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Commensurability and beyond: from Mises and Neurath to the future of the socialist calculation debate

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Abstract

Mises' 'calculation argument' against socialism argues that monetary calculation is indispensable as a commensurable unit for evaluating factors of production. This is not due to his conception of rationality being purely 'algorithmic,' for it accommodates non-monetary, incommensurable values. Commensurability is needed, rather, as an aid in the face of economic complexity. The socialist Neurath's response to Mises' is unsatisfactory in rejecting the need to explore possible non-market techniques for achieving a certain degree of commensurability. Yet Neurath's contribution is valuable in emphasising the need for a balanced, comparative approach to the question of market versus non-market that puts the commensurability question in context. These central issues raised by adversaries in the early socialist calculation debate have continued relevance for the contemporary discussion.

Keywords: socialism, calculation, commensurability, money, rationality, value.

1. Introduction

This paper aims to clarify the strengths and weaknesses of two adversaries in what has since become known as the ‘socialist calculation debate’. Ludwig von Mises and Otto Neurath held opposing views on the feasibility of establishing a democratic, non-market economy. A balanced evaluation of their respective contributions is of more than just historical interest. It is shown here to have important implications for assessing the more recent course of the debate and establishing the objectives of future research.

The Austrian economist Ludwig von Mises’ 1920 paper, ‘Economic Calculation in the Socialist Commonwealth,’ in which he rejects the possibility of rational economic planning in socialism, sparked a debate that continues to this day (Kirzner 2001, 171).

ⁱ Mises’ critique of socialism was primarily aimed at the Austrian socialist Otto Neurath and his proposals for a ‘socialised’ economy (O’Neill 1998, 113). By the 1930s, the debate had extended to English speaking journals and books (Vaughn 1980, 535) with socialists such as Henry Dickinson, Oskar Lange and Maurice Dobb all responding to Mises’ ‘socialist calculation argument.’ Meanwhile, F.A. Hayek followed on from Mises in further developing the case against socialism. Mises’ work remains influential, with a number of recent contributions having emphasised its centrality to the case for the indispensability of markets (Kirzner 2001, 194).ⁱⁱ

Neurath's account of socialism was, like Mises' critique, of great significance as an early contribution to the debate. The detailed proposals for a socialist economy offered by Neurath represented a departure from the approach of traditional Marxists such as Kautsky, who considered such a speculative approach to be 'utopian' (Cartwright et al 1996, 22). As has been highlighted by O'Neill, an important feature of Neurath's work is his emphasis upon the incommensurability of values. Neurath contends that monetary calculation is inadequate as a means for rational choice and proposes a broader conception of rationality that incorporates decision-making in terms of multiple criteria (O'Neill 1998, 116-118; O'Neill 2003, 187-193; Uebel & Cohen 2004, 11). A further sense in which Neurath is of significance, discussed later in this paper, is his recognition of the implications of this incommensurability thesis for how we should assess both the socialist calculation debate and more generally the case against markets.

In this paper, Mises' calculation argument is firstly introduced and analysed. The role of commensurability and the conception of 'practical rationality' in his thesis are discussed, with reference to O'Neill's reading of Mises as offering an 'algorithmic view of practical rationality.' A different interpretation of Mises is offered here and is supported by subsequent discussion of his use of the concepts of rationality, subjective value, and utility. On this reading, Mises' position in the calculation debate is shown to be consistent with that of Hayek. The adequacy of Neurath's response to the calculation argument of Mises and Hayek is then assessed. The philosophical position shown here to be evident in the work of Mises, as well as Neurath and Hayek, is also shown to prompt some further questions that demand a broader

approach to the debate about market and non-market systems. Finally, implications of this assessment for the present and future of the calculation debate are highlighted.

2. Mises' economic calculation argument

Mises' calculation argument is founded upon three advantages that he cites of conducting economic calculation in terms of market exchange values (Mises 1935, 97-8). The first of these is that it facilitates interpersonal valuation; the second concerns the necessity of factor markets and the third points to the role of money as a commensurable unit of measurement. These are each discussed below. The latter two points require extended discussion, reflecting the detailed treatment that Mises gives to them.

The first advantage of market exchange values is that they enable the individual valuations of all participants in the market system to be incorporated into the process of economic calculation. As Mises puts it, "exchange value... arises out of the interplay of the subjective valuations of all who take part in exchange" (Mises 1935, 97). This first argument is discussed only briefly by Mises and is closely connected to the two further advantages of market calculation assessed below.

3. The need for factor markets

The second argument for market calculation specifically relates to the need for market exchange of factors of production. Factors of production are of three kinds: natural resources, human labour and "higher goods." The latter category means manufactured

goods that are used during the production process rather than for final consumption.ⁱⁱⁱ Mises holds that factor markets cannot exist in socialism, a society in which “all the means of production are the property of the community” (Mises 1935, 89). His argument is therefore not intended to apply to forms of guild or market socialism that incorporate factor markets. Given that in socialism, by definition, there is no market exchange of factors, “it will be impossible to determine (their) monetary value” (ibid, 92). Here, Mises is implicitly assuming the point which he later states: “Exchange relations between production-goods can only be established on the basis of private ownership of the means of production.” (ibid, 112). This thesis is further bolstered by Mises’ subsequent emphasis upon the importance of incentive-driven entrepreneurship in a market system as part of the process of establishing exchange value of factors (ibid, 116).

In socialism, the system for allocating factors of production is logically distinct from the system of distribution that allocates consumption, or ‘final goods’:

“It is characteristic of socialism that the distribution of consumption-goods must be independent of the question of production and of its economic conditions” (ibid, 90).

Mises allows that money could be used in socialism for the distribution of ‘final’ goods (ibid, 92). He seems to consider it likely, if not inevitable, that, even if socialism started out with a rationing system, monetary exchange of final goods would emerge. However, “the means of distribution of consumption goods” is, for him, of “more or less secondary importance” (ibid, 90). This form of monetary

exchange would only ever be operating within “narrow limits” (ibid, 91) in socialism, given the collective ownership of the means of production.

For Mises, it is the allocation of factors of production that is the key problem for socialism (Mises 1935, 104; Vaughn 1980, 539) and is generally referred to by contemporary commentators as the ‘economic calculation’ problem (see, for example, Armentano 1969, 129; Lavoie 1985, 51-4, Boettke 1990, 13). The problem of economic calculation thus relates to what shall be referred to here as ‘productive calculation,’ meaning decisions facing producers about what to produce and which factors to use.

Mises makes clear that this calculation problem arises from economic complexity. Producers must choose from a wide range of possible scales, methods and objectives of production.^{iv} That the need for factor markets is seen by Mises to originate from the complexity of production choices is clear when he notes that factor markets are not necessary in a simple economy. He allows that factor markets are not necessary for the “farmer in economic isolation” who must choose between the expansion of pasture farming and hunting (Mises 1935, 96). But for Mises, it is “obvious “ that “this is only possible in very simple conditions” (ibid, 97). Such choices require the producer to reduce “all elements in the computation” to the alternative possible sets of final consumption goods that he could then “evaluate immediately” in deciding which to produce (Mises 1936, 115). There are two different aspects of this problem of economic calculation that are highlighted by Mises. First is the complex, “diverse” range of modern productive processes (Mises 1935, 96). Monetary calculation is essential, he comments, because it “affords us a guide through the oppressive

plenitude of economic potentialities” (ibid, 101). Monetary valuation is a means of comparing these productive methods. Secondly, Mises makes the important point that the economic calculation offered by the market embodies more than just technical information about the productivity of different factors:

“technical calculation is not enough to realise the ‘degree of general and teleological expediency’ of an event; it can only grade individual events according to their significance; but... it can never guide us in those judgements which are demanded by the economic complex as a whole” (ibid, 129).

Economic rationality thus involves ensuring that the value of higher goods relates to the subjective valuations that consumers attribute to the final goods they might be used to produce. The opportunity cost of using a higher good for a particular productive purpose is tied to the consumer valuations of the range of final goods that might be produced. As Mises puts it, monetary calculation “enables us to extend judgements of value which apply directly only to consumption goods – or at best to production goods of the lowest order – to all goods of higher orders” (Mises 1936, 117). Economists refer to this feature of factor prices incorporating consumer preference as ‘factor imputation.’ Lavoie further explains it:

“In a complex, multistage production structure, these evaluations of higher order goods are ‘derived’ or ‘imputed’ from the producer evaluations at the next lower stage of producer goods and ultimately from the consumers’ demands for the lowest order of goods. Were anything to sever this connection of value imputation between lower and higher stages of production, a potential ‘calculation problem’... could emerge”

(Lavoie 1985, 51).

Lavoie explains that, for Mises, there is an extra degree of complexity involved in calculating how to employ higher order goods, compared to the allocation of final goods.

“Consumer evaluations may be inaccurate in the sense that consumption goods may fail to meet expectations, but producer evaluations that combine complex technological questions with value questions are far more susceptible to error, and the error that results is more likely to have serious social consequences” (Lavoie 1985, 51).

Due to this complexity of economic calculation, attempts to consciously plan a system of factor prices according to these principles will inevitably fail:

“The mind of one man alone... is too weak to grasp the importance of any single one among the countless many goods of a higher order. No single man can ever master all the possibilities of production, innumerable as they are, as to be in a position to make straightway evident judgements of value without the aid of some system of computation” (Mises 1935, 102).

In a static economy, Mises allows, it is “conceptually possible” (ibid, 109) to conduct economic calculation but the problem of complexity is of course compounded once it is recognised that “in real life... our economic data are for ever changing” (ibid, 109).^v As a result of this inevitability of economic change the “socialist economic

order” is left “floundering in the ocean of possible and conceivable economic combinations without the compass of economic calculation” (ibid, 110).

4. Did Mises hold an ‘algorithmic conception of practical rationality’?

The third advantage of monetary calculation offered by Mises is that monetary units enable the costs of each decision to be expressed in terms of a single, common denominator. Such monetary costs, or ‘exchange values,’ are the price for which goods exchange on the market. As Mises puts it, “calculation by exchange value makes it possible to refer values back to a unit” (Mises 1935, 98). The necessity of a commensurable unit of measurement arises from the need for incorporating interpersonal comparisons, as well as the complex range of higher and final goods. The three advantages of monetary calculation offered by Mises are thus closely interconnected.

The reason why Mises considers a commensurable unit of measurement to be necessary shall now be discussed further, with reference to the interpretation offered by John O’Neill. O’Neill’s interpretation appears in his commentaries on the calculation debate (O’Neill 1995, 1996 and 1998) and in his review of Neurath’s discussion of non-market associations (O’Neill 2003). On O’Neill’s reading, Mises’ thesis on the need for a commensurable unit originates from his “algorithmic” conception of practical reason. This interpretation is encapsulated in the following two passages from O’Neill:^{vi}

“Mises had rejected the possibility of socialism on the grounds that rational choices between alternatives were impossible in the absence of a single monetary measure through which comparisons could be made. Mises assumes an algorithmic conception of practical reason. Rational decision making requires a single common unit which reduces the choice between different options to a matter of calculation, of the application of mechanical procedures of calculation to arrive at a determinate answer to a question” (O’Neill 2003, 188).

“Comparability between options requires monetary prices that measure exchange value such that one is able to have a determinate answer to the advantages of alternatives by way of simple rules” (O’Neill 2003, 188).

In assessing O’Neill’s interpretation it is helpful to introduce a distinction between two kinds of conception of practical rationality and to consider which kind of theory Mises is offering. The first is an *instrumentalist* conception of practical rationality that is concerned solely with establishing procedures as means for achieving given ends. A second kind of theory is of a practical rationality that incorporates *ethical judgement* and hence evaluates the ends of activity , rather than just the means.

Turning firstly to practical rationality in the instrumental sense, Mises certainly does propose that monetary calculation is a necessary tool for making practical choices between different means for achieving desired ends. This point is made in the following quote by Mises that is cited by O’Neill:

“The practical man... must know whether what he wants to achieve will be an improvement when compared with the present state of affairs and with the advantages to be expected from the execution of other technically realisable projects which cannot be put into execution if the project he has in mind absorbs the available means. Such comparisons can only be made by the use of money prices” (Mises 1949, 209).

Given the essentially algorithmic nature of monetary calculation, this would seem to support O’Neill’s interpretation. Indeed, Mises does refer to reason as being concerned solely with the means for achieving certain ends, such as in the following comment in *Human Action*:

“All instinctive impulses defy examination by reason because reason deals only with the means of attaining ends sought and not with ultimate ends” (Mises 1949, 173).

As O’Neill notes, Mises states in *Epistemological Problems of Economics*: “the ultimate goals—the values or ends—at which action aims are beyond rationality” (Mises 1960, 148). Here, Mises is stating his subjectivist position, which holds that there can be no rational justification for the particular moral ends that we hold (O’Neill 1998, 43). Mises illustrates this point by using the following example: “It is neither more nor less rational to aim at riches like Croesus than to aim at poverty like a Buddhist monk” (Mises 1949, 880).

In addition to Mises’ instrumentalism, O’Neill’s reading can draw further support from Mises’ remarks on the irrationality of socialist production when the instrument of monetary calculation is absent:

“for the most part, it would no longer be possible to speak of rational production. In the absence of criteria of rationality, production could not be consciously economical” (Mises 1936, 119).

Mises later states: “economic activity is rational activity” (ibid, 124) and rational production becomes “completely impossible” when “one gives up a freely established monetary price” (Mises 1935, 104). Mises even questions whether “rationality and logic in thought itself” would be possible without the economic calculation that is facilitated by the market (ibid, 105).

Thus Mises certainly does ascribe an instrumental role to monetary calculation that is in this sense an algorithmic tool for rational decision-making. But is this a complete account of Mises’ conception of rationality? Mises also offers a conception of non-algorithmic, non-instrumentalist ethical judgement. It is to be argued here that this cannot be excluded from an account of Mises’ conception of practical rationality or of the thrust of his calculation argument against socialism.

While there is clearly evidence that, for Mises, monetary calculation is *necessary* for rational economic calculation, it does not follow that he considers calculation in terms of monetary exchange values to always be *sufficient* for rational choice between productive alternatives. Although O’Neill does not explicitly address the point, his discussion implies that for Mises, calculation in terms of monetary exchange values is always *sufficient* for rational choice to occur. This is evident in the two passages from O’Neill quoted above, which refer to a “determinate answer” to choices being reached

by means of an algorithmic, mechanical process of comparing monetary prices. It is again evident when he suggests that, for Mises, there is an “algorithm... for arriving at an optimal decision” (O’Neill 2003, 191). Mises, on this reading, allows no room for non-monetary criteria to be considered in productive decisions. It is to be argued here that Mises’ account of such decisions does incorporate non-algorithmic, non-monetary values and therefore that it is misleading to refer to his conception of practical rationality as algorithmic.

O’Neill offers the following passage from *Socialism* in support of his reading of Mises:

“If, for example, we are considering whether a hydraulic power-works would be profitable we cannot include in the computation the damage which will be done to the beauty of the waterfalls unless the fall in values due to a fall in tourist traffic is taken into account. Yet we must certainly take such considerations into account when deciding whether the undertaking shall be carried out” (Mises 1936, 116, cited in O’Neill 1998, 117).

However, rather than supporting the O’Neill interpretation, this passage offers evidence against it. By “such considerations,” Mises is referring to the “elements of value which are not the subject of exchange,” that, he says, “elude” the computations based on exchange value (Mises 1936, 116). The value of the natural beauty of the waterfall is one such consideration. Contrary to the O’Neill interpretation, Mises is arguing that this non-economic good “must certainly” (ibid, 116) be taken into account when deciding whether to build the power works.

As O'Neill acknowledges (O'Neill 1998, 117), Mises considers the beauty of the waterfall to be a 'non-economic' good. Mises gives further examples of such non-economic goods, including the "beauty of a place or of a building, the health of the race, the honour of individuals or nations" (Mises 1936, 116). O'Neill interprets Mises as arguing that such non-economic goods both can and must be evaluated solely in monetary terms. According to O'Neill, Mises argues that when "hard choices" need to be made, as in the waterfall case, we must assign monetary values to non-economic goods, thus becoming "implicit accountants, putting a price on unpriced goods" (O'Neill 1998, 117). It is true that Mises does consider it *necessary* to establish the monetary cost of different alternatives. It is also true that decisions such as in the waterfall case, do themselves influence prices. But monetary criteria are not sufficient for reaching a rational decision. Mises explicitly states that non-economic goods "cannot enter into money calculations" (Mises 1936, 116).

O'Neill uses the following passage from Mises as evidence for his interpretation:

"If we know precisely how much we have to pay for beauty, health, honour, pride, and the like, nothing need hinder us from giving them due consideration. Sensitive people may be pained to have to choose between the ideal and the material. But that is not the fault of a money economy. It is in the nature of things" (Mises 1936, 116).

Here, Mises does not mean that the *value* of non-economic goods can be expressed monetarily. Knowing how much we have to pay for an economic good rather means knowing the difference between the monetary price of the policy that preserves it and

the policy that does not. To illustrate this point, the cost of preserving the non-economic value of the waterfall is as follows: let C = the cost of building the hydraulic power works and maintaining it over a certain period of time. Let B = the revenue from the energy generated during that time. Let ER = the tourist revenue that would be gained if the power works was not built during that time. The monetary opportunity cost of preserving the beauty of the waterfall by not building the power works (OC) can be expressed as:

$$OC = (B - C) - ER$$

OC does not, for Mises, fully express the value of preserving the waterfall because it does not and cannot take into account the value of the 'non-economic goods' that it provides, such as its natural beauty. Mises' position can be expressed in terms of the formulation of total economic value (TEV) used by contemporary environmental economists (Pearce et al 1989):

$$TEV = AUV + OV + EV$$

where

AUV = actual use value

OV = option value

EV = existence value

In this formulation, option value is distinguished from actual use value in that it refers

to the value of potential use. Existence value is the intrinsic value of environmental goods, as distinct from their actual or potential use (ibid, 60-61). The tourist revenue (ER) above constitutes the AUV of the waterfall.^{vii} However, ER does not capture the OV and EV of the waterfall and it is this part of TEV that, Mises allows, cannot be captured by monetary cost.

In relation to his waterfall example, Mises holds that, when only monetary criteria are considered, the opportunity cost of preserving the waterfall (OC, as defined above) is a positive value. However, Mises is not claiming that $TEV=OC$. His claim is rather that knowing OC is *a necessary part of* making a rational choice about the future of the waterfall. This rational choice involves comparing OC to the ‘non-economic’ components of the value of the waterfall (expressed in the above formulation as $OV+EV$).^{viii} This is clear in *Human Action* where Mises considers the development of a water supply project that would result in the demolition of a historical landmark:

“The fact that the feelings which recommend the conservation of the monument cannot be estimated in a sum of money does not in any way impede the councilmen’s decision. The values that are not reflected in any monetary exchange ratio are, on the contrary, by this very fact lifted into a particular position which makes the decision rather easier” (Mises 1949, 216).

It is therefore clear that, for Mises, such normative decisions involve weighing non-monetary values such as aesthetic values or ecological goods against their monetary cost. This is not an algorithmic process in the sense suggested by O’Neill that there is a determinate answer yielded by the procedure itself. It involves making a comparison

between monetary cost on the one hand and a non-economic value on the other. The non-economic good is, in this sense, being treated ‘in natura,’ without being assigned a monetary value. Hence, as Cockshott and Cottrell observe, Mises’ use of the waterfall example shows that “Mises, to his credit, is also quite willing to admit that important environmental issues cannot be brought within the ambit of *monetary* calculation either” (Cockshott and Cottrell 1993, 82-83). In this respect, Mises’ position is consistent with that of contemporary environmentalists who point to the limitations of ‘contingent valuation,’ a method for assigning monetary values to ecological services^{ix}.

O’Neill’s interpretation of Mises originates from the interpretation held by Otto Neurath. Neurath states that, for Mises, “money calculation discloses whether production should be undertaken or not” (Neurath 1925a, 428).^x This explains his surprise at Mises’ comments on the deliberate destruction of goods by monopolists (Mises 1936, 387-8) in which, as Neurath points out, Mises makes room for “a concept of wealth separate from the money calculation” (Neurath 1925a, 428). However, on the interpretation offered here, Mises is being quite consistent. He does, after all suggest that non-economic goods “are just as much motives of rational action, provided people think them significant, as those normally called economic,” (Mises 1936, 116) and adds that there is “no difficulty in taking them into account”(ibid, 116). He further remarks that monetary calculation can be misleading “when it is employed to estimate the value of things which are not exchangeable as, for instance, when people attempt to estimate the loss due to emigration or war” (ibid, 117). The motivational importance of such values means that, for Mises, in spite of his

subjectivism, there is a sense in which ethical judgements are a part of practical rationality:

“And since complete satisfaction is impossible, the sphere of economic activity is coterminous with the sphere of rational action. It consists firstly in valuation of ends, and then in the valuation of the means leading to these ends. All economic activity depends, therefore, upon the existence of ends. Ends dominate economy and alone give it meaning” (Mises 1936, 124-5).^{xi}

In *Human Action*, he expresses the point as follows:

“Economics, as a branch of the more general theory of human action, deals with all human action, i.e. with man’s purposive aiming at the attainment of ends chosen, whatever these ends may be. To apply the concept *rational* or *irrational* to the ultimate ends chosen is nonsensical” (Mises 1949, 880).

When contrasted to Mises’ explicitly instrumentalist treatments of the concept of rationality, these passages leave a certain ambiguity about the status, rational or otherwise, of ethical judgements. What is however clear is that, on Mises’ account, the ‘economic’ activity, that is here “coterminous” with rational activity, is meant in a broad sense that does incorporate non-monetary values as an important motivator of action. Mises’ distinguishes between two senses of the term ‘economic’. Economic activity in the general sense consists of the “valuation of ends, and then in the valuation of the means leading to these ends” (Mises 1936, 124). Narrow, or ‘purely economic’ action involves only “exact,” “money calculation” (ibid, 124) and

essentially consists of numerical profit and loss calculation (Mises 1960, 158). Mises considers economic activity in the former, more general sense to be synonymous with rational activity (Mises 1936, 124-5).^{xii} Economic in the narrow sense excludes ‘non economic’ objectives that are included as motives of economic activity in the general sense. This includes “immaterial,” or moral, as well as material ends (ibid, 125), as might be, the case, for example, in a decision to go to war (ibid, 126). The aesthetic value of the waterfall or historical monument referred to in Mises’ examples would also fall into this category.

The concept of rationality is thus concerned with realising both monetary objectives and non-monetary, incommensurable values. The waterfall example shows that, for Mises, evaluative judgements are often required that cannot be reduced to purely monetary calculation or algorithmic rationality. Normative ends constitute a part of rational activity in the sense that they motivate rational choice. The close relationship between ethical judgements and the instrumental activity through which values are realised means that it is misleading to characterise Mises’ conception of practical rationality as purely ‘algorithmic.’

5. Subjective value, exchange value and utility

Consistent with Mises’ view that not all values can be reduced to money prices, is his concept of subjective value that he distinguishes from monetary, or exchange, value. That subjective value is not reducible to exchange value is a point made subtly in Mises’ 1920 paper when he states that “Money is no yardstick of value, nor yet of price. Value is not indeed measured in money, nor is price. They merely consist in

money” (Mises 1935, 98).

Mises also explains the sense in which subjective values are not measurable:

“Valuation can only take place in terms of units, yet it is impossible that there should ever be a unit of subjective use-value for goods. Marginal utility does not posit any value, since it is obvious that the value of two units of a given stock is necessarily greater than, but less than double, the value of a single unit. Judgments of value do not measure; they merely establish grades and scales” (Mises 1935, 96-7).

For Mises, the value of goods can only be expressed ordinally, as a preference ranking, rather than in terms of a cardinal unit of measurement. Mises rejects the possibility of cardinal measurement of subjective value in his subsequent work, *Socialism*:

“There are in the sphere of values and valuations no arithmetical operations; there is no such thing as a calculation of values” (Mises 1949, 122).

Mises expands upon this point in *Human Action*. He considers the value of all goods to consist in their *utility*. Yet Mises rejects the claims of previous utilitarian philosophers and economists such as Jevons who considered utility to be a phenomenon that is measurable. They “failed to recognise the purely formal character of the notions *pain* and *pleasure* and gave them a material and carnal meaning” (Mises (1949), 15). He criticises those mathematical economists who “have gone so far as to declare economic calculation could be established on the basis of units of

utility” (ibid, 353). Mises’ conception of value is utilitarian only in a “formal” sense of “that which acting man aims at because it is desirable in his eyes” (ibid, 21). This preference satisfaction theory of utility allows for the possibility of differences in the subjective content of different individuals’ satisfaction.

Mises emphasises that the ordinal ranking of goods guides the exchange transactions of market participants and is, in this sense, the basis of monetary calculation. In relation to the waterfall, the comparison between the opportunity cost of its preservation and the non-economic benefits yields such an ordering. But there is clearly a difference between allowing for the possibility of the preference ordering of such non-economic goods and the claim that exact monetary values can be assigned to them. As shown above, Mises does not make this latter claim and makes clear that monetary values cannot be assigned to such goods.

Mises’ concept of subjective value is not reducible to exchange value. He points out that it is because of this divergence in the subjective value and exchange value of a good that exchange occurs at all (Mises 1949, 205). Although Mises does not make the point in quite these terms, it would seem that, with respect to final goods, exchange occurs when the exchange value of a good is lower than its subjective value to the consumer. Economists have since referred to this extra utility, gained by consumers, as a ‘consumer surplus.’

Rather than being a sole determinant of exchange value, subjective value is one of its four sources. Another two are the costs of production and the market structure. The fourth is the interaction between supply and demand, including speculative trading, as

is acknowledged by Mises' comments in his 1920 paper on the fluctuation of exchange value:

“The exchange-relationship which obtains between money and goods is subjected to constant, if (as a rule) not too violent, fluctuations originating not only from the side of other economic goods, but also from the side of money” (Mises 1935, 204).

Such divergence between subjective value and exchange value needs to be assessed by economic actors in particular cases. Mises' recognition that prices generally only approximate to subjective values reflects his scepticism about whether the neoclassical concept of equilibrium is ever attained in real economies. In contrast to the neoclassical school, Mises views economic decision-making as an imperfect process based upon subjective judgements that are often intuitive, even unconscious (Lavoie 1985, 64), rather than being purely algorithmic.

That Mises distinguishes between subjective value and monetary price supports the interpretation offered here that his theory of economic calculation makes room for non-monetary values. In terms of advocating a theory of ordinal utility, Mises occupies common philosophical ground with his adversary in the calculation debate, Otto Neurath. Whilst Mises' conception of utility is more formalistic than that of Neurath^{xiii}, this formalism reveals that his calculation argument is not dependent upon any substantive notion of utility. Given that, for Mises, prices emerge from the ordinal ranking of options by market participants, it is notable that such rankings could in principle be made according to any kind of ethical criteria. The case for prices hinges upon their usefulness as a calculative tool rather than them being a comprehensive

and precise measure of value. The fundamental reason for the indispensability of monetary calculation lies not in the algorithmic nature of rational choice but as further explained below, in the complexity of economic decisions.

6. Complexity as the source of the calculation problem

The concept of complexity lies at the root of Mises' argument that economic calculation is impossible in socialism. This can be illustrated using the waterfall example discussed above. Given the complex range of interconnections that characterise an economy, the monetary valuations of C, B and RE referred to above embody a multiplicity of valuations of other goods. To take C, the cost of building the power works, this valuation must embody the opportunity cost of the factors of production required, which itself depends upon the value of all alternative uses of these factors. A valuation such as this encapsulates a complex set of interrelationships across the economy that requires a commensurable unit in terms of which it can be expressed.

Mises views our cognitive abilities as limited in relation to such complexity. This is implicit when he remarks that the level of complexity of economic problems that are soluble 'in natura' depends upon our intellectual ability:

"How far it is possible to bring the relatively remote prerequisites of well-being into this rank order without resorting to more complicated processes of thought depends on the intelligence of the individual. It is certain, however, that even for the most gifted person the difficulties of weighing means and ends become insurmountable as

soon as one goes beyond the simplest processes of production involving only a short period of time and few intermediary steps" (Mises 1960, 156).

Monetary calculation, originating from market exchange, is therefore presented by Mises as a necessary tool for economic calculation in a complex economy. This is why he refers to money prices as "aids to the mind" (Mises 1935, 102).

As O'Neill acknowledges, Mises gives examples of simple decisions being made 'in kind.'^{xiv} The first of these to be discussed here relates to the decision of socialist planners about what to produce. The second relates to the other aspect of productive calculation, how best to produce it.

The first example is a choice between whether to produce 1000 hectolitres of wine or 500 of oil. Mises allows that it would be possible to make such a simple decision without the need for monetary calculation.

"It will be evident, even in a socialist society, that 1000 hectolitres of wine are better than 800, and it is not difficult to decide whether it desires 1000 hectolitres of wine rather than 500 of oil" (ibid, 103).

Mises was later to state explicitly that in socialism it would be possible to make such judgements concerning the consumption goods that should be produced:

"It is not a question of whether there shall be produced cannons or clothes, dwelling houses or churches, luxuries or subsistence. In any social order, even under Socialism,

it can very easily be decided which kind and what number of consumption goods should be produced. No one has ever denied that.” (Mises 1936, 141).

Ramsay-Steele, a contemporary proponent of the economic calculation argument against socialism, recognises the implications of Mises’ position here. He views Mises as having conceded too much in allowing for the possibility of ‘in natura’ valuation even in such simple cases. His response is as follows:

“Well, I deny it. A society that cannot value factors *ipso facto* cannot value final goods – therefore a society that can value final goods can value factors, so Mises’ unwarranted concession about consumer goods contradicts his economic calculation argument. Without knowing what consumer goods cost to produce, the administration is in no position to select the kind and number of consumer goods” (Ramsay-Steele 1992, 118).

Ramsay-Steele is denying the possibility of evaluating alternative sets of final goods ‘in natura,’ in a way that would incorporate both production costs and public demand. Mises, with his scepticism about the possibility of democracy in socialism (see Mises 1936, 82-5), is not necessarily seeking to incorporate public demand into the imagined decision, at least not in the complete sense in which monetary demand is incorporated into market outcomes. Still, Ramsay-Steele argues against Mises, on the grounds that the choice between oil and wine could not be made by the socialist planners without their having knowledge of production costs. As he points out, Mises is allowing for the possibility of choices being made ‘in natura’^{xv}. In so far as such non-algorithmic judgements are part of rational decision-making, they count as evidence against Mises

holding a purely algorithmic conception of rationality.

The second example given by Mises is that of the one-man economy of Robinson Crusoe. The simplicity of this economy means that not only is Crusoe able to choose between final goods but he is also able to “form judgements of the significance to him of goods of a higher order” without numerical calculation (Mises 1935, 96). This requires Crusoe to consider the “intersubstitutability” of these higher order goods. Their usefulness must be assessed in relation to the subjective value of “lower order” goods that Crusoe is aiming to produce for his own consumption. This is a potentially complex task and it is significant that Mises allows for the possibility of it being performed through ‘in natura’ calculation, even in a simple economy.

The ‘wine or oil’ and Crusoe examples indicate the possibility of the two different aspects of productive calculation being possible in simple cases without monetary calculation. The implication is that, for Mises, it is when cases become more complex that the difficulty arises for socialist calculation.^{xvi} Mises’ 1920 article highlights complexity as the source of the calculation problem. In *Socialism* Mises further describes the situation in which socialist planners would find themselves in the absence of factor markets:

“This is not to say that the socialist community would be entirely at a loss. It would decide for or against the proposed undertaking and issue an edict. But, at best, such a decision would be based on vague valuations. It could not be based on exact calculations of value” (Mises 1936, 122).

This allowance for the possibility of “vague valuations” again suggests that the question of the feasibility of rational ‘in natura’ decision-making is a matter of degree. It depends upon the level of complexity in a productive decision and the cognitive ability of the decision maker, although Mises makes clear that even the most intelligent humans could not make rational productive decisions ‘in natura’ in any but the simplest economies.

Cockshott and Cottrell agree that complexity is the source of the need for monetary calculation:

“The limits of such planning in kind are set by the degree of complexity of the production processes. At some point, it becomes impossible to achieve a synoptic appreciation of the relevant interconnections; beyond this point, rationality in the allocation of resources requires the use of some objective ‘unit’ in which costs and benefits may be expressed” (Cockshott and Cottrell 1993, 78).

7. Hayek on calculation and rationality

One implication of Mises’ acknowledgement of non-economic goods is that it calls into question whether the epistemological assumptions of Mises and Hayek were really “in conflict,” as O’Neill suggests (O’Neill 2003, 189). This supposed difference between Mises and Hayek does not account for Mises’ acknowledgement of qualitatively different values that are incommensurable and non-measurable. The reason O’Neill draws such a distinction between Mises and Hayek is his interpretation

of Mises' argument on the need for commensurability as implying an algorithmic conception of practical rationality:

“Mises' criticisms of socialism turn primarily on assumptions about commensurability that Lange and Taylor shared, but which Neurath and Hayek rejected” (O'Neill 2003, 189).

It is true that Hayek rejected the idea that commensurable units of measurement are sufficient for achieving rational calculation but as we have seen, so did Mises. So in what other sense did Mises make assumptions about commensurability that Hayek rejected? Hayek does refer far less frequently than Mises to the need for a commensurable unit of measurement. This fact underlies O'Neill's comment that, “In Hayek's work, the issue of calculation is largely absent” (O'Neill 2003, 189). Yet, as Horwitz points out, “one way of reading the shift in emphasis is that Hayek simply took for granted that Mises's original claim in the 1920 article was correct and clear, so that Hayek no longer needed to make the point” (Horwitz 1998, 443). But Hayek fully agrees with what he refers to as Mises' “demonstration” that factor prices are necessary for ensuring the “economic use of resources” (Hayek 1949b, 143). Hayek says of Mises' thesis that it “represents the starting-point from which all the discussions of the economic problem of socialism... must necessarily proceed” (ibid, 143).^{xvii} This agreement is implicit in much of Hayek's discussion of the need for markets and he does make it explicit in places. He criticises the Lange-model for not incorporating a factor market that would be sufficiently free from centralised control (ibid, 133-4) and endorses Mises' case for a “competitive market” as necessary for the pricing of factors (ibid, 143).

Hayek frequently emphasises the importance of the complexity problem that concerned Mises. He explains that the beauty of prices is that they can serve as a guide for purchasers of goods, without them needing to know of the events that give rise to them (Hayek 1949a, 84; 1982b, 117). This point applies to the purchasers of both final goods and factors of production. Hayek agrees with Mises that this complexity is the source of the need for factor prices as a commensurable unit of measurement. Also like Mises, he refers to two aspects of this complexity. The first is the huge variety of productive processes. Producers need to know “which of the available technical methods is the most economical in the given circumstances, and the changes in the relative scarcities in the different materials” (Hayek 1982b, 117) This entails a need for prices: “What he will need in order to choose successfully from among the opportunities known to him are signals in the form of known prices he can get for the alternative services or goods he can produce” (Hayek 1982b, 9). The second source of complexity is that factor prices are influenced by consumers’ valuations of final goods. Hayek explains that it is necessary to attach “to each kind of scarce resource a numerical index which cannot be derived from any property possessed by that particular thing, but which reflects, or in which is condensed, its significance in view of the whole means-end structure” (Hayek 1949a, 85). In this sense, if monetary calculation is, for Mises, a necessary component of practically rational productive decision-making, then the same can be said of Hayek. Like Mises, Hayek also emphasises the importance and inevitability of economic change (e.g. Hayek 1949a, 82; 1949c 101; 1949d 173) in his presentation of the problem of complexity.

The importance of prices as a commensurable unit is implicit in Hayek's account of the function of factor markets. He refers to the need to equalise the marginal rates of substitution for all factors, which can only be achieved "by all producers adjusting the relative quantities of the different factors which they use according to their uniform market prices" (Hayek 1982a, 118-9). Hayek was sceptical about whether this equilibrium can be reached but this is not to diminish the importance of the process of striving to reach it. Mises, after all, shared this scepticism concerning the neoclassical concept of equilibrium (Mises 1949, 707).

Hayek's agreement with Mises on the need for factor prices supports Lavoie's view that Mises and Hayek offer the same calculation argument (Lavoie 1985, 50).^{xviii} However, it is true that, as O'Neill points out, Hayek places greater emphasis upon the epistemic difficulties that would face any non-market form of economic calculation. He stresses that the economic problem of society is a problem of how knowledge is to be made available and used (Hayek 1949a, 78; Hayek 1949c, 95). Such knowledge, in the Hayekian account, is both dispersed and continually changing (O'Neill, 1998 129; Shapiro 1989, 141). Furthermore, much of it is 'tacit,' meaning that it cannot be "articulated in propositional form" (O'Neill 1998, 130) and is thus "linguistically inaccessible" (Horwitz 1996, 73). Hence the "central problem" of planning is "our incapacity to assemble as a surveyable whole all the data which enter into the social order" (Hayek 1982b). The decentralised process of market exchange enables such dispersed, often tacit, knowledge to be utilised by those who possess it (Hayek 1949a, 84). The impossibility of a single planning board being able to address the complex, economy-wide problem of economic calculation fits with Hayek's more general thesis in *Law, Legislation and Liberty* that some social scientists fail to

recognise the limitations to human reason. Such scepticism seems to O'Neill to distinguish Hayek from Mises.

While Mises does not refer to the problem of how tacit knowledge might be articulated in a non-market society, he does, as we have seen, point to the scale and complexity of the data that exist in an economy, as well as to the limitations of human reason in relation to this complexity. Hayek also points to these limitations. Reason involves abstracting, or “singling out” only some aspects of the complex situations that we experience before making a decision (Hayek 1982a, 30). Contrary to some rationalists’ presentation of rationality as a perfectly logical process, “it is always only in combination with particular, non-rational impulses that reason can determine what to do, and its function is essentially to act as a restraint on emotion or to steer action impelled by other factors” (Hayek 1982a, 32). Even though Hayek’s account of rationality is not strictly an instrumentalist one, reason is still an influence in the selection of means for achieving our desired ends. Hayek does not question the rationality of the choices made by producers “endeavouring to produce their outputs as cheaply as possible” (Hayek 1982b, 118). There is no reason to doubt that he views the cost-based decisions by individual producers as rational when he states: “The continuous flow of goods and services is maintained by constant deliberative adjustments” (Hayek 1949a, 83). Horwitz agrees that Hayek attaches importance to the role of human reason in productive decisions:

“If Hayek were completely dismissing the possibility of rational action by individuals, how does one make sense of his repeated claim that spontaneous orders are comprised

of the multitude of consciously calculating individuals and organizations we know as families and firms” (Horwitz 1998, 441).

Like the Misesian argument concerning entrepreneurship^{xix} (which is not so prominent in Hayek’s work), Hayek’s discussion of knowledge gives further support to the view that only the process of market exchange can make available the commensurable unit of measurement that is necessary for economic calculation. As Lavoie argues, Hayek’s contribution is best seen as an expansion of the Misesian argument rather than a refutation of it (Lavoie 1985, 145). Mises and Hayek may differ, especially in terms of emphasis, in the reasons that they give for why a commensurable unit can only be available in a market system. But both do agree that it is necessary and in this sense they do not differ on the issue of commensurability.

What do Mises and Hayek think would be the result of a society in which there was no market-based productive calculation? They both expect that the result would be a drop in the standards of living.^{xx} For Ramsay-Steele, Mises’ tone generally suggests that: “when an attempt is made to implement world-wide socialism, the collapse will be so great that the prerequisites of large-scale society will be unsustainable and society will fragment into unco-ordinated bands (Ramsay-Steele 1992, 121). The emphasis of Hayek, however, is upon the threat to democracy posed by the bureaucratic burden of non-market economic calculation. Whichever of these two implications are drawn from it, the calculation argument is one that demands a response from advocates of democratic, non-market socialism. It is to the adequacy of the response of one such advocate, Otto Neurath, that we now turn.

8. Neurath's response

The challenges posed to socialists such as Neurath by both Mises and Hayek are founded upon this argument concerning the complexity of productive calculation. From this starting point, they each develop their respective arguments concerning entrepreneurship, epistemology and democracy. A socialist response therefore needs to directly confront the calculation argument. In his 1920 paper, Mises says of Neurath, that he “overlooks the insuperable difficulties that would have to develop with economic calculation in the socialist commonwealth” (Mises 1935, 108n). So how satisfactory is Neurath's response?

For Neurath, socialism would not employ a general unit of calculation (Neurath 1935, 103). Instead, Neurath proposes that a “register” of “life conditions” be developed by means of ‘calculation in kind.’ Life conditions include all aspects of the standard of living, from food, housing and other material goods to leisure pursuits and environmental quality. Measurement ‘in kind’ of such a heterogeneous concept requires a variety of units of measurement, including physical quantities, time units and other statistical indicators. Neurath does not seek to show that such calculation in kind can achieve commensurability between productive alternatives. Indeed, he explicitly rejects this possibility (Neurath 1935, 103). The focus of his argument, as shall be shown below, is to question the assumption that money as a general unit of calculation can serve as a basis for rational decision-making.

Neurath's discussion of economic efficiency does share some common, if uncontentious, ground with Mises and Hayek. He remarks that the efficiency of a

factory depends not just on the production techniques it employs but on the usefulness of the product it produces (Neurath 1925a, 426). On the problem of factor allocation, Neurath does recognise that “it can make sense to find out the importance of alterations in these components” (Neurath 1917, 336). But, for Neurath, whether a certain productive activity is ‘economical’ is something that “cannot be arrived by calculation” (Neurath 1925b, 471) because the ends of economic activity, i.e. improvement in life conditions, cannot be subject to a general measure. Neither does he consider there to be any general measure of economic factors to be available in the absence of a market economy. He dismisses the “theory of economic factors” (by which he refers to the Austrian theory of factor imputation) as “based on the assumption that increases in the quality of life which are connected with some part of the condition of life, could be proportionally attributed to the contributing causes in a general way” (Neurath 1917, 335-6).

Neurath’s view that, like cost accounting, factor imputation is “a derivative of money calculation” (Neurath 1917, 335) and will not exist in socialism might be taken as conceding to Mises that there could be no economic calculation in socialism (Uebel 2004, 50-1). Where Neurath does confront the Misesian argument is in his rejection of the rationality of monetary calculation. This is partly through his recognition of the existence of non-monetary, incommensurable values and in this respect, as we have seen, there is no disagreement with Mises. It was in his emphasis upon the implications of this philosophical position for the pro-market case that Neurath’s extensive comments expose a weakness in both Mises and Hayek.

Once the incommensurability of values is admitted, some important questions about the pro-market position arise. The first question is: how wide is the range of goods for which monetary valuation is inappropriate? Neurath points to several examples of what welfare economists refer to as ‘externalities’. They are both positive and negative in nature and include public goods such as health, security (Neurath 1925a, 446), parks (Neurath 1937, 518), leisure, education and negative effects such as stress (Neurath 1919, 373), accidents (Neurath 1935, 79), waste and planned obsolescence (Neurath 1920, 379). Neurath also emphasises the importance of ecological criteria, showing awareness of the need to conserve natural resources for future generations (Neurath 1937, 518). Whilst Mises does point to the scarcity of natural resources in response to those socialists who assume abundance (Mises 1936 113; Mises 1949,236-7) he offers no comment on the potential scale of the problem of externalities. Neurath, by contrast, discusses how various public goods and negative externalities^{xxi} all contribute to the ‘quality of life,’ a concept that he argues is not quantifiable though can be gauged approximately in terms of ‘conditions of life’ such as units of physical goods, time devoted to work and leisure and various other indicators, some of which remain to be formulated (Neurath 1920-1, 356). Neurath comments that “no proper place” has been found in economics for this problem of measuring the standard of living (Neurath 1937, 519). Another dimension of social welfare considered by Neurath is the distribution of goods, which should be “not only an effect, but also a goal of human action” (Neurath 1925a, 414). For Mises, by contrast, evaluative judgements concerning the distribution of wealth are beyond the scope of economics. He therefore does not address the scale of the problem of inequality in a market system.

Secondly, given that non-monetary criteria make decisions inevitably ethical, political and often indeterminate (Uebel 2004, 12) are they not themselves a source of the complexity that both market and non-market systems face? Thirdly, what kind of institutions will be required in order to ensure that non-monetary values are incorporated into economic decision-making and how can they be developed? The Marxian argument put by Neurath that profit is the driving force of production in capitalist economies (Cartwright 1996, 29) causes a problem for attempts to demonstrate that such institutions can be developed satisfactorily within a market context. Indeed, the profit motive might itself be viewed as a source of complexity in creating incentives that can conflict with addressing problems such as externalities.

Neurath thus recognises that, given the incommensurability of values, the choice between a market and non-market society itself involves multiple criteria. There is a need for a “comparative economic theory” (Neurath 1935, 68) in which the problem of economic calculation, as defined by Mises, is just one of numerous considerations that must be incorporated into an approach that weighs both sides of the argument. A comparative approach is evident in the work of some socialists such as Oskar Lange and Maurice Dobb. They point to certain key advantages of socialism, including the capacity to take into account externalities (Lange 1937b, 125; Dobb 1969, 150), establish more equal levels of income distribution (Lange 1937b, 123-5; Dobb 1969, 125), as well as to avoid problems of monopoly (Lange 1937b, 132; Dobb 1969, 151) and instability (Lange 1937b, 126; Dobb 1960; Dobb 1969). Lange acknowledges that in socialism there would be imperfections in the non-market allocation of investment resources but adds: “it seems that this deficiency may be regarded as overbalanced by the advantages enumerated” (Lange 1937b, 127).

Contemporary commentaries on the Misesian contribution to the calculation debate do not acknowledge the need for this comparative approach.^{xxii} Interestingly, this need is implicit in the concept of catallactic^{xxiii} efficiency to be found in Mises and Hayek (Cordato 1994, 132). Their strictly subjectivist ethics means that the key question for defining such efficiency is: “what is the institutional setting that will maximise the extent to which the individual members of the catallaxy will be able achieve their several goals? (ibid, 132).” Thus Mises and Hayek’s work, in highlighting the need for a comparative approach, itself demands a broad assessment of the relative merits of market and non-market systems.

Hence, Mises’ neglects important questions that follow from his recognition of non-monetary values. These are questions concerning how non-monetary values can be accommodated in any economy, ranging from market to non-market. Neurath’s discussion of these issues is an important strength of his contribution.

9. Conclusion

The core of Mises and Hayek’s case against socialism is that monetary prices, as a commensurable unit of measurement, are an indispensable tool for rational economic calculation in the face of complexity. This is not to underplay the importance of further aspects of the Austrian case for the market, such as those relating to entrepreneurship, innovation and information discovery. It is rather to point out that, on the Austrian view, numerical factor values are indispensable as a guide to the efforts of market participants in the fulfilment of these latter functions. If socialists are

to show how productive calculation can be achieved in the absence of market exchange, it follows that the problem of achieving commensurability needs to be confronted directly as a necessary part of the case for non-market production. This of course should be as a complement to and not to the exclusion of addressing the related issues of incentives, knowledge discovery and democracy that feature in the case for markets.

Otto Neurath, whose discussion of economic decision-making in socialism was considerably more extensive than most before him, did not provide an adequate response to the problem of factor valuation. More recent proposals, such as those proposed by Devine (1988) and Albert and Hahnel (2003), both of which, unlike Neurath, do allow for monetary factor pricing, suggest that these prices could be established through a democratic, participatory process involving co-ordination by committees across various geographical scales and industries, representing both consumer and producer interests. Yet, their outlined political frameworks, while valuable in many respects, are not supplemented by specific models for quantitative calculation to aid to such pricing decisions. Until this area for future research has been further explored, these proposals for participatory planning remain, as Hodgson suggests, vulnerable to the Hayekian argument that they place too great a burden upon the democratic institutions they envisage (Hodgson 1998, 415).

Still, it has been shown here that, for both Mises and Hayek, the two most significant founders of the modern case for markets, the need for productive calculation to be based upon market exchange rests upon it *reducing the degree of complexity* rather than ensuring determinate solutions through entirely algorithmic means. This has

important implications for the future of the calculation debate. It leaves open the possibility of exploring how certain non-market forms of measurement might be used to achieve the required degree of commensurability. Various techniques have been proposed for calculating ‘shadow prices’ for factors of production under socialism in response to the calculation argument.^{xxiv} Two other interesting avenues for further research are calculations in terms of labour time and energy. Cockshott and Cottrell highlight the possibility of economy-wide labour time calculation that is made possible by developments in information technology.^{xxv} They acknowledge that labour-based calculation cannot entirely determine every decision and suggest that natural resource management should be treated as a separate criterion in decision-making. Another approach developed by some ecological economists is to measure the cost of economic processes in terms of energy units (e.g. Patterson 1998). There is the possibility of more than one technique being combined. Such an approach might be taken to be consistent with Neurath’s proposals for ‘calculation in kind.’ However, Neurath’s references to a multiplicity of measurement units and his dismissal of the problem of factor valuation do not amount to a sufficiently serious attempt to address the need for achieving a certain degree of commensurability between options.

The recognition of non-monetary values by both Mises and Hayek also points to the need to take a broader view of the debate about socialism versus the market. A comparative approach is needed that evaluates both sides of the argument and puts the economic calculation argument in context. This is a task that needs to be addressed, even if it goes beyond the scope of economics in the Misesian sense of establishing the best means for achieving given ends.

Future research must therefore draw two lessons from the early calculation debate between Mises and Neurath. Firstly, there is a need to further explore whether the required degree of commensurability can be achieved through non-market techniques. Secondly, a broader, comparative approach, considering the problems of the market highlighted by its critics, is also needed to set the commensurability question in context. It is, after all, possible that any loss of Misesian productive efficiency resulting from the non-market model will be judged to be a price worth paying.

ⁱ 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, 2n)

ⁱⁱ See, for example, Vaughn (1980), Murrell (1983), Lavoie (1985), Ramsay-Steele (1992).

ⁱⁱⁱ Mises understands the phrase 'factors of production' to include labour (see for example Mises 1922, 59), although it is not a phrase that he uses frequently. He uses the term 'higher goods' or 'goods of a higher order' to refer to material factors of production.

^{iv} Max Weber, had, approximately simultaneously, developed this same argument in 1921 (Hayek 1949b, 143). Weber argued that non-monetary calculation (or 'calculation in kind') was inadequate for evaluating productive activity where the possible productive means or final products of that process are qualitatively different. He pointed to the need for enterprises to be aware of inefficient usage and to monitor the value of their stocks, concluding that for calculation in kind "there are formidable problems involved here which are incapable of objective solution" (Weber 1968, 102).

^v Recent commentators agree that Mises allows for the logical validity of the mathematical definition of equilibrium pricing in socialism, as formulated by Barone in 1908 (Barone 1935). It is, for Mises, economic change that makes socialist calculation impossible (Lavoie 1985, 56; Murrell 1983, 100).

^{vi} This interpretation of Mises is also offered in O'Neill (1998).

^{vii} This can include the revenue accruing from both direct use (e.g. a toll paid by visitors to see the waterfall) and indirect use (e.g. hotel revenue generated by the presence of the waterfall nearby).

^{viii} Note that, in contrast to Mises, Pierce et al hold that it is possible to assign monetary values to OV and EV.

^{ix} A survey of such critiques is provided in Common et al (1993).

^x Further discussion of Neurath's interpretation of Mises is provided in O'Neill (1995).

^{xi} In *Human Action*, Mises hints at a similar point: "Man produces by dint of his reason; he chooses ends and employs means for their attainment" (Mises 1949, 142).

^{xii} Mises expresses strong scepticism about the possibility of achieving a clear-cut distinction between 'economic' in this narrow sense and 'non-economic' goods (Mises 1936, 125; Mises 1960, 157-8).

^{xiii} Neurath's concept of "quality of life" incorporates notions of pleasure and prosperity, as well as an Epicurean notion of community prosperity (Cartwright et al 1996, 30; Neurath 1925a, 414-8).

^{xiv} O'Neill writes "rational economic decision making, *beyond the most simple individual decisions*, requires a single measure on the basis of which the worth of alternative states of affairs could be calculated and compared" (my emphasis, O'Neill 1998, 114).

^{xv} Ramsay-Steele does note that Mises' imagined choice between 1000 hectolitres of wine and 500 of oil might presume that the socialist planners *did* know production costs (Ramsay-Steele 1992, 118). But this reading, as Ramsay-Steele observes, is inconsistent with the passage from *Socialism* cited above (Mises 1936, 141).

^{xvi} Lavoie makes this point: "the complexity of the decision being made, sharply distinguishes Crusoe's problem from that which would be before the central planning board" (Lavoie 1985, 61).

^{xvii} Lavoie (1985, 151) refers to this passage from Mises.

^{xviii} Lavoie's conclusion here also follows from his refutation of the suggestion that Mises' rejected the 'logical possibility' in a stronger sense than did Hayek.

^{xix} Accounts of Mises' view on the importance of entrepreneurship are given in Vaughn (1980) and Lavoie (1985).

^{xx} For Mises, attempts at socialism would result in a society in which the provision of consumption goods is "diminished" (Mises 1920, 130). Hayek suggests that there would be a "decline in the general wealth" (Hayek 1949b, cited in Lavoie 1985, 154).

^{xxi} The latter is a concept used by Roemer (Roemer 1994, 57).

^{xxii} This includes the contributions of Vaughn (1980), Murrell (1983), Lavoie (1985), Ramsay-Steele (1992) and Kirzner (2001).

^{xxiii} *Catallactics* is defined as the "science of exchanges" (Rowley 1994, 289).

^{xxiv} For example, in his 1933 paper, 'Price Formation in a Socialist Community', Dickinson envisages the Supreme Economic Council (S.E.C.) using mathematical techniques to set prices both for factors of production and consumer goods. These calculations are based upon data that are gathered about the demand function for consumer goods, as well as technical data about production functions and the supply of resources. Dickinson had been influenced by Enrico Barone's mathematical solution for determining prices under socialism, as set out in his 1908 paper 'The Ministry of Production in the Collectivist State'. Barone offered a mathematical demonstration that it is possible, in principle, for a socialist ministry of production to establish a set of 'prices' (or "equivalences" as he refers to them) that are analogous to the Walrasian market equilibrium (Schumpeter 1954, 987). Barone himself was sceptical about the feasibility of implementing such a model and Dickinson later assigns to it a less central role in his outline of a socialist economy (Dickinson 1939). A different approach to the problem of establishing 'shadow prices' is taken by the Soviet mathematician Leonid Kantorovich whose model of productive calculation (less ambitiously than the Barone model) assumes the final set of output goods as given. He infers shadow prices (or "objectively determined valuations") for factors of production from the optimal production plan for meeting final demand, with the supply of factors taken as given (see Kantorovich (1965) for an accessible explanation of this approach).

^{xxv} Hodgson, a pro-market participant in the debate, acknowledges that Cockshott and Cottrell may have an answer to the problem of economic calculation, once it is granted that the required information is available to the planners. Hodgson, drawing from the Hayekian epistemological objection to markets, argues that this is an assumption that cannot be made. However, this Hayekian argument is one to which O'Neill (2003) makes a valuable response.