 For example, the Cockshott & Cottrell model adopts the assumption that technical coefficients are known.

1993 when Cockshott & Cottrell proposed their model.⁵ The socialist calculation debate looks set to remain very much alive.

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⁵ An interesting new area of research is that of multi-agent systems; see, for example, Luck et al. (2003).

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