Ludwig von Mises' Argument Against the Possibility of Socialism: Early Concepts and Contemporary Relevance

Ludwig Van Den Hauwe

1 Introduction

The Socialist Calculation Debate is almost certainly one of the most important debates that have ever taken place within the field of economics and probably the most important debate in economics of the 20th century. The outcome of the debate has been subject to diverging interpretations and ongoing dispute, however. These disagreements persist to this day. This paper recalls Mises' original result and reviews some of the subsequent debates and recent developments.

2 Mises' Early Argument

At the time when socialism became an immediate political issue at the end of World War I, the opening round in the Socialist Calculation Debate was fired by Ludwig von Mises in 1920, in his article "Die Wirtschaftsrechnung im sozialistischen Gemeinwesen". According to the standard account, before 1920 socialist theorists paid little attention to how a socialist economy would work in practice, most heeding Marx's admonition to avoid such "utopian" speculation.[1] Then Mises, known at the time

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[1] When the "standard account of the calculation debate" is mentioned reference is made to such examples as Schumpeter ([1942] 1975, in particular Chap. 16) and Bergson (1948). Discussions of the "revisionist view" can be found in Hoff ([1949] 1981), Salerno (1990), and Rothbard (1991), among others. For good summaries of the debate see also Cottrell (1998) in Davis et al. (1998); further also Vaughn (1994) in Boettke (1994) and Boettke et al. (2014) in Garrison and Barry (2014).

L. Van Den Hauwe (✉)
Brussels, Belgium
e-mail: ludwigvandenhauwe@gmail.com

mainly as a monetary theorist, published the sensational article later translated as "Economic Calculation in the Socialist Commonwealth" (Mises [1920] 1990).

Mises' thesis was that rational economic calculation was impossible under socialism. His basic argument was that, in any but the simplest economy, economic calculation demands the use of a scalar common denominator for costing and valuation.[2] In the capitalist economy, market prices provide such a common denominator. Mises assumed that, while there may exist a market for consumer goods in a socialist economy, there will not be a market for the means of production (as state property, the means of production will be *res extra commercium*), and neither will there be a labor market in anything like the capitalist sense. For this reason market prices will not be available as a means of calculation and socialism is not economically practicable.

In a complex, modern economy with multiple stages of production, resource allocation requires the existence of money prices for capital goods, prices that under capitalism arise from an ongoing process of competitive bidding by entrepreneurs for the factors of production. This process cannot be replicated by input-output analysis, computer simulations, or any other form of artificial market.

Mises's main point was that socialism fails because decision makers require meaningful prices for all of these factors in order to be able to choose from the vast array of possible factor combinations.

Mises' main argument can be summarized in three statements:

1. Rational economic activity requires the pricing of all goods, production goods as well as consumption goods.
2. Pricing requires the existence of a market.
3. A market requires the existence of independent owners of the goods exchanged.

All these are impossible in a socialist society which by definition is a society in which the private ownership of means of production is abolished, and business initiative is invested in a central authority which alone directs industrial activity (Hoff [1949] 1981; also Yeager 1949).[3]

A first somewhat simplistic objection that is still sometimes heard consists in pointing out that socialist centrally planned economies have actually existed for several decades in the former Soviet Union and in the communist nations of Eastern Europe and that this fact contradicts (or seems to contradict) Mises' impossibility claim. However, the point to be stressed is that without markets for physical and financial capital—which determine what tasks will be performed and whether they have been performed adequately—an economic system must rely on outside references to tell it what to do and will have difficulty generating anything *new* since without

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[2]As summarized by Salerno (1990, 52): "Without recourse to calculating and comparing the benefits and costs of production using the structure of monetary prices determined at each moment on the market, the human mind is only capable of surveying, evaluating, and directing production processes whose scope is drastically reduced to the compass of the primitive household economy".

[3]This characterization corresponds to the old or original definition of socialism. More recent definitions have improved upon this definition and some progress has occurred in the ways in which socialism can be defined from a scientific viewpoint. See further.

economic calculation, there is no way to figure out if tasks have been performed efficiently.

Hence of course, the only reason the Soviet Union and the communist nations of Eastern Europe could exist at all is that they never fully succeeded in establishing socialism worldwide, so they could use world market prices to establish implicit prices for the goods they bought and sold internally (Rothbard 1991, 73–74). In Mises's words, these economies were not isolated social systems. They were operating in an environment in which the price system still worked. They could resort to economic calculation on the ground of the prices established abroad. Without the aid of these prices their actions would have been aimless and planless. Only because they were able to refer to these foreign prices were they able to calculate, to keep books, and to prepare their much talked about plans (Mises [1949] 1998, 698–99).

From a history of economic thought perspective, it will be noted that at about the same time that Mises' famous article appeared in 1920, similar ideas came from the pens of Max Weber in Germany and also of Boris Brutzkus in Russia.[4]

Max Weber maintained that calculation *in natura* could not give a rational solution of the problems which would confront a planned economy. Max Weber emphasized that conservation and rational employment of capital could only be secured in a society based on exchange and the use of money, and that the loss and destruction which would result were rational calculation not feasible in a completely socialized society, could make it impossible to maintain the present population in densely populated areas (also Hoff [1949] 1981, 3).

Mises, Weber, and Brutzkus were not the first writers to question the economic efficiency of planning. As early as 1902, the Dutch economist Nicolaas G. Pierson had emphasized that a socialist community would have to face the problem of value (Pierson [1902] 1935).

But it was left for Professor Mises to revolutionize academic discussion, which Mises accomplished by his dogmatic insistence that rational economic calculation under socialism would be impossible ("*unmöglich*").[5]

3   Brief Review of the Ensuing Debate

Because scholars differ about what Mises "really meant," however, it may be useful here to provide a brief review of the debate.

Throughout the 1920s and early 1930s Mises's argument became the focus of intense discussion within the German-language literature. Eventually it was agreed

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[4]See Weber ([1921] 1978), parts of his Wirtschaft und Gesellschaft 1922 translated into English as Theory of Social and Economic Organization, and Brutzkus (1935). On the early contributions of Pierson, Weber and Brutzkus, see also Steele (1981).

[5]Attention can be drawn to a paper by Ebeling (1993) who discusses a number of Mises' forgotten predecessors. Ebeling draws attention to five books in particular which deserve recognition for their work on this topic: Albert Schäffle (1874); Paul Leroy-Beaulieu (1885); William Graham (1891); Victor Cathrein (1890); Benedict Elder (1915).

that Mises was correct at least to point out that a socialist society could not do without such things as money and prices, as some early socialists had suggested, and that there was no feasible way to set prices according, say, to quantities of labor time. Nevertheless it was felt that Vilfredo Pareto and his follower Enrico Barone (1908) had shown that nothing was "theoretically" wrong with socialism, because the requisite number of demand and supply equations to make the system "determinate" would exist under either capitalism or socialism. If the planners could somehow get the necessary information on preferences and technology, they could in principle compute an equilibrium allocation of final goods.[6]

The most important response to Mises and the one almost universally accepted by economists, was what became known as "market socialism" or the "mathematical solution," developed by Oskar Lange (1936, 1937) (and previously by Taylor 1929; Dickinson 1933; Lerner 1934). A few remarks about market socialism are in order here because we can even today still find in certain secondary literature such statements as that "Von Mises thesis was refuted by Lange and Lerner. They showed that certain forms of a socialist economy are possible" (see Backhaus and Backhaus 2018, 4). But in fact it's the other way around; the truth is that Mises' critique had anticipated market socialism. The market socialists diverted the debate into statics (Lavoie 1985, Chap. 4) whereas Mises had already clearly pointed out, among other things, that

> a stationary economic system can never exist. Things are continually changing, and the stationary state, although necessary as an aid to speculation, is a theoretical assumption to which there is no counterpart in reality. (Mises [1932] 1981, 105)[7]

Mises' argument was reprinted and elaborated upon by Hayek in his edited volume of 1935, *Collectivist Economic Planning* (Hayek [1935] 2009a). Also reprinted there was Barone's 1908 essay, "The Ministry of Production in the Collectivist State" (Barone [1908] 1935). This piece was to play a paradoxical role in the debate.

Barone made the argument that a socialist planning ministry, in order to comply with the dictates of economic rationality, would have to duplicate the effects of competitive capitalism (in particular, to minimize cost of production and to set prices equal to marginal costs). Barone had applied Pareto's system of equations to demonstrate that "all the economic categories of the old régime must reappear,

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[6]I here follow freely the excellent summary account provided by Klein ([1996] 2010; also [1999] 2010).

[7]For excellent recent critiques of market socialism from an Austrian perspective, see Huerta de Soto (2015) and Machaj (2018; also 2007). In particular on the anticipatory criticism of market socialism of not only Mises but also Hayek, see Huerta de Soto (2015, 98–101). On the basis of a comparative analysis of the economic implications of property rights in capitalism and socialism Machaj (2018) attempts to demonstrate that a respect for ownership is of central importance for the functioning of economic calculation and in consequence also for economic and financial structures in the capitalist order. Ownership is more important than prices because it allows for including the competitive potential of entrepreneurs in prices. Socialism is inefficient because it abolishes property constraints, which are a tool for economic control, forcing adequate discipline in satisfying the consumer.

though maybe with other names: prices, salaries, interest, rent, profit, saving etc." (Barone [1908] 1935, 289; also Yeager 1949).

The Ministry of Production, through deliberate arrangement, would have to satisfy the two conditions that would result automatically from perfect competition, that is, equalization of prices with cost, and minimization of costs of production. The system of equations giving the correct allocation of resources and labor would be identical with the system reflecting the operation of free competition.[8]

Barone took this conclusion- which is known as the formal equivalence argument —as a criticism of the socialist contention that a rational society would allocate resources on a basis quite different from the "anarchic" market. The problem the socialist planning ministry would have to solve would be "formally equivalent" to the problem solved by the market through free competition.

However, Lange, in his famous (1936, 1937) response on behalf of socialism, and some other socialist writers, turned Barone's point against its author.

Whereas one could argue that Barone—and other writers before the time of Mises' famous article such as Wieser, Pareto, and Cassel—had used the concept of equilibrium determination through simultaneous equations as an expository device, these socialist writers envisaged the solution of simultaneous equations as the actual method of socialist resource allocation.

In a system of market socialism, capital goods are collective property, but individuals are free to own and exchange final goods and services. The system would work like this. First, the Central Planning Board chooses arbitrary prices for consumer and capital goods. At those prices, the managers of the various state-owned enterprises are instructed to produce up to the point where the marginal cost of each final good is equal to its price, and then to choose the input mix that minimizes the average cost of producing that quantity. Then, consumer goods prices are allowed to fluctuate, and the Central Planning Board adjusts the prices of capital goods as shortages and surpluses of the final goods develop. Resources would thus be allocated according to supply and demand, through a process of "trial-and-error" essentially the same as that practiced by the managers of capitalist firms. Lange's contribution, it has generally been held, was to show that production under market socialism could be just as efficient as production under capitalism, since the socialist planners would receive exactly the same information from a socialized economic system as did entrepreneurs under a market system.

Thus according to Lange's famous (1936, 1937) response on behalf of socialism Barone's point showed that the task facing the planning authority was essentially the same as that facing the market economy. In each case, the equations of general equilibrium had to be solved. If the market could do so, then so could the planners, if not directly, then via trial and error, by first setting a price vector then instructing the managers of socialist enterprises (a) to choose the production method that minimized

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[8]Implicit or explicit in the work of Barone and many post-Mises writers is thus the concept of "optimum conditions" which are the heart of modern welfare economics. Hayek summed up several of the conditions very neatly as the requirement that "the marginal rates of substitution between any two commodities or factors must be the same in all their different uses" (Hayek [1948] 1980, 77; see also Yeager 1949).

average cost at those prices and (b) to produce output up to the point at which marginal cost equaled price. If the attempt to comply with these instructions gave rise to excess supplies and demands (as it well might) then the planning authority should adjust the price vector (raising the prices of goods in excess demand and cutting the prices of goods un excess supply) and try again. It was admitted that prices were indeed necessary (as in Mises' argument) but these need not be real market prices: they might equally well be accounting prices set by the state. Besides, the state had an extra degree of freedom: it could choose the distribution of income and optimize the allocation of resources relative to that distribution, which might be quite different from that engendered by the market.

With the widespread acceptance of the theory of market socialism, there developed an "orthodox line" on the socialist calculation debate, neatly summarized in Abram Bergson's well-known survey of "Socialist Economics" (1948) and in Joseph Schumpeter's Capitalism, Socialism and Democracy ([1942] 1975, 172–86). According to this line, Mises first raised the problem of the possibility of economic calculation under socialism, only to be refuted by Pareto and Barone; Hayek and Robbins then "retreated" to the position that socialist planners could calculate in theory, but that in practice the information problem would make this too difficult; then the market socialists showed that trial and error would eliminate the need for complete information on the part of the planners. Therefore, the argument goes, economic theory per se can say nothing conclusive about the viability of central planning, and the choice between capitalism and socialism must be purely political.

Market socialism was seen as an answer not only to Mises's calculation problem, but also to the issue of "practicality" raised by Hayek and Lionel Robbins. Hayek, in his contributions to Collectivist Economic Planning (Hayek [1935] 2009a, 1–40; [1935] 2009b), later expanded in "The Competitive Solution" ([1948] 1980, 181–208) and his well-known papers "Economics and Knowledge" ([1948] 1980, 33–56) and "The Use of Knowledge in Society" ([1945] 1984), and Robbins, in his The Great Depression ([1934] 2007), had changed the terms of the debate by focusing not on the problem of calculation, but on the problem of knowledge. For Hayek and Robbins, the failure of socialist organization is due to a mechanism design problem, in that planners cannot allocate resources efficiently because they cannot obtain complete information on consumer preferences and resource availability. Furthermore, even if the planners were somehow able to acquire these data, it would take years to compute the millions of prices used by a modern economy. The Lange–Lerner–Taylor approach claimed to solve this preference-revelation problem by trial-and-error, so no actual computations would be necessary (also Klein 2010).

Mises in his critique had already anticipated the later argument for "market socialism". Mises claimed that without private ownership of the means of production, there would be no market prices for capital goods, and therefore no way for decision-makers to evaluate the relative efficiency of various production techniques. Anticipating the later argument for "market socialism," Mises argued that even if there were markets for consumer goods, a central planner could not "impute" meaningful prices to capital goods used to produce them. In short, without market-generated

prices for both capital and consumer goods, even the most dedicated planner would find it "impossible" to allocate resources according to consumer wants.

4 The Historical Misinterpretation of the Outcome of the Argument: Why the Standard Account Is Disputable

4.1 The Emergence of a Revisionist Account of the Socialist Calculation Debate

The outcome of the debate concerning the possibility of socialism has been much disputed and misinterpreted. From the standpoint of the revisionist account it is rather generally considered that the widespread acceptance, among socialist theorists, of competitive solution proposals quite clearly amounts to an implicit acknowledgement on their part of the soundness of Mises' original contribution, published in 1920, regarding the impossibility of economic calculation in socialist economies—also Huerta de Soto ibid. 174—even if we have to add immediately that Mises considered that a socialist system with a market and market prices is self-contradictory, as self-contradictory as is the notion of a triangular square.

However, in the early postwar period, most commentators on the debate (notably Bergson, Schumpeter and Samuelson) reckoned that the socialists had come off best. There was no reason why the socialist planners could not mimic a competitive equilibrium via a Lange-type procedure. And Mises' argument against the possibility of socialism was not considered conclusive.

All this changed when this account of the debate—known as the standard account—came under attack during the 1980s and in particular when it was sharply challenged by Don Lavoie in his 1985 book *Rivalry and central planning: The socialist calculation debate reconsidered*.

Lavoie's revisionist claim was that the two sides in the debate had been talking past one another. Lange and others who made similar arguments—such as Dickinson, Lerner and Taylor—as well as other commentators, took a Walrasian approach and were thinking in terms of attaining static general equilibrium while the Austrians had a quite different problem in mind, namely that of dynamic adjustment and discovery in the face of continuously changing technological possibilities and preferences. According to Lavoie, Mises never denied that socialism would be able to perform acceptably under static conditions, but this was irrelevant to the real world. The whole Walrasian apparatus served at best to define the end-point of dynamic adjustment in a market economy, but this limit was never reached in a real capitalist economy and neither could it be reached under socialism. The formal equivalence argument stemming from Barone was therefore beside the point of the Austrian charge that socialism had no means of emulating the profit-seeking dynamic of capitalism.

Mises and the Austrians, therefore, were not defeated. Rather, the illusion of victory belongs to the "anti-Misesians" because their conception of the market and the problem requiring a solution was different from Mises's conception of the market and the economic problem.

The entire orientation of the Austrian approach was in terms of how markets worked under conditions of imperfect knowledge, constant change and the passage of time.

Mises and the Austrians, as Lavoie explains, conceived of the market economy as a dynamic competitive process in which a complex system of division of labor was matched by an equally complex system of division of knowledge. Rivalry in the market was the means through which decentralized knowledge was conveyed to every corner of the economy via the price system to assist mutual coordination of production and consumption plans. At the same time, market rivalry was the means through which knowledge in the market was discovered and used for the satisfaction of consumer demands. This "Austrian" conception of the market process is in contrast to the neoclassical view of perfect competition, in which all the "knowledge problems" of market coordination are assumed away; either by postulating the presence of "perfect knowledge" on the part of all market participants; or through the assumption that all relevant knowledge can be translated into quantitative and objective forms that are easily conveyable to planners for their use and application to the problem of resource allocation in a centrally organized economy.

From the Austrian perspective market-socialist proposals are mostly irrelevant to the real problems of socialist organization. In his critique of market socialism in *Human Action* (Mises [1949] 1998, 694–711) Mises complained that the market socialists—and, for that matter, all general equilibrium theorists—misconceive the nature of "the economic problem." Lange, Lerner, and Taylor looked primarily at the problem of consumer goods pricing, while the crucial problem facing a modern economy concerns the capital structure: namely, in what way should capital be allocated to various activities? Lange, Lerner, and Taylor see the market through a strictly static, neoclassical lens, where all the parameters of the system are given and only a computational problem needs to be solved. In fact the market economy is a dynamic, creative, evolving process, in which entrepreneurs—using economic calculation—make industries grow and shrink, cause new and different production methods to be tried and others withdrawn, and constantly change the range of available products. It is these features of market capitalism, and not the incentives of agents to work hard, that are lost without private property ownership.

4.2 *Huerta de Soto's Revision of the Concept and Definition of Socialism*

In line with this development it is now also possible to provide a revisionist definition of socialism. Prof. Huerta de Soto has argued that the theory of entrepreneurship, as developed by Israel M. Kirzner, must be an essential element of any analysis of the impossibility of socialism (see Huerta de Soto 2009b).

Socialism is here defined as any system of institutionalized aggression against the free practice of entrepreneurship, in other words socialism is all systematic and institutionalized aggression which restricts the free performance of entrepreneurship in a determined social area and which is carried out by a controlling organism which is in charge of the tasks of social coordination necessary in said area.

Huerta de Soto (2015) lists several reasons why Lange's classic model, broadly interpreted, could never work, such as

1. the impossibility of assembling the list of capital goods;
2. the complete arbitrariness of the time period for which parametric prices are fixed;
3. the lack of a true market for labor and consumer goods and services;
4. the inanity of the rules Lange proposes;
5. the theoretical impossibility of the trial-and-error method;
6. the arbitrary fixing of the interest rate;
7. ignorance of the typical behavior of bureaucratic agencies.

And the thrust of the argument/reason why socialism is an intellectual error is in general terms always the same: it is not theoretically possible that the organism in charge of practicing institutionalized aggression possesses sufficient information to endow its commands with contents of a coordinating nature.

5 Persistence of the Standard Account

Despite these revisionist claims even today the standard account seems to retain a certain following. In what follows I will try to understand why this is the case by taking a closer look at two authors who have been extremely influential in shaping the consensus around the standard view; these authors are Friedrich von Wieser and Joseph Schumpeter.

Friedrich von Wieser's work seems to have exerted considerable influence in shaping the consensus around the standard account of the Socialist Calculation Debate. The influence of Wieser probably explains some of the problems surrounding an adequate understanding of Mises's arguments against the possibility of economic calculation under socialism.

The problem of a rational economic order seems to be bound up with that of solving the imputation problem (*Zurechnungsproblem*) with respect to complementary factors of production with alternative uses.[9]

Very typical for Wieser's approach is that he systematically treats the imputation problem (*Zurechnungsproblem*) before the introduction of the market, exchange and money. For instance in his Social Economics ([1914] 1927) he treats the topics "Problem of Attribution of Yields" and "Common and Specific Attribution of Yields" in Sects. 20 and 21 (111–123) of Book I devoted to the "Theory of the Simple Economy" which is some sort of socialist commonwealth. In such a simple economy, there is no exchange, no market, no prices and no money.

Wieser's view concerning the calculation of values was decisive for the way he would "solve" the problem of economic imputation-or: "das Problem der wirtschaftlichen Zurechnung". Wieser proposes to measure "productive contributions" by a system of simultaneous equations. He postulates two conditions for his theory of imputation:

1. that the value of the productive agents is equal to the value of their products; and
2. that the productive agents combine in fixed proportions, which vary between industries (also Stigler [1941] 1994, 166–7). These conditions are expressed algebraically by the following equations, in which x, y, and z represent the value of single units of productive agents X, Y, Z, and the values on the right sides of the equations are prices of single units of three products:

$$x + y = 100 \tag{1}$$

$$2x + 3z = 290 \tag{2}$$

$$4y + 5z = 590 \tag{3}$$

By solving these equations simultaneously, the values of the units of productive agents are discovered. That of x is 40; of y, 60; of z, 70. These are the "productive contributions" of these agents. Value (and the principles leading to its determination) is, Wieser believed, a politically neutral concept in the simple economy. As in Natural Value, Wieser divorced his analysis of capital and its functions from private property. In a manner similar to that of the Lange-Lerner investigations, goods and productive factors are stripped of their pecuniary connotations and the economic system thus conceived can supply the basis for either the individualistic or for the socialist economy (also Ekelund 1970, 182). It has to be pointed out how peculiar Wieser's approach to the imputation problem, especially in his Social Economics, in fact is and why it is problematic (Wieser [1914] 1927; see also Hoppe and Salerno 1999).

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[9]The problem of imputation is the problem of assigning value to each higher-order good used in the production of a consumer good. See Endres (1997, 184).

Let's recall Mises' starting point (also Van Den Hauwe 2009, 191–2). Whereas acting man cannot calculate with values, that is, he cannot use values as a vehicle of economic calculation, he can use money prices in reckoning; where there are no money prices, there are no such things as economic quantities (Mises 1998, 210); economic calculation cannot comprehend things which are not sold and bought against money (ibid. 215); computation requires a common denominator to which all items are to be referable; the common denominator of economic calculation is money; economic calculation always deals with prices, never with values (ibid. 332). It is the task of the theory of value and prices to show how the choices of individuals result, in the sphere of interpersonal exchange, in the emergence of market prices (Böhm-Bawerk 1959, Volume II, Book III). The monetary, private property, market system provides the basis for economic calculation by transforming the ordinal preference rankings of different individuals, which are impossible to compare, into a quantity of common, cardinal units. Ordinal utility can thus become the basis for socially-meaningful cardinal comparisons of value. Money prices, only possible in a monetary, private property, market system, provide a common cardinal unit in which different factors can be compared in social value. All mathematical or arithmetic operations with ordinally-ranked marginal utilities are impossible; there is no such thing as total utility. As Mises wrote,

> [o]ne cannot add up values or valuations. One can add up prices expressed in terms of money, but not scales of preference. One cannot divide values or single out quotas of them. A value judgment never consists in anything other than preferring a to b. (Mises [1949] 1998, 332)

Furthermore Mises had argued that the process of value imputation does not result in derivation of the value of the single productive agents from the value of their joint product. Even if it is permissible to declare that, due allowance being made for time preference, the value attached to a product is equal to the value of the total complex of complementary factors of production, it would be nonsensical to assert that the value attached to a product is equal to the "sum" of the values attached to the various complementary factors of production. It is only the market that, in establishing prices for each factor of production, creates the conditions required for economic calculation. The prices of the single factors of production are formed on the market as the resultant of the concurring actions of competing highest bidders. The prices of the factors of production are only indirectly connected, viz., through the intermediary of the prices of the consumers' goods, the products of their joint employment, with the valuations of the individuals. Not the valuations but the appraisements are transferred from the goods of the first order to those of higher orders. Mises clearly distinguishes between appraisement and valuation. Appraisement in no way depends upon the subjective valuation of the man who appraises. He is not intent upon establishing the subjective use-value of the good concerned, but upon anticipating the prices which the market will determine. Valuation is a value judgment expressive of a difference in value. Appraisement is the anticipation of an expected fact (Mises [1949] 1998, 329).

In Mises' own words:

> The prices of the complementary factors of production are conditioned by the prices of the consumers' goods. The factors of production are appraised with regard to the prices of

the products, and from this appraisement their prices emerge. Not the valuations but the appraisements are transferred from the goods of the first order to those of higher orders. The prices of the consumers' goods engender the actions resulting in the determination of the prices of the factors of production. These prices are primarily connected only with the prices of the consumers' goods. With the valuations of the individuals they are only indirectly connected, viz., through the intermediary of the prices of the consumers' goods, the products of their joint employment." (ibid. 330–1) And of course "[e]conomic calculation always deals with prices, never with values." (ibid. 332)

As Hoppe and Salerno recall, the crucial insight that the prices of the factors of production are only indirectly related to the marginal values of their products—through the prices of the consumers' goods and their appraisement by entrepreneurs bidding competitively for scarce factors of production—is of essential significance for a correct understanding of the Socialist Calculation Debate and its neglect is part of the explanation of the common misinterpretation of its outcome.[10]

For Mises, imputation is not a value problem but a price problem. Imputation cannot be translated into a value problem (Kauder 1965, 187). Wieser to the contrary offers a system of simultaneous equations as his solution of the imputation problem (Kauder 1965, 185).

However, a solution of the imputation problem along the lines indicated by Wieser is clearly impossible. As will be reminded further, it was Schumpeter's failure to realize this point which led him to teach that Pareto and Barone had essentially "solved" the problem of socialist calculation (Steele 1992, 112ff.; also Oversloot 1990).

To conclude our digression about von Wieser let's remind that Samuel Bostaph (2003) has recently summarized von Wieser's project as follows: "In Natural Value (NV) in 1893 (1971) and Social Economics (SE) in 1914 (1967), Wieser sought to use the new value theory of Carl Menger as a key component in an argument for the possibility of economic calculation in a socialist or communist system. In so doing, Wieser presented an argument for "natural value" as the unit of calculation and for

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[10]Hoppe and Salerno characterize the contrasting viewpoints, i.e. that of Menger and Böhm-Bawerk and Mises on the one hand and that of Wieser and Schumpeter on the other, in the following terms:

"Menger und Böhm-Bawerk hatten es unternommen (…) dies Problem zugleich praktisch une realistisch unter Bezugnahme auf im Markt tatsächlich gezahlte Geldpreise zu lösen. Der Grenznutzen der Produktionsfaktoren ergebe sich nicht direct aus dem Grenznutzen ihrer Produkte, sondern nur indirect und vermittelt, durch die auf dem Produktionsgütermarkt vom ihm Wettbewerb stehenden Unternehmern angebotenen (Höchst-)Preise. Wieser—und ähnlich Mayer und Schumpeter—vertraten dagegen die Auffassung, das seine exakte und numerisch eindeutige Zurechnung durch die Methode der Wertrechnung an Stelle von monetärer Kalkulation nötig und möglich sei. (….) Mit anderen Worten, Wieser behauptet, dass auch in einer sozialistischen Gesellschaft, also einer verkehrslosen Wirtschaft ohne Markt und Geldpreise, gerechnet werden muss und kann und das Problem der Zurechnung im Hinblick auf komplementäre Produktionsfaktoren mit alternativen Verwendungsweisen—und mithin auch das problem einer rationalen Wirtschaftsplannung—einer eindeutigen Lösung zugeführt warden kann. (…) Mises verwarf die Auffassungen Wiesers zur Zurechnungsproblematik nicht nur als unhaltbar, sondern zeigte demgegenüber, an Menger und Böhm–Bawerk anknüpfend, dass sich das Problem ausschiesslich unter Rückbezug auf Gelfpreise und ausschliesslich im Rahmen einer auf dem Sondereigentum beruhenden Marktwirtschaft lösen lässt" (pp. 120–123).

"imputation" as the method of deriving the values of higher order goods from the "natural values" of first order goods. He also assumed a general equilibrium context in his theoretical explanation of how socialist or communist economic planning using "natural value" could take place" (ibid. 4).

On the basis of an extensive and detailed analysis this author concludes that

> (…) Wieser did not develop the theories of value, exchange, and price beyond the legacy of Carl Menger. In fact, he distorted and obscured them in his own presentation with his empty concept of "natural value" and his equally spurious imputation theory. Further, he provided an apparent theoretical support for socialist and communist theory from a school of thought whose previous and subsequent development (at least in the hands of Menger, Böhm-Bawerk, and Mises) was antithetical to such theories (ibid. 30).

Schumpeter is deservedly considered among the greatest historians of thought in economics and his account of the Socialist Calculation Debate, which conforms with the standard view of the controversy, has been extremely influential in the development and shaping of the consensus around this view. He devoted only a few pages—in the "Equilibrium" chapter—of his monumental *History of Economic Analysis* (Schumpeter 1954) to the issue but a great deal of his *Capitalism, Socialism and Democracy*—especially Chap. XVI "The Socialist Blueprint"—discusses the debate specifically (Schumpeter [1942] 1975).

Schumpeter believes it to be clear that "economic rationality" can be attained without actual markets in capital resources and that "this follows from the elementary proposition that consumers, in evaluating ("demanding") consumers' goods, *ipso facto* also evaluate the means of production which enter into the production of those goods." This is Schumpeter's famous *ipso facto* (ibid. 175).

As we have seen, however, it is not correct to suggest that the consumers, in valuing consumer goods, ipso facto also value and thus determine the prices of the single and complementary factors of production. This process requires the mediation of the private property market order. It is the excessive preoccupation with equilibrium and its mathematical expression that prevents a clear grasp of this truth.

Hayek had on several occasions expressed his disagreement with Schumpeter on this issue:

> Professor Schumpeter is, I believe, also the original author of the myth that Pareto and Barone have "solved" the problem of socialist calculation. What they, and many others, did was merely to state the conditions which a rational allocation of resources would have to satisfy and to point out that these were essentially the same as the conditions of equilibrium of a competitive market. This is something altogether different from showing how the allocation of resources satisfying these conditions can be found in practice. (Hayek [1945] 1984, 223–4)

And further:

> Like so many mathematical economists Schumpeter appears to have been seduced by the habitual assumption of "given data" to believe that the relevant facts that for his construction the theorist must assume to exist are actually known to any one mind. This becomes evident in Schumpeter's most startling assertion that the possibility of "economic rationality", being attained in a planned system, follows for the theorist "from the elementary proposition that consumers in evaluating ("demanding") consumers' goods, *ipso facto* also evaluate the means of production which enter into the production of those goods." This is a meaningful

statement only in the context of a system or equation in which not only all the technical possibilities of production but also their relative scarcities are assumed to be known. As an assertion about what happens in the real world it is sheer nonsense. (Hayek [1982] 1984, 59–60)

6 Generalizing Mises' Analysis: Calculation and the Theory of the Firm

To understand Mises's position in the calculation debate, one must realize that his argument is not exclusively, or even primarily, about socialism. It is about the role of prices for capital goods.

Entrepreneurs make decisions about resource allocation based on their expectations about future prices, and the information contained in present prices. To make profits, they need information about all prices, not only the prices of consumer goods but the prices of factors of production. Without markets for capital goods, these goods can have no prices, and hence entrepreneurs cannot make judgments about the relative scarcities of these factors. In short, resources cannot be allocated efficiently. In any environment, then—socialist or not—where a factor of production has no market price, a potential user of that factor will be unable to make rational decisions about its use.

Thus Mises' claim was simply that efficient resource allocation in a market economy requires well-functioning asset markets. To have such markets, factors of production must be privately owned. Rothbard's contribution was to generalize Mises' analysis of this problem under socialism to the context of vertical integration and the size of the organization, thus making an important Austrian contribution to the theory of the firm (Rothbard [1962] 2004, 609 ff.; also Klein 2010).

In other words the need for monetary calculation in terms of actual prices not only explains the failures of central planning under socialism, but also places an upper bound on firm size.

The ideas developed in the calculation debate suggest that when organizations are large enough to conduct activities that are exclusively internal—so that no reference to the outside market is available—they will face a calculation problem as well as an incentive problem. In other words, the firm is in the same situation as communist economies: it needs outside market prices to plan and evaluate its actions.

Rothbard writes in *Man, Economy, and State* that up to a point, the size of the firm is determined by costs, as in the textbook model. However, the "ultimate limits are set on the relative size of the firm by the necessity for *markets* to exist in every factor, in order to make it possible for the firm to calculate its profits and losses" (Rothbard [1962] 2004, 599).

When we mention "theory of the firm" we think of the contribution of Coase (1937). There has been some debate within the Austrian literature about whether the basic Coaseian approach is compatible with Austrian economics.

Ronald Coase, in his celebrated 1937 paper on "The Nature of the Firm," was the first to explain that the boundaries of the organization depend not only on the productive technology, but on the costs of transacting business, that is, on the costs and benefits of contracting. The boundary of the firm is determined by the tradeoff, at the margin, between the relative transaction costs of external and internal exchange.

By the time of his 1976 paper, Rothbard had adopted an explicitly Coaseian framework in his discussion of the limits to firm size. His own treatment, Rothbard says, "serves to extend the notable analysis of Professor Coase on the market determinants of the size of the firm, or of the relative extent of corporate planning within the firm as against the use of exchange and the price mechanism. Coase pointed out that there are diminishing benefits and increasing costs to each of these two alternatives, resulting, as he put it, in an "optimum amount of planning" in the free market system. Our thesis adds that the costs of internal corporate planning become prohibitive as soon as markets for capital goods begin to disappear, so that the free-market optimum will always stop well short not only of One Big Firm throughout the world market but also of *any* disappearance of specific markets and hence of economic calculation in that product or resource" (Rothbard 1976, 76).

Machaj (2018, 123–32; also 2007) points to some weak points in Coase's contribution. Coase's answer to the question of why companies exist, is not satisfactory. Coase's analysis lacks deeper reflection on the concept of the company, and despite his attempts to break away from the neoclassical, mechanistic framework of management, he still uses it. He did not give a sufficiently precise distinction between transaction and organization costs. Because Coase does not formulate a satisfying theory of the company, his works will not give us the answer to why there is no one big firm created in the market, in the form of a global, voluntary, socialist cartel. Rothbard concluded that "voluntary socialism" cannot emerge because at some point creating larger and larger units of management would eliminate markets, which are used by companies to assess the rationality of their plans. Rothbard's theorem regarding the limits of possible mergers in the market seems better than Coase's theory of the firm, but it does not fully solve the posed problem either. One exclusive owner would only emerge on the market if the entrepreneurial division of labour entirely disappeared, which would happen only if one entrepreneur would be more skillful than all the other entrepreneurs in the market, which is hardly possible. One great company does not emerge because there are no companies that would be able to form an economic unit exclusive enough and efficient enough to satisfy the needs of all consumers. The diversity of entrepreneurs and their abilities result in economization of their talents through the entrepreneurial division of labour.

7 Mechanism Design Theory: A Contribution to the Debate?

7.1 Introduction

After the Royal Swedish Academy of Sciences had decided to award the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2007 jointly to Leonid Hurwicz, Eric S. Maskin and Roger B. Myerson "for having laid the foundations of mechanism design theory", the Wall Street Journal published a piece by Peter Boettke entitled "A Market Nobel" (Boettke 2007). Boettke then wrote:

> Leonid Hurwicz, in his classic papers "On the Concept and Possibility of Informational Decentralization" (1969), "On Informationally Decentralized Systems" (1972), and "The Design of Mechanisms for Resource Allocation" (1973), embraced Hayek's challenge. He developed mechanism-design theory to test the logic of the Mises-Hayek contention that socialism could not possibly mobilize the dispersed knowledge in society in a way that would permit rational economic calculation for the alternative uses of scarce resources. Mises and Hayek argued that replacing the invisible hand of the market with the guided one of government would not work. Mr. Hurwicz wanted to see if they were right, and under what conditions one could say they were wrong. Those efforts are at the foundation of the field that was honored by the Nobel Prize committee. To function properly, any economic system must, as Hayek pointed out, structure incentives so that the dispersed and sometimes conflicting knowledge in society is mobilized to realize the gains from exchange and innovation.

Now the contention that the 2007 Nobel Prize was a "Market Nobel" is in one respect perhaps a defensible proposition but in another respect a somewhat disputable claim. The following considerations have to be kept in mind:

1. Mechanism design theorists tend to consider Hayek's work an important precursor to the modern theory of mechanism design. Hayek's contribution is acknowledged to the extent it implied "the recognition that economic institutions of all kinds must serve an essential function of communicating widely dispersed information about the desires and the resources of different individuals in society" (Myerson 2008, 586). Hayek ([1945] 1984) had alleged that the mathematical economists of his day were guilty of overlooking the importance of communication in market systems.

2. The founders of mechanism design theory make two further claims, however, that seem more questionable or, at least, require critical examination. The first of these is that the Socialist Calculation Debate was inconclusive. As Myerson states it: "(…) the inconclusiveness of economic theorists' debates about socialism versus capitalism showed the limitations of price theory for evaluating non-price institutions like the socialist command economy (…). Price theory could show (under some conditions) that free markets will achieve allocative efficiency, but such results about free markets did not prove that socialist command economies could not achieve similarly good outcomes" (ibid.). The second claim is that the failure to conclusively demonstrate the impossibility of socialism can be explained by the lack of adequate theoretical and in particular mathematical tools. Allegedly

the "intuitive" approach of Hayek was simply not up to the task. As Myerson states it: "Hayek also alleged that the mathematical economists of his day were particularly guilty of overlooking the importance of communication in market systems. But questions about fundamental social reforms require fundamental social theory. In a search for new fundamental theories, the abstract generality of mathematics should be particularly helpful. So the failure that Hayek perceived should not have been attributed to mathematical modeling per se, but it was evidence of a need for fundamentally new mathematical models" (ibid. 587).

Among the mathematical economists who accepted the challenge from Hayek, Leo Hurwicz has long been considered the leader (Myerson 2007, 2009). Indeed, Leonid Hurwicz—the father of the subject—was directly inspired by the Planning Controversy between Hayek and Ludwig von Mises on the one hand and Oskar Lange and Abba Lerner on the other to develop the theory (Maskin 2015; Arrow and Hurwicz 1977, passim)

As Myerson observes in his Hurwicz Lecture (Myerson 2007, 2009):

"The pivotal moment occurred when Hurwicz (1972) introduced the concept of incentive compatibility. In doing so, he took a long step beyond Hayek in advancing our ability to analyze the fundamental problems of institutions. From that point on, as Makowski and Ostroy (1993) have observed, "the issue of incentives surfaced forcefully, as if a pair of blinders had been removed." By learning to think more deeply about the nature of incentives in institutions, we have gained better insights into important social problems and policy debates."

According to Maskin (2015) Hayek had a remarkable intuitive understanding of some major propositions in mechanism design—and the assumptions they rest on—long before their precise formulation. In particular Maskin suggests that the mechanism design literature has provided precise treatments of two claims made by Hayek:

Hayek gave at least two reasons why the free market cannot be improved upon. First, he asserted that other Pareto optimal mechanisms – mechanisms leading to Pareto optimal allocations of resources – require more *information* than the market does. That is, a consumer or producer has to *report* more information about himself (e.g., his preferences or technology), and he needs to *know* more about other consumers and producers (e.g., about their demands and supplies). Second, Hayek claimed other Pareto optimal mechanisms, unlike the market, are in conflict with consumers' and producers' own interests, i.e., they are not *incentive compatible*. (Maskin 2015)

There are thus two questions we must consider: (1) Is the fundamental problem of socialism an incentive problem rather than a calculation problem as originally identified by von Mises? I call this question "the calculation versus incentives question"; and (2) Is the fundamental problem of socialism an information or knowledge problem rather than a calculation problem and if so, what kind of information or knowledge are the proponents of this claim talking about? I call this question "the calculation versus knowledge problem".

According to the mechanism design theorists, the answer to both questions is quite clearly in the affirmative. Maskin writes:

I will suggest in this paper that the mechanism design literature has provided precise treatments of these two claims. Specifically, it has established that Hayek's first assertion is, in fact, correct in settings in which there are no significant externalities (so that, in particular, there are no public goods). Moreover, the literature has also verified his second claim, given the additional assumption there are large numbers of consumers and producers (so that none of them has market power).

It would seem beyond dispute that at least von Mises was unambiguous about the fact that the essential problem of socialism relates to the impossibility of economic calculation. But even on this issue otherwise authoritative commentators are not always clear about the relevant distinctions. Thus Boettke writes:

Mises, Hayek's mentor in Vienna, had raised the challenge in his book "Socialism," and before that in an article, that without having the means of production in private hands, the economic system will not create the incentives or the information to properly decide between the alternative uses of scarce resources. Without the production process of the market economy, socially desirable outcomes will be impossible to achieve. (Boettke 2007)

Does it make no real difference whether the essential problem of socialism is (a) a calculation problem, (b) a knowledge problem or (c) an incentive problem?

I consider these questions in the next sections. It will appear that commentators have not always been clear about the relevant distinctions.

7.2 Calculation Versus Incentives

The distinction between calculation and incentives is important because the modern economics literature on organizational design—from transaction cost explanations of firm size, to public choice theories of bureaucracy, to recent work on market socialism and the "soft budget constraint" (Kornai 1986)—focuses primarily on incentive problems, possibly encouraged by Lange's (1937, 127) famous warning about bureaucracy.

Incentive theory asks how, within a specified relationship, a principal can get an agent to do what he wants him to do. Mises's problem, however, was different: How does the principal know what to tell the agent to do? That is, just what activities ought to be undertaken? What investments should be made? Which product lines expanded and which ones contracted?

It is now typically held that the differences between capitalism and socialism lie in the different incentive properties of the two systems. Centrally directed systems are thought to be subject to greater agency costs—managerial discretion, shirking, and so on—than market systems. After all, Lange himself warned that "the real danger of socialism is that of a bureaucratization of economic life" (Lange 1937, 127).

The incentive problem had long been known and was expressed in the famous question: "Under socialism, who will take out the garbage?" That is, if everyone is compensated "according to his needs," what will be the incentive to do the dirty and unpleasant tasks; or, for that matter, any tasks at all?

The traditional socialist answer was that self-interest is a product of capitalism, and that socialism would bring about a change in human nature. In the worker's paradise would emerge a "New Socialist Man," eager to serve and motivated only by the needs of his fellows. Experience has exposed the charming naiveté of such notions.

But Mises's challenge to socialism is distinct from this well-known incentive problem. The calculation debate was not primarily about agency or managerial incentives (Rothbard 1991, 51–52).[11]

Assume for the moment that everyone is willing to work just as hard under central direction as under a market system. There still remains the problem of exactly what directives the Central Planning Board will issue. The Board will have to decide what goods and services should be produced, how much of each to produce, what intermediate goods are needed to produce each final good, and so on.

The market economy, Mises argued, is driven not by "management"—the performance of specified tasks, within a framework given to the manager—but by entrepreneurship, the speculation, arbitrage, and other risk-bearing activities that determine just what the managerial tasks are. It is not managers but entrepreneurs, acting in the capital and money markets, who establish and dissolve corporations, create and destroy product lines, and so on. These are precisely the activities that even market socialism seeks to abolish. In other words, to the extent that incentives are important, what socialism cannot preserve are high-powered incentives not in management, but in entrepreneurial forecasting and decision making.

The relevant incentive problem, he maintains, is not that of the subordinate manager (the agent), who takes the problem to be solved as given, but that of the speculator and investor (the principal), who decides just what is the problem to be solved.

Mises has been described as saying that it is unreasonable to expect managers of socialist enterprises to "play market," to act as if they were managers of private firms where their own direct interests were at stake. This may be true, but Mises's prime concern was that entrepreneurs cannot be asked to "play speculation and investment" (Mises [1949] 1998, 705).

This also explains why traditional command-style economies, such as that of the former USSR, appear to be able only to mimic those tasks that market economies have performed before; they are unable to set up and execute original tasks.

We provisionally conclude that the emphasis on incentives found in the recent literature and in particular since Hurwicz' seminal contribution seems to have missed Mises' essential point.

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[11]In the book-length treatment, Socialism ([1932] 1981), Mises also discusses the incentive problem in greater detail (pp. 163–84).

7.3   Calculation Versus Knowledge (Information)

In his 1973 paper in the American Economic Review "The Design of Mechanisms for Resource Allocation" Hurwicz paraphrases Hayek as follows:

> "It should be recalled that one of Hayek's (1935, 212) chief points in summing up the state of the debate concerning the feasibility of a centralized socialist solution was that the number of variables and equations would be "at least in the hundreds of thousands" and the required equation solving "a task which, with any of the means known at present, could not be carried out in a lifetime. And yet these decisions would … have to be made continuously … ."
>
> The market-simulation procedure developed by Lange and Lerner may be viewed as an early example of a decomposition algorithm.
>
> From the point of view of the economics of information processing it is clear that a parceling out of the task may be advantageous even if single agency capacity constraints have not been reached; this may well lower the resource cost and cut down the time required for the completion of the computing process.
>
> But another informational consideration, stressed by Hayek (1935, 1945) has gained special prominence: the difficulty of placing all the relevant information in the hands of a single agency because information is dispersed throughout the economy. A natural assumption is that, initially, each economic unit has information about itself only: consumers about their respective preferences, producers about their technologies, and resource holders about the resources. An attempt to transfer all this information to a single agency before it starts its calculations is regarded as either impossible (in the sense that much information would be lost) or too costly in relation to the existing accuracy requirements." (Hurwicz 1973, 5)

Hurwicz refers in this context to Hayek's 1945 essay "The Use of Knowledge in Society" and thus appears to be addressing the central issue of knowledge dispersal.

Several authors have pointed out that Hurwicz's paraphrasing of Hayek misrepresents Hayek's point. There is first of all the issue regarding the "computational" problem of solving a very large system of equations; from a Hayekian viewpoint this issue was strictly secondary.

Early commentators on the debate had seen Hayek as retreating from Mises' strong claim regarding the impossibility *in principle* of rational economic calculation under socialism, to the weaker objection that the planners could not solve the equations representing general equilibrium on a practical time scale. And they saw Lange's trial and error solution as an answer to that objection. As explained already this was a misrepresentation. (see Lavoie 1985) The true problem is not data processing, but rather the collection—even the *creation*—of information on production possibilities and people's preferences. Such information cannot be regarded as "given"; rather, it is generated in the process of rivalrous competition between capitalist entrepreneurs as they attempt to put into practice, and hence test the profitability of, their various incompatible plans for investment and production (Lavoie 1985, 1986; Huerta de Soto 2010; Cottrell 1998, 472–473).

In 1982 Hayek clarified

> I feel I should perhaps make it clear that I have never conceded, as is often alleged, that Lange had provided the theoretical solution of the problem, and I did not thereafter withdraw to pointing out practical difficulties. What I *did* say (in *Individualism and Economic Order*, p. 187) was merely that from the factually false hypothesis that the central planning board

could command all the necessary information, it could *logically* follow that the problem was in principle soluble. To deduce from this observation the "admission" that the real problem can be solved in theory is a rather scandalous misrepresentation. Nobody can, of course, transfer to another all the knowledge he has, and certainly not the information he could discover only *if* market prices told him what was worth looking for. (Hayek 1982)

Thus for Hayek the essential argument on the impossibility lies not in the practical difficulty of algebraically solving a system of countless equations, but in the insoluble, theoretical-dynamic problem of assuming that the central regulatory agency can acquire the subjective, practical information that is created in dispersed form and found scattered throughout the minds of millions of economic agents. Hence, for Hayek the fundamental problem economic calculation poses has nothing to do with the strictly "algebraic"—or in today's terms "computational"—difficulty of solving the corresponding system of equations, and in fact he attaches only secondary importance to it (also Huerta de Soto 2010, 143–4). According to Lavoie (1986, 6 fn 9) "Hayek was not talking about costs of transmitting known bits of data, either in the sense that some known data would be lost, or in the sense that some of its accuracy would be sacrificed."

To the contrary Hayek's whole point was, as he had stressed even in his earliest critique of socialist models, not only that the relevant knowledge is scattered but also that it is not given and does not "exist" in any articulated ready-made form that is amenable to communication to the CPB (Hayek [1935] 2009b, 210–211).

Thus the essence of the "knowledge problem" argument is not simply that plant managers know things that the CPB does not or that communication of this knowledge by the former to the latter would, as Hurwicz said, entail the cost of losing some data or accuracy. The problem is rather that the relevant knowledge is inarticulate. The producers know more than they can explicitly communicate to others. As Lavoie concludes

> Thus if this argument concerning inarticulate knowledge can be sustained, the whole corpus of market socialist models for resource allocation will be subject to the criticism that they cannot in principle be implemented. Their shortcoming would not merely be a matter of insufficient development but instead a basic and inherent aspect of the whole research program. (ibid.)

Huerta de Soto goes even further by reminding us that planometrics is theoretically impossible because, first, economic agents, to a great extent, lack the knowledge which would have to be transmitted, since such knowledge arises only from a process in which actors can freely exercise their entrepreneurship, and second, they could not transmit the knowledge they do possess either, because it is mostly of a tacit, inarticulable nature. Therefore the dialogue or transmission of dispersed information between economic agents and the central planning agency, as Hurwicz proposes it, is theoretically impossible (Huerta de Soto 2010, 157).

Hayek himself had indicated that he did not consider the Hurwicz type models to be any better in the treatment of "the knowledge problem" than Lange's models had been (1982, p. 141).[12]

Let's recall the essential characteristics of such knowledge: it is

1. subjective knowledge of a practical, non-scientific nature;
2. practical knowledge that has an exclusive and dispersed nature;
3. practical knowledge that is mostly *tacit* and *inarticulate*;
4. knowledge that as a consequence of the exercise of entrepreneurship is constantly newly created—all entrepreneurial acts imply the creation *ex nihilo* of new information—and
5. is simultaneously *transmitted* throughout the market and
6. which generates a learning effect, that is, economic agents have learnt to act in coordination, i.e. to modify and discipline their behavior in accordance with the other human beings (Huerta de Soto 2009b).

If these arguments can be sustained this would mean that minds of the caliber of Arrow and Hurwicz are ignorant of the most fundamental principles of the functioning of the market because they have failed to recognize the essential characteristics of the *type of knowledge* economic agents use and generate.

This is perhaps not be the appropriate occasion to enter into a digression about the epistemological status of inarticulate knowledge. It may be pointed out, however, that the essential insight can be further elucidated with reference to an analogy with Gödel's incompleteness phenomenon. Following up on earlier suggestions by Hayek and Van Den Hauwe (2011), Jan Marc Berk states the essential point with reference to the bottom-up economy very clearly by noting that any attempt at solving the economic coordination problem in a monocentric, top-down fashion will necessarily remain "incomplete" and be doomed to failure.[13]

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[12]According to Hayek "[i]t was probably the influence of Schumpeter's teaching more than the direct influence of Oskar Lange that has given rise to the growth of an extensive literature of mathematical studies of "resource allocation processes" (most recently summarized in K.J. Arrow and L. Hurwicz, Studies in Resource Allocation Processes, Cambridge University Press, 1977). As far as I can see they deal as irresponsibly with sets of fictitious "data" which are in no way connected with what the acting individuals can learn as any of Lange's".

[13]"Een bottom-up-economie, een wereld waarin agenten beperkt zijn in hun cognitieve vaardigheden en daar in hun handelen rekening mee houden door zich ook door onbewust of ontastbaar gedrag te laden leiden, is in lijn met de fundamentele bijdrage van Hayek. Hayek stelde in 1945 dat het centrale probleem van de macro-economie was het verklaren van het gedrag van agenten die handelen zonder dat iemand van hen beschikt over voldoende kennis en informatie om volledig geïnformeerde beslissingen te nemen (Hayek 1945). (…) Naar analogie van de fundamentele onvolledigheidsstellingen van de beroemde wiskundige en logicus Kurt Gödel stelde Hayek dat wat ik hier de top-down-benadering heb genoemd, niet juist kan zijn. Er bestaat namelijk geen homo economicus die in staat is zijn eigen gedrag volledig te verklaren en te begrijpen omdat zijn begrip begrensd wordt door de beschikbare expliciete kennis terwijl zijn gedrag daarnaast wordt bepaald door onbewust aanwezige, ontastbare, kennis. Voorbeelden van dat laatste zijn handelingen, routines, attitudes, waarden, ervaringen. Deze laatste kennis kan, omdat zij niet of nauwelijks overdraagbaar is, geen deel uitmaken van de economische blauwdruk, waardoor de top-down-benadering per definitie onvolledig is (zie Van Den Hauwe 2011). Niemand weet dus alles, iedereen

We can conclude that Hayek et al. on the one hand and Arrow, Hurwicz et al. on the other clearly seem to be talking past one another on the issue of the informational character of the problems of socialism. What about Mises' view in this connection? Is the calculational problem identified by Mises identical or at least similar or analogous to the Hayekian knowledge problem? It seems that this question is disputed in the recent literature. This issue is considered in the next section.

7.4 Dehomogenizing Von Mises and Hayek with Respect to the Impossibility of Socialism?

At least since Salerno (1993) a number of economists within the Austrian school have been obsessed by stressing the differences between Mises and Hayek, driving a wedge between them and "dehomogenizing" their work. As Salerno then wrote:

> Without tracing out this doctrinal development in any detail, suffice it to say that today the term "Austrian economics" is used to designate two very different paradigms. One derives from Wieser and may be termed the "Hayekian" paradigm, because it represents an elaboration and systematization of the views held by F. A. Hayek, a student of Wieser's at the University of Vienna. Although it is yet to be generally recognized by Austrians, Wieser's influence on Hayek was considerable and is especially revealed in the latter's early work on imputation theory, which sought to vindicate the Wieserian (as against the Böhm-Bawerkian-Misesian) position that the imputation problem must be solved within the context of an exchangeless economy subject to the control of a single will yet somehow able to calculate using (subjective) value as the "arithmetic form of utility."

The Hayekian paradigm stresses the fragmentation of knowledge and its dispersion among the multitude of individual consumers and producers as the primary problem of social and economic cooperation and views the market's price system as the means by which such dispersed knowledge is ferreted out and communicated to the relevant decision-makers in the production process.

The other paradigm is the "Misesian" paradigm, so called because Ludwig von Mises was the first to systematically expound it. This paradigm represents a development of Bohm-Bawerk's thought and focuses on monetary calculation using actual market prices as the necessary precondition for the rational allocation of resources within an economic system featuring specialization and division of labor (Salerno ibid., 114–115).

According to the "dehomogenization" thesis, von Mises and Hayek have elaborated two entirely distinct and separate criticisms of socialism and these criticisms point to problems that are of an entirely different nature, on the one hand a property (rights) problem and on the other hand an information problem. This thesis remains controversial, however: it is defended by Salerno (1990, 1993, among others), Her-

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weet iets. Markten en andere instituties—zoals geld—zorgen voor coördinatie van die decentraal beperkt aanwezige kennis" (Berk 2014, 42).

bener (1991) and Hoppe (1996), among others, but criticized by Kirzner (1996), Yeager (1994, 1997) and Huerta de Soto (2010).[14]

8 Does Computable Economics (Gödel's Incompleteness Phenomenon) Provide New Insights Regarding the Impossibility of Socialism?

8.1 Further Developments Regarding "the Mathematical Solution"

Murphy (2006) claims that the issue of the number of equations necessary for the so-called mathematical solution has not been given adequate attention, even by the Austrians. An attempt is made to establish the proposition that, if the hypothetical planners are to actually use the Lange-Lerner approach to overcome all of the entrepreneurial incentive problems traditionally raised by critics of socialism, the vector of prices (that the Central Planning Board would announce to the citizens of the socialist commonwealth) would need to contain not merely billions or trillions of prices, but in fact an *uncountably infinite* number of them. As Cantor's diagonal argument from set theory shows, it is demonstrably impossible to construct such a list. Therefore, socialist economy is truly impossible, in every sense of the word.[15]

Murphy's argument has been attacked from several perspectives. Jablecki and Machaj (2008) argue that Murphy is not only wrong in claiming that the number of goods included in the list should be uncountable, but also that the number of equations/prices is irrelevant from the point of view of market socialism. Market socialism *can* produce prices, i.e. cardinal numbers enabling some sort of profit and loss calculations. However, those prices will be of no use in guiding the central planner, since he himself produces the very guidance that he is supposed to follow. While prices can be set to equate supply with demand according to planner's preferences, these preferences cannot themselves be based on an independent calculation of opportunity costs, as reflected in independently determined scarcity prices, since

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[14]It is here not the place to add another chapter to this rather sterile debate. I nevertheless quote the following passage from Huerta de Soto (2010): "Though it is true (…) that Hayek's view has at times been interpreted too strictly, as if he merely referred to a problem arising from the dispersed nature of existing knowledge, and as if uncertainty and the future generation of knowledge, issues Mises particularly stressed, posed no difficulty, both viewpoints can be easily combined, since they are closely related" (ibid. 45). According to Lavoie (1985, 50) "the calculation argument as explained by Mises is substantially the same as that subsequently argued by Hayek, in contrast to the standard view, which (…) holds that Hayek retreated from a more extreme Misesian position" and "many elements of Hayek's later contributions on knowledge and competition can be found in embryonic state in Mises's original statement of the problem of calculation under socialism".

[15]An introductory but excellent reference with reference to Cantor's diagonalization argument and also for various metamathematical results including Gödel's incompleteness theorems—see further—is Hoffmann (2013a).

the scarcity prices in use are themselves fixed on the basis of the planner's preferences. In contrast, prices under capitalism, though *technically* formed in a similar way, reflect private property constraints and the intellectual division of labor as fulfilled by many independently competitive decisions concerning the allocation and utilization of resources. The competitive solution mimics the market and differs from capitalism only as far as the *ultimate ownership* of factors of production is concerned.

Murphy's argument is criticized from a different perspective by Cottrell, Cockshott and Michaelson (2007). These authors question Murphy's requirement that planning requires pre-knowledge of all possible prices and argue that the computational feasibility of economic planning at a detailed level is an issue that must be investigated in its own right, and cannot be settled by appeal to Cantor. The domain of prices to which planning is applied is in principle finite rather than infinite and thus Cantor's arguments are inapplicable. Moreover these authors present specific arguments that suggest that detailed planning is indeed feasible. Planning over finite prices is tractable.

8.2   The Computer and the Market

The model of Cottrell et al. deserves some further consideration. Attention should in particular be drawn to Allin Cottrell and W. Paul Cockshott (1993a, b) who argue that modern information technology (and theory) makes a substantial difference to the conclusions reached more half a century ago, and they give reasons why the failure of the particular system of planning employed in the former Soviet Union need not invalidate the notion of planning in general. These authors belong to a small group of socialist authors who put great hopes in the development of computer science and information science in view of solving the problem of centralized socialist management.

What is the role computers and information science can have in view of solving the problems of a socialist commonwealth?

In a paper of 1965 entitled The Computer and the Market Lange had actually claimed, years after his proposal for market socialism, that even market socialism would be made obsolete with the advent of high-speed computers, which could instantly solve the huge system of simultaneous equations for the central planner.

> Were I to rewrite my [1936] essay today my task would be much simpler. My answer to Hayek and Robbins would be: So what's the trouble? Let us put the simultaneous equations on an electronic computer and we shall obtain the solution in less than a second. The market process with its cumbersome *tâtonnements* appears old-fashioned. Indeed, it may be considered as a computing device of the pre-electronic age. (Lange 1965, 401–402)

Cottrell and Cockshott use developments in the theory of artificial intelligence to try to show that the problems faced by socialism according to Mises and Hayek are in fact surmountable. They present what they call the 'absent response', namely a re-assertion of the classic Marxian argument for economic calculation in terms

of labour time. They argue that labour-time calculation is defensible as a rational procedure, when supplemented by algorithms which allow consumer choice to guide the allocation of resources, and that such calculation is now technically feasible with the type of computing machinery currently available in the West and with a careful choice of efficient algorithms.

In fact computer science and in particular it's theoretical branch computability theory, play a paradoxical role in the context of this debate because computability theory is also the science of what cannot be computed, of the limits to computability.

It would seem that recent developments in the newly emerging and rapidly developing field of computable economics (Velupillai 2000, 2007, 2010; Zambelli 2010) have provided additional ammunition in the case against the possibility of socialism especially as regards issues of computability and decidability.[16]

Doria (2017b, 57 ff.) in a contribution to a volume entitled *The Limits of Mathematical Modeling—The Significance of Gödel's Incompleteness Phenomenon* (Doria 2017a) points out that results proving that markets in equilibrium may have noncomputable prices disprove Lange's main argument in favor of a planned economy. Lange

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[16]Computable economics is about basing economic formalisms on recursion theoretic fundamentals. This means we will have to view economic entities, economic actions and economic institutions as computable objects or algorithms. Computable economics looks at economics from the point of view of what can and cannot be computed. In traditional economics, everyone is able to do all sorts of complicated computations. Common sense suggests that economists often assume too much about what mathematical feats can be achieved by the economic actors of their theory. Computable economics goes beyond this commonsense insight to identify cases in which traditional economists have assumed that people can perform feats of computation that are mathematically impossible. Mathematicians use the words "computable" and "non-computable" to distinguish possible from impossible mathematical feats. Mathematicians say that a function is not "computable" if you cannot program a computer to solve it. If no combination of computer and program can solve a well-formulated mathematical problem, then the problem is "undecidable". To show that a problem is undecidable, a mathematician must show that no possible combination of program and computer will get you the answer. In the strict mathematical sense, when a function is not computable or a problem not decidable, it is not just that we cannot hope to solve it realistically. It is nor merely hard to solve, it is impossible to solve. The literature on computability and decidability goes back to Kurt Gödel's famous incompleteness proof of 1931. Gödel showed that mathematics is radically incomplete because there are true statements that cannot be proved. He showed that there is literally no end to the list of true-but-not-provable theorems. There are whole regions of mathematical truth that we just cannot get to. Before Gödel, many mathematicians implicitly assumed we could compute anything, at least in principle, and rigorously prove any true mathematical theorem. After Gödel, it has become an ongoing challenge to work out what we can and cannot compute, what is and is not mathematically possible (Gödel 1931). Computability issues are not just about abstract problems in mathematics. They can crop up in social situations because each person needs to anticipate the actions of others in order to compute his or her best path forward. Well-meaning policy makers are overambitious when they try to substitute policy plans for the entrepreneurial market process. Markets have a crucial advantage over such overambitious policy makers: markets do not have to know where they are going. The entrepreneurial market process does not require anyone to compute the final result ahead of time. The market does not know where it is going and does not need to know. To the contrary policy makers who wish to control or greatly influence the results of the entrepreneurial market process must know where they want to go. They must calculate outcomes ahead of time, which is, as the logic of computable economics has shown, not generally possible (also Koppl 2008). Velupillai has shown that there is an undecidability of policy in a complex

thought that given the (possibly many) equations defining an economy, a huge and immensely powerful computer would *always* be able to figure out the equilibrium prices, therefore allowing (at least theoretically) the existence of an efficient global policy maker.

However true this may be, the Austrian critique of socialist planning was never primarily about the limitations of computation. Cottrell and Cockshott, among others, treat as a computational issue what is really an epistemological one. The computational and epistemological arguments should not be confused, however. But even if and to the extent that the problem could be considered as a computational one, authors such as Cottrell and Cockshott, who invoke modern advances in artificial intelligence to perform the complex calculations necessary for the efficient ex ante allocation of resources, would still have to meet the Gödelian argument from undecidability and incompleteness.[17]

It can be shown that equilibrium prices in competitive markets are in general *noncomputable*, and so fall outside the scope of the techniques available in the usual formal modeling tools (Doria 2017b, 54). This means there are also obstacles to forecasting when one deals with *linear* systems as in the case of determining competitive market equilibrium (ibid.). Whenever social phenomena are described by dynamical systems, uncertainties in forecasting are usually supposed to be due to the nonlinearities in the systems considered, that is to say, they are related to the sensitivity those systems exhibit when small changes are made in the initial conditions. Linear systems do not have that kind of behavior and so are supposed to be strictly deterministic.

As Horwitz (1996) points out, the argument of the aforementioned authors fundamentally misunderstands the role of money and money prices in enabling economic calculation. Mises drew a clear relationship between the ability to perform economic calculations and the use of money and money prices. His reference to "money prices" throughout the calculation debate is more than just another way of saying "market prices"; it reflects his theoretical argument that the price system's ability to aid in economic calculation derives from the use of money in the process of price formation.

Mises was only concerned with real money prices, which would not be available with socialized means of production, even if the planning board could still have access to prices in the sense of terms on which alternatives are offered by solving for equilibrium prices using a trial and error process. Mises' theoretical framework implied that the calculation issue only made sense when talking in terms of real money prices generated in a money-using economy.[18]

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economy: if the economy is complex, then you cannot program a computer to predict the specific outcome of a policy (Velupillai 2007).

[17]Readers unfamiliar with Gödel's incompleteness theorems might benefit from Hoffmann (2013b). See also Hoffmann (2013a) and of course Gödel (1931).

[18]Money prices provide the necessary guideposts toward rational economics since, as Mises wrote "(t)he human mind cannot orientate itself properly among the bewildering mass of intermediate products and potentialities of production without such aid" (Mises [1920] 1990, 19). As he points out, "(n)o single man can ever master all the possibilities of production, innumerable as they are, as to be in a position to make straightway evident judgments of value without the aid of some system

The subsequent drift away from these issues and shift in focus to equilibrium models—what Lavoie (1985, 78) calls the "diversion of the debate into statics"—left behind discussion of the role of actual money prices in assisting in economic calculation. As Hayekians would also recognize, the flaw in Lange-type proposals was that they sought to use equilibrium theory to describe a world of pervasive disequilibrium, and that economic systems are better described using process analysis and evolutionary thinking.

9   General Conclusion

It seems plausible to assume that it makes a difference whether the most fundamental problem connected with socialism is (a) a calculation problem as originally identified by Mises, (b) an incentive problem, or (c) a knowledge problem. While (b) and (c) have been acknowledged in the mainstream literature, in particular in the context of a reflection upon and an allegedly more precise elaboration of Hayek's contribution, (a) seems to have largely disappeared from the general perception.

The general impression that comes forward from reviewing the socialist calculation debate then, and which still goes on to this day, is that the differing camps in this debate have largely been talking past one another, that is, a situation of mutual misunderstanding, where two or more people talk about different subjects, while believing that they are talking about the same thing. The latter seems to be true of at least one side in the debate, namely that of the central planners and the design theorists.

One implication of this situation is that the main lessons of the Socialist Calculation Debate haven't been generally absorbed, neither by the mainstream of the economics profession, nor by the general public. This is particularly true in the monetary sphere, a subject I haven't treated today. The monetary sphere is the main sphere where some form of central planning is today still considered theoretically legitimate and put into practice in particular by central banks. The monetary theory of business cycle developed by the Austrian School can in fact be considered a particular application and exemplification of the general insights provided by the theorem of the impossibility of socialism. This also means that the conclusions of the socialist calculation debate retain the highest degree of relevance in view of understanding real world events.

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of computation. The distribution among a number of individuals of administrative control over economic goods in a community of men who take part in the labour of producing them and who are economically interested in them, entails a kind of intellectual division of labour, which would not be possible without some system of calculating production and without economy" (Mises [1920] 1990, 17–18). It is this notion of an "intellectual division of labour" that forms the core of the later criticisms of central planning.

References

Arrow KJ and Hurwicz L (eds.) (1977) Studies in resource allocation processes. Cambridge University Press, London

Backhaus J and Backhaus U (2018) Socialization Proposals: the aspect of labor participation, paper presented at: 31st Heilbronn Symposion in Economics and the Social Sciences, June 14–16, 2018

Barone E ([1908] 1935) The Ministry of Production in the Collectivist State, reprinted in: Hayek ([1935] 2009), pp 245–290

Bergson A (1948) Socialist Economics in: Howard S. Ellis, ed., A Survey of Contemporary Economics, Vol. 1. Richard D. Irwin, Homewood Ill.

Berk J M (2014) Monetaire economie en de Crisis: Monetaire economie in Crisis?, TPEdigitaal jaargang 8(4), pp 32–47

Boettke P (1994) The Elgar Companion to Austrian Economics, Aldershot: Edward Elgar Publishing Ltd

Boettke P (2007) A Market Nobel, The Wall Street Journal, October 16, 2007

Boettke P, Coyne C J and Peter T. Leeson (2014) Hayek versus the neoclassicists: lessons from the socialist calculation debate, in: Garrison, R.W. and Norman Barry (2014), pp 278–293

Böhm-Bawerk E (1959) Capital and Interest, Libertarian Press, Illinois

Bostaph S (2003) Wieser on Economic Calculation under Socialism, The Quarterly Journal of Austrian Economics, Vol. 6, No. 2, pp 3–34

Brutzkus B (1935) Economic Planning in Soviet Russia, London

Cathrein V (1890) Socialism: Its Theoretical Basis and Practical Application, English trans., rev. and enI. by Victor F. Gellellmann. Benziger, Brothers New York

Coase R H (1937) The Nature of the Firm, Economica NS 4. pp 386–405

Cockshott W P and Cottrell A (1993a) Calculation, Complexity and Planning: The Socialist Calculation Debate Once Again, Review of Political Economy, 5, (1), pp 73–112

Cockshott W P and Cottrell A (1993b) Socialist Planning After the Collapse of the Soviet Union, Revue Européenne des Sciences Sociales, XXXI, (96), pp 167–85

Cottrell A (1998) Socialist Calculation Debate, The, in Davis et al. (1998), pp 471–473

Cottrell A Cockshott P and Michaelson G (2007) Is Economic Planning Hypercomputational? The Argument from Cantor Diagonalisation, IJUC, pp 1–16

Davis J B, Wade Hands D and Mäki U (1998) The Handbook of Economic Methodology. Elga, Cheltenham

Dickinson H D (1933) Price formation in a socialist community, Economic Journal, 43, pp 237–50

Doria F A (ed.) (2017a) The Limits of Mathematical Modeling in the Social Sciences – The Significance of Gödel's Incompleteness Phenomenon. World Scientific, London

Doria F A (2017b) Axiomatics, the Social Sciences, and the Gödel Phenomenon: A Toolkit Chapter 1, in: Doria (2017a) 1–90

Ebeling R M (1993) Economic Calculation Under Socialism: Ludwig von Mises and His Predecessors, in: Chapter 2 in: Herbener (1993)

Ekelund R B (1970) Power and Utility: The Normative Economics of Friedrich von Wieser, Review of Social Economy, 28, pp 179–96

Elder B (1915) A Study of Socialism. B. Herder, St. Louis

Endres A M (1997) Neoclassical Microeconomic Theory—The Founding Austrian Version. Routledge, London

Garrison R W and Barry N (2014) Elgar Companion to Hayekian Economics. Edward Elgar, Cheltenham

Graham W (1891) Socialism: New and Old. A. Appleton, New York

Gödel K (1931) Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme, Monatshefte für Mathematik und Physik 38, pp 173–198

Hayek F A ([1948] 1980) Individualism and Economic Order. University of Chicago Press, London

Hayek F A ([1982] 1984) Two Pages of Fiction: The Impossibility of Socialist Calculation, in: Leube and Nishiyama (1984), pp 53–61

Hayek F A ([1935] 2009a) Collectivist Economic Planning. Mises Institute, Auburn

Hayek F A ([1935] 2009b) The Present State of the Debate, Chapter V in Hayek, F.A. ([1935] 2009a) pp 201–243

Hayek F A ([1945] 1984) The Use of Knowledge in Society, reprinted as Chapter 11 in K R Leube and C Nishiyama, pp 211–224

Herbener, J M (1991 Ludwig von Mises and the Austrian School of Economics, The Review of Austrian Economics, 5, no. 2, pp 33–35

Herbener J M (1993) (ed.), The Meaning of Ludwig von Mises – Contributions in Economics, Sociology, Epistemology, and Political Philosophy. Kluwer, Dordrecht

Hoff T J B ([1949] 1981) Economic Calculation in the Socialist Society. Liberty Fund, Indianapolis

Hoffmann D W (2013a) Grenzen der Mathematik—Eine Reise durch die Kerngebiete der mathematischen Logik. Springer Spektrum, Heidelberg

Hoffmann D W (2013b) Die Gödel'schen Unvollständigkeitssätze—Eine geführte Reise durch Kurt Gödels historischen Beweis. Springer, Spektrum Heidelberg

Hoppe H-H (1996) Socialism: A Property or Knowledge Problem?, The Review of Austrian Economics, 9, no. 1, pp 143–149

Hoppe H-H and Salerno, J T (1999) Friedrich von Wieser und die moderne Österreichische Schule der Nationalökonomie, in: Hax, H (1999) Friedrich von Wiesers "Über den Ursprung und die Hauptgesetze des wirtschaftlichen Werthes", Verlag Wirtschaft und Finanzen, Düsseldorf, pp 105–134

Horwitz S G (1996) Money, money prices, and the socialist calculation debate, in: Advances in Austrian Economics, 3, pp 59–77

Huerta de Soto, J (2009a) The Theory of Dynamic Efficiency. Routledge, New York

Huerta de Soto, J (2009b) Entrepreneurship and the economic analysis of socialism, Chapter 4 in Huerta de Soto (2009a), pp 63–83. Routledge, New York

Huerta de Soto, J (2010) Socialism, Economic Calculation and Entrepreneurship. Elgar, Cheltenham

Huerta de Soto, J (2015) Austrians versus Market Socialists, in: Oxford Handbook of Austrian Economics (ed. P. Boettke and C.J. Coyne), pp 94–114, OUP, New York

Hurwicz L (1973) The Design of Mechanisms for Resource Allocation, American Economic Review, 63, 2 (May 1973)

Hurwicz L (1977) On informationally decentralized systems, in: K J Arrow and L Hurwicz (1977), pp 425–459

Jablecki J and Machaj M (2008), Cantor's Diagonal Argument: An Extension to the Socialist Calculation Debate—A Comment, Quarterly Journal of Austrian Economics, 11, pp 123–131

Kauder E (1965) A History of Marginal Utility Theory. Princeton University Press, Princeton

Kirzner I M (1988) The Economic Calculation Debate: Lessons for Austrians, The Review of Austrian Economics, Vol. 2, pp 1–18

Kirzner I M (1996) Reflections on the Misesian Legacy in Economics, The Review of Austrian Economics, Vol. 9, no. 2, pp 143–154

Klein P G (2010) The Capitalist & The Entrepreneur, Auburn: Mises Institute

Klein P G ([1996] 2010) Economic Calculation and the Limits of Organization, Chapter 1 in: Klein (2010), pp 1–21

Klein P G ([1999] 2010) Entrepreneurship and Corporate Governance, Chapter 2 in: Klein (2010), pp 23–48

Koppl R (2008) Computable Entrepreneurship, Entrepreneurship Theory and Practice, Volume 32, Issue 5, pp 919–926

Kornai J (1986) The soft budget constraint, Kyklos 39, pp 3–30

Lange, O (1936) On the economic theory of socialism: Part I, Review of Economic Studies, 4, no. 1 (October), pp 53–71

Lange O (1937) On the economic theory of socialism: Part II, Review of Economic Studies, 4, no. 2 (February), pp 123–142

Lange O (1965) The Computer and the Market, in: Alec Nove and D. M. Nuti, eds., Socialist Economics, Penguin Books, London, 1972

Lavoie D (1981) A Critique of the Standard Account of the Socialist Calculation Debate, Journal of Libertarian Studies, Volume V, Number 1, pp 41–87

Lavoie D (1985) Rivalry and central planning – The socialist calculation debate reconsidered. Cambridge University Press, London

Lavoie D (1986) The Market As A Procedure for Discovery and Conveyance of Inarticulate Knowledge, Comparative Economic Studies, Vol. 28, No. 1, pp 1–19

Lerner, A (1934) Economic theory and socialist economy, Review of Economic Studies, 2, pp 51–61

Leroy-Beaulieu P (1885) Collectivism, English transl. John Murray, London

Leube, K R and Nishiyama, C (eds.) (1984) The Essence of Hayek. Hoover Institution Press, Stanford

Machaj M. (2007) Market Socialism and the Property Problem: Different Perspective of the Socialist Calculation Debate, Quarterly Journal of Austrian Economics, 10, pp 257–280

Machaj M (2018) Capitalism, Socialism and Property Rights. Agenda Publishing, Newcastle upon Tyne

Maskin E (2015) Friedrich von Hayek and mechanism design, Review of Austrian Economics, 28, pp 247–252

Mises L von ([1932] 1981) Socialism – An Economic and Sociological Analysis. Liberty Classics, Indianapolis

Mises L von ([1920] 1990) Economic Calculation in the Socialist Commonwealth. Mises Institute, Auburn

Mises L von ([1949] 1998) Human Action – A Treatise on Economics. Mises Institute, Auburn

Murphy R P (2006) Cantor's Diagonal Argument: An Extension of the Socialist Calculation Debate, The Quarterly Journal of Austrian Economics, Vol. 9, N° 2, pp 3–11

Myerson R B (2007) Fundamental Theory of Institutions: A Lecture in Honor of Leo Hurwicz, downloaded version

Myerson R B (2008) Perspectives on Mechanism Design in Economic Theory, American Economic Review 98:3, pp 586–603

Myerson R B (2009) Fundamental theory of institutions: a lecture in honor of Leo Hurwicz, Rev. Econ. Design, 13, pp 59–75

Oversloot J (1990) Sabbatswerkers in de Sovjetunie, Leiden

Pierson, N G ([1902] 1935) The Problem of Value in the Socialist Community, reprinted in: Hayek ([1935] 2009), pp 41–85

Robbins L ([1934] 2007) The Great Depression. Mises Institute, Auburn

Rothbard M N (1976) Ludwig von Mises and economic calculation under socialism, in: Lawrence S. Moss (ed.) The Economics of Ludwig von Mises: Toward a Critical Reappraisal. Sheed and Ward, Kansas City

Rothbard M N (1991) The End of Socialism and the Calculation Debate Revisited, The Review of Austrian Economics, Vol. 5, No. 2, pp 51–76

Rothbard M N ([1962] 2004) Man, Economy, & State, with Power and Market, Scholar's Edition. Ludwig von Mises Institute, Auburn

Salerno J T (1990) Postscript: Why a Socialist Economy is "Impossible", in: Mises, Ludwig von ([1920] 1990), pp 51–71

Salerno J T (1993) Mises and Hayek Dehomogenized, The Review of Austrian Economics, Vol. 6, No. 2, pp 113–146

Schäffle A (1874) The Quintessence of Socialism, English trans. Swan Sonnenschein, London

Schumpeter J A ([1942] 1975) Capitalism, Socialism and Democracy, Harper & Row, New York

Schumpeter J A (1954) History of Economic Analysis. Oxford University Press, New York

Stigler G J ([1941] 1994) Production and Distribution Theories. Transaction Publishers, New Brunswick

Steele D R (1992) From Marx to Mises-Post-Capitalist Society and the Challenge of Economic Calculation. Open Court, Illinois

Steele D R (1981) Posing the Problem: The Impossibility of Economic Calculation under Socialism, The Journal of Libertarian Studies, Volume V, Number 1, pp 7–22

Taylor F M (1929) The guidance of production in a socialist state, in: B E Lippincott, ed. (1964), On the Economic Theory of Socialism. McGraw-Hill, New York

Van Den Hauwe L (2009) Foundations of Business Cycle Research-Volume II. VDM Verlag Dr. Müller, Saarbrücken

Van Den Hauwe L (2011) Hayek, Gödel, and the case for methodological dualism, Journal of Economic Methodology, Vol. 18, No. 4, pp 387–407

Vaughn K I (1994) The socialist calculation debate, in: Boettke P (1994), pp 478–484

Velupillai, V (2000) Computable Economics. Oxford University Press, New York

Velupillai, V (2007) The impossibility of an effective theory of policy in a complex economy, in: M. Salzano & D. Colander (Eds.) Complexity hints for economic policy. Springer, Milan, pp 273–290

Velupillai V (2010) (ed.) Computable Foundations of Economics. Routledge, London

Weber M ([1921] 1978) Economy and Society. University of California Press, Berkeley

Wieser F von (1956) Natural Value. Kelley & Millman, New York

Wieser F von ([1914] 1927) Social Economics. George Allen & Unwin Ltd., London

Yeager L B (1949) The Debate About the Efficiency of a Socialist Economy, mimeo

Yeager L B (1994) Mises and Hayek on Calculation and Knowledge, The Review of Austrian Economics, Vol. 7, no. 2, pp 93–109

Yeager L B (1997) Calculation and Knowledge: Let's Write Finis, The Review of Austrian Economics, Vol. 10, no. 1, pp 133–136.

Zambelli S (2010) Computable, Constructive and Behavioral Economic Dynamics. Routledge, New York