

Ludwig von Mises's approach to capital as a bridge between Austrian and institutional economics

EDUARD BRAUN*

Institute of Management and Economics, Clausthal University of Technology, Clausthal-Zellerfeld, Germany

PETER LEWIN**

Naveen Jindal School of Management, University of Texas at Dallas, Richardson (TX), USA

NICOLÁS CACHANOSKY***

Department of Economics, Metropolitan State University of Denver, Denver (CO), USA

Abstract. Ludwig von Mises seems to be something of an outlier within the Austrian school when it comes to capital – though his position is clearly foreshadowed in a neglected article by Carl Menger (1888). In this paper, we examine Mises's view on capital and suggest that it constitutes a bridge between Austrian and institutional economics. As an outflow of Mises's approach, an incipient financial approach may be discerned, an approach to capital that integrates concepts from financial theory into a broader view of capital that contains both institutional and Austrian elements.

1. Introduction

Ludwig von Mises never produced a work devoted solely to an exploration of the meaning of capital or its role in the economy. Other Austrian school economists like Böhm-Bawerk (1889), Hayek (1941), Lachmann (1978) and Kirzner (1966), all published books on the subject, in addition to numerous articles. But Mises's views must be gleaned from his remarks in works devoted to other specific or general topics. He did not enter into any 'capital controversy' or specifically consider them. Yet, his views on capital are interesting and highly suggestive in a way that we believe has not hitherto been explored. In particular, Mises seems to be something of an outlier within the Austrian school when it comes to capital – though his position is clearly foreshadowed in a neglected article by Menger (1888). In this paper, we examine Mises view on capital and suggest that it provides a bridge between Austrian and institutional economics.

*Email: eduard.braun@tu-clausthal.de

**Email: plewin@utdallas.edu

***Email: ncachano@msudenver.edu

In recent years, Geoffrey Hodgson (2008; 2014; 2015) has made the case for an approach to capital that recognizes the historical and institutional specificities of capitalism. ‘[T]o understand capitalism’, Hodgson (2014: 1063) remarks, ‘we must understand capital’, and to that end we must return to and deal with the meaning of capital that is employed by business people in this economic system. Hodgson credits Hobson, Sombart, Weber, Mitchell Innes, Fetter and Schumpeter for having realized this necessity, and criticizes others for having created different definitions of capital that do not allow for an analysis of the specificities of capitalism. From the Austrian camp, he singles out Böhm-Bawerk (1889) and Hayek (1941) in order to (correctly) demonstrate that their concept of capital ignores exactly those aspects that are relevant to an understanding of the role of capital in capitalism, namely money and the finance of business enterprise. Instead, these authors considered capital to be an (ahistorical) physical factor of production (Hodgson, 2015: 179, 182).

Hodgson is well aware that not all adherents of Austrian economics stick to this physical approach. In the introduction to a reprint of one of Frank Fetter’s essays (Fetter, 2008), Hodgson (2008: 127) notes that Fetter’s work could be considered to be a synthesis of institutional and Austrian views because his subjectivist approach to value theory did not prevent him from recognizing the historically specific aspects of economic phenomena, in particular of capital. We argue in this paper that Fetter is not an exception. It is of all people Ludwig von Mises, well known for his attempts to build a universal and ahistorical science of human action (Mises, 1949) and criticized by Hodgson (2015) for downgrading law and other historically specific social institutions, who deviated from other Austrian economists and stuck to the business concept of capital.

In this paper, we present and interpret Mises’s approach to capital and capital theory. We connect to Braun (2015b) who, in a reaction to Hodgson (2014), demonstrated that the Austrian approach to capital does not have to be regarded as being separated from institutional and historical facts of capitalism. We further show, based on Lewin and Cachanosky (2016), that Mises’s approach can be used as a conjunction to an incipient financial approach, an approach to capital that integrates concepts from financial theory into a broader Austrian view of capital. By demonstrating that Ludwig von Mises’s approach to capital is well worth considering by institutional economists, we hope to add to the mutual understanding of the Austrian and the institutional schools that has already been aimed at, among others, by Samuels (1989) and Wynarczyk (1992).

In the next section, we examine the distinction between physical and financial capital as actually made within the Austrian school, taking note of the contributions of Menger (1888) and of Mises. Note that this distinction was also famously made by Veblen (1908) in his critique of John Bates Clark. In section 3, we explain why Mises’s take on capital theory has been more

or less ignored so far. It appears that this situation is partly due to some terminological choices on his part. In [section 4](#), we present his approach in more detail. In [sections 5](#) and [6](#), we enrich Mises's capital theory with elements of the modern financial theory and show how it can be applied to an understanding of the business cycle as a phenomenon specific to capitalism. [Section 7](#) concludes.

2. Physical vs. financial capital in the Austrian School

The term 'capital' as used by economists is anything but unambiguous. Already the way Adam Smith expressed himself 'invited confusion between money capital on the one hand, and capital in the sense of capital goods on the other' (Hennings, 1990: 112). This double meaning of capital – physical capital or capital goods vs. financial capital or money capital – has haunted economic theory ever since. Even three extensive and international controversies between leading economists on the role of capital in economics have not settled the issue. Although the neoclassical side has, with Samuelson (1966), conceded the logic of the Neo-Ricardians concerning the neoclassical concept of capital as used in the aggregate production function, the concept is still employed as if nothing had happened. The settlement of the issue seems to have been adjourned *sine die*.

This ambiguity continues even within the Austrian School famous for its 'Austrian Theory of Capital', which is suggestive of a high degree of uniformity on this. One could say that there is, in the Austrian School, a majority of economists who define capital in a physical way, as a technical requirement for considering roundabout methods of production. But there is also a minority consisting basically of two authors – Carl Menger and Ludwig von Mises – who want to confine the use of the term *capital* partly or totally to financial capital. They do not regard capital as an ingredient in the production process, but as an important aspect of the organization of production by private agents in the market economy. They focus on the necessity of the concept of financial capital for economic agents to be able to perform profit and loss calculations.

Before we present the two diverging viewpoints within the Austrian school, we want to stress that the distinction between the minority and the majority view is not really a distinction between different authors. Carl Menger has contributed to both viewpoints as he changed his position on capital over the course of his life. In the words of Diehl (1926: 435), 'in 1888, Carl Menger published his well-known essay "Zur Theorie des Kapitals" [A Contribution to the Theory of Capital (Menger, 1888)], where he adopted the point of view which he had fought in earlier days and considered it the nature of capital to be a sum of money dedicated to the acquisition of income'. Mises too adhered to the physical capital concept in his early *Theory of Money and Credit*. In that work, Mises was not addressing the nature of capital and decided to stick to Böhm-Bawerk's

terminology simply because he was not able to present his own one within the scope of the work.¹

It is mostly ignored that there even exists a minority view on capital within the Austrian school. The content of Carl Menger's later essay on capital is little-known. Only very recently has the issue of a dissenting view on capital by the older Carl Menger been noted. Braun (2015a) demonstrates the differences between Menger (1871) and Menger (1888) and explains Menger's reasons for his turn to the concept of financial capital. But Braun (2015a) only hints at Mises's (1922; 1949) adoption of Menger's (1888) financial capital concept and leaves open the place of this concept in Mises's system, where it was developed in an independent theory of capital. In the remainder of this section, we show how Menger's (1888) and Mises's (1949) approach to capital deviates from the one usually connected to the Austrian school.

In his early *Principles of Economics*, Carl Menger laid the foundations for what was later to become the Austrian Theory of Capital. In contrast to the classical British authors, he distinguished not only between production goods and consumption goods each as a homogeneous quantity, but divided the production process into several consecutive stages. Thus, the complex of production goods was structured into goods of different orders, where the goods of higher order were farther away in time from the final output than the goods of lower order (see, for example, Skousen, 2007: 16). In this way, Menger (1871) was able to conceptualize the role of time in the production process and use it to explain what he considered to be a very important cause of wealth creation, namely the extension of human plans to the goods of higher orders (Menger, 1871: 73). Capital, in his early opinion, is the combination of economic goods of higher order in the present for purposes that lie in the future (Menger, 1871: 155, 303–304).

Eugen von Böhm-Bawerk took over Menger's (1871) discussion of the role of time in the production process and built his theory of interest upon it.² Böhm-Bawerk (1889: 22) too defined capital physically and in relation to the time-consuming production process, namely as 'the complex of intermediate products which appear on the several stages' of production. He also clearly worked out an important cornerstone of the Austrian theory of capital: the trade-off between

1 'The fact that I have followed the terminology and method of attack of Böhm-Bawerk's theory of interest throughout this chapter does not imply that I am an adherent of that theory or am able to regard it as a satisfactory solution of the problem. But the present work does not afford scope for the exposition of my own views on the problem of interest; that must be reserved for a special study, which I hope will appear in the not-too-distant future'. (Mises, 1912: 339, n.)

2 We do not mean to imply that there was no difference between Böhm-Bawerk and Menger in their approach to capital (as in Menger, 1871). Menger adhered consistently to the subjective-value nature of *all* goods, including production goods (goods of higher order) and included in useful production goods intangibles like goodwill, trading alliances and the like, in a way that Böhm-Bawerk did not. Our point is simply that Menger did not think of capital in financial terms until later (Endres and Harper, 2011).

more roundabout ways of production and the needs of present consumption. On the one hand, he argued, in the spirit of Menger (1871), production leads to better results when (wisely chosen) more roundabout (i.e. time-consuming) methods encompassing more intermediate stages of production are employed (Böhm-Bawerk, 1889: 20–23). On the other hand, the ability of entrepreneurs to implement more roundabout methods of production is limited. There must be a fund of consumption goods – what Böhm-Bawerk called subsistence-fund – which supports the owners of the factors of production while the more roundabout production processes are getting installed (Böhm-Bawerk, 1889: 400).

With this trade-off, Böhm-Bawerk outlined the problem area around which many later contributions to Austrian capital theory would revolve. Most notably, the Austrian Business Cycle Theory (ABCT) as developed by Mises (1912) and expanded on by Strigl (1934), Hayek (1935), Rothbard (1962) and Garrison (2001) is based on this aspect: absent productivity gains, a reduction in consumption is needed to lengthen the structure of production and to undertake more roundabout ways of production. If people do not save more yet the banking system, by artificially lowering the interest rate, makes entrepreneurs *believe* that savings have increased, the production structure is ‘lengthened’ despite a lack of savings. But this degree of roundaboutness *seems* to be sustainable because the interest rate is below its equilibrium or natural level; ultimately, these too roundabout methods of production prove to be unsustainable and their abandonment or truncation triggers an economic crisis.

Those treatments of Austrian Capital Theory which are not primarily concerned with the said trade-off or the business cycle, especially Lachmann (1978) and Lewin (2011), focus rather on the *fundamental* heterogeneity of capital goods. They do not only stress the different order of goods in the time-consuming production process, but the complexities of the myriad of interwoven capital goods that characterize modern economies, and deal with the question as to how this heterogeneity can be handled and ordered by entrepreneurs.

All these contributions have in common that they define capital in a physical way. For them, capital consists of tangible capital goods that allow for higher productivity. Financial capital, insofar as it is dealt with, is considered as something that might be important from the individual entrepreneur's private point of view, but does not help in the explanation of the modern production process as a whole, as seen from a bird's-eye perspective of the economic theorist. Physical capital is capital from the standpoint of society, means of production that help to increase the tangible output of the (national) economy.

Unexplored by most Austrian authors and historians of economic thought, a different viewpoint on capital has been introduced into the body of Austrian economics which does not focus on the physical qualities of the factors of production. In 1888, Carl Menger published an essay on the theory of capital where he implicitly and significantly altered his earlier definition and instead

advocated a financial capital concept. He opposed all attempts to define capital as something physical because he thought it necessary to stick with common parlance where capital does not relate to physical assets or capital goods, but to sums of money dedicated to the acquisition of income (Braun, 2015a). Furthermore, Menger (1888: 10) remarked that a definition of capital as goods of higher order does not capture the idea that the theorists really want to capture. Each household employs hundreds of higher order goods, for example, kitchen appliances, which could impossibly be called ‘capital’ from any standpoint (Braun, 2015a: 86 f.).

Menger (1888) does not do much more than criticize other definitions of capital, opting for the abandonment of physical capital concepts in economics. In particular, he does not indicate what a capital-theory that is based on the financial capital concept he endorses would look like (Braun, 2015a: 91). Of the later Austrians only Mises based his discussion of capital on Menger’s (1888) financial capital concept. Both in his treatise on socialism (Mises, 1922: 123) and in his opus magnum *Human Action*, Mises (1949: 262) stuck to the more common understanding of capital and chose to orient his definition of capital to business practice. For him, capital is a sum of money which is determined by accounting.

Capital is the sum of the money equivalent of all assets minus the sum of the money equivalent of all liabilities as dedicated at a definite date to the conduct of the operations of a definite business unit. It does not matter in what these assets may consist, whether they are pieces of land, buildings, equipment, tools, goods of any kind and order, claims, receivables, cash, or whatever (Mises, 1949: 262).

To Mises, it is not physical characteristics that determine whether assets are part of capital or not. Of primary interest is rather which role they play in the operations of business units (Lewin, 1998). Thus, Mises, together with Menger (1888), deviates from the majority view of the Austrian school on capital. Different from Menger (1888), however, Mises (1920; 1922; 1949) actually contains several hints as to what a capital theory based on a financial capital concept would look like.

3. Ambiguities in Mises’s take on capital

Mises does not abandon the contributions of his predecessors to the Austrian theory of (physical) capital. He elaborates at quite some length on Böhm-Bawerk’s trade-off between longer periods of production, characterized by additional higher order goods, and the need for consumption (Mises, 1949: 476–480). He differs from Böhm-Bawerk and most other Austrians in that he tries to separate these ‘physical’ considerations from the theory of capital. His lengthy treatment may have caused confusion – or at least failed to clear-up

existing confusions because of the terminological choice he makes at the outset of his discussion of capital to refer to production goods as *capital* goods.

After he has presented his definition of capital as the money-value of the assets and liabilities of a business unit, he investigates the physical capital concept employed by most other economists. But although he considers physical capital, defined as 'the totality of the produced factors of production', to be 'an empty concept' and a 'mythical' notion, he nonetheless, with some apprehension, calls these factors '*capital goods*' (Mises, 1949: 263). These goods are, in his (1949: 490) words 'intermediary stations on the way leading from the very beginning of production to its final goal, the turning out of consumers' goods'. That he is well aware of the problematic nature of this terminology can be seen in the very sentences where he introduces the concept: 'We may *acquiesce* in the terminological usage of calling the produced factors of production capital goods. *But this does not render the concept of real [=physical] capital any more meaningful*' (Mises, 1949: 263, italics added).

Mises (1949: 260, italics added) is clearly aware that it is very important not to confuse (financial) capital and physical capital goods:

From the notion of *capital-goods* one must clearly distinguish the concept of *capital*. The concept of capital is the fundamental concept of economic calculation, the foremost mental tool of the conduct of affairs in the market economy.

Despite these unambiguous statements, historians of economic thought and other Austrian economists have not given much weight to his distinctive definition of capital. Kirzner, for example, although he clearly recognizes Mises's non-physical definition of capital (Kirzner, 1976: 141), does not adopt this definition in his *Essay on Capital* but rather deals with capital goods, the period of production and waiting (Kirzner, 1966). Also Rothbard (1962: 47–70), in his *Man, Economy and State* which was thought to follow Mises's *Human Action* closely (Hülsmann, 2007: 935), does not seem uncomfortable when he identifies capital with capital goods and thus follows a physical capital concept. Mises's definition which clearly aims at a financial capital concept has not been made much use of by later Austrian economists. Rather Mises is categorized, with some minor qualifications, among other Austrian authors in that he focuses, in his discussion of capital, on the role of the complex of capital goods in the production process (Endres and Harper, 2011: 367–368).

The reason why Mises's alternative approach to capital has not been echoed by later economists seems to be that there are important passages in Mises (1949) that also allow for a different interpretation of his viewpoint. Though very clear on the distinction between capital and capital goods, Mises himself jumbles up the two notions later in his book. It is clear from his definitions that he thinks that the notion of capital 'is not a category of all acting' (Mises, 1949: 264) and definitely not present in Robinson Crusoe's world (Mises, 1949: 262). But

in another place, he appears to contradict himself by maintaining that capital is actually ‘a praxeological concept’ (Mises, 1949: 512), that is, a phenomenon that is part of the *universal* science of human action. In similar fashion, he does not seem to stick consistently to his statement that the ‘idea of capital has no counterpart in the physical universe of tangible things’ (Mises, 1949: 511). At another place (Mises, 1949: 500 italics added), he declares that capital is always made up of (physical!) capital goods:

There is no such thing as an abstract or ideal capital that exists apart from concrete capital goods. [...] we must realize that capital is always embodied in definite capital goods and is affected by everything that happens with regard to them. The value of an amount of capital is a derivative of the value of the capital goods in which it is embodied. The money equivalent of an amount of capital is the sum of the money equivalents of the aggregate of capital goods to which one refers in speaking of capital in the abstract. [...] Capital is always in the form of definite capital goods. These capital goods are better utilizable for some purposes, less utilizable for others, and absolutely useless for still other purposes.

These quotations that seem to contradict his earlier definitions come from the chapter on ‘Action in the Passing of Time’. Mises’s discussion here is all about the degree of *specificity* of *capital goods*, the distinction between ‘free’ and ‘fixed’ capital and the significance and validity of these distinctions. And in this regard, he does not only talk about the distinction between capital and capital goods, but also about the *connection* between them, as in the quote above – ‘Capital is always *in the form* of definite capital goods’ (italics added). Mises is here using a confusing terminology. It seems that what he wants to say is that the (financial) capital of any business is embodied in *business assets* – without them there is no capital in the business to speak of. By employing the term *capital goods* instead of *business assets*, he confines the term capital to *physical* means of production, which may constitute a part of capital but not necessarily the whole of it.

It is perhaps understandable then that later authors have mostly ignored Mises’s approach to capital. Although he is mostly clear that capital goods in themselves and by themselves are not capital and that only as *business assets* does their money value become capital, in the said chapter, what he says can be and has been interpreted as an elaboration on earlier Austrian work on the role of capital goods in the production process.

This is all the more the case in an earlier essay where Mises deals with the phenomena of heterogeneous capital goods and malinvestment, and with the ‘consequences [that] are brought about by limitations in the convertibility of *fixed capital*’ (Mises, 1931: 233, italics added). We see Mises here struggling once more with the *relationship* between financial capital and the physical production goods to which capital is connected historically and through time. His use of phrases like ‘fixed capital’ or ‘free capital’ invites confusion as to what capital

is, and what Mises actually thought. Notice the distinction between 'individual capital goods' and 'true capital' in the following quotation.³

[O]nly 'true capital,' in Clark's sense, has mobility, but [. . .] individual capital goods do not. Capital goods, as produced material factors of production, are intermediary steps on the way toward a definite goal—a consumer's good. If in the course of the period of production subsequent changes in the entrepreneur's goals are caused by a change in the data of the market, the intermediary products already available cannot always be used for the attainment of the new goals. This holds true both of goods of fixed and goods of circulating capital, although in greater measure of the former. Capital has mobility in so far as it is technologically possible to transfer individual capital goods from one branch of production to another or to transport them from one location to another (Mises, 1931:232, footnote reference to J.B. Clark omitted).

It is not clear in this passage whether capital mobility refers to capital goods or Clark's true capital or both.

4. Mises's approach to an historically specific theory of capital

We have shown why Mises has been classified with other Austrian economists when it comes to the analysis of capital. This being said, Mises can be shown to hint at what a theory of capital building upon a financial capital concept would look like. Capital, in Mises's view, is a basic tool of the economic calculations of entrepreneurs under capitalism. He clearly considers it as an *historically specific* concept à la Hodgson (2014):

The concept of capital cannot be separated from the context of monetary calculation and from the social structure of a market economy in which alone monetary calculation is possible. It is a concept which makes no sense outside the conditions of a market economy. It plays a role exclusively in the plans and records of individuals acting on their own account in such a system of private ownership of the means of production, and it developed with the spread of economic calculation in monetary terms (Mises, 1949: 262).

Monetary calculation based on capital is only possible under capitalism. Owing to what Mises calls capital-accounting, entrepreneurs are able to compare the economic significance of their inputs and their outputs even in a complicated and dynamically 'changing industrial economy' (Mises, 1949: 511). That is what distinguishes capitalism from other economic systems.

[O]nly people who are in a position to resort to monetary calculation can evolve to full clarity the distinction between an economic substance [capital] and the advantages derived from it [income], and can apply it neatly to all classes, kinds, and orders of goods and services (Mises, 1949: 261).

3 Thanks to J. Houston McCulloch for pointing us to this reference. See also McCulloch (2014).

Mises's theory of capital is a theory of the way monetary calculation based on (financial) capital helps entrepreneurs to organize the production process under capitalism. One could also say that his theory of capital is a theory of capitalism, a theory of how entrepreneurial operations are guided by capital accounting.

Mises's take on the theory of capital is only rudimentary and needs further elaboration (see e.g. Braun, 2015b). In this, he does not deviate from other economists who endorsed the financial capital concept. At the hands of Mises, however, this concept has brought about a significant result nonetheless: Mises's critique of socialism. Mises (1920: 6) famously argues that *without* the institutions of monetary calculation, it would not be possible to reduce inputs and outputs to a common denominator and an industrial economy would not be sustainable. Hence, the impossibility under socialism to economize on resources and to determine where input factors can be employed most economically.

[I]t lies in the very nature of socialist production that the shares of the particular factors of production in the national dividend cannot be ascertained, and that it is impossible in fact to gauge the relationship between expenditure [production effort] and income [production proceeds] (Mises, 1920: 2; brackets contain our own translations).

A socialist government would badly need what the capitalist system has, namely the concepts of capital and income to guide its operations. However, without private ownership in the means of production, without markets and prices for such goods, the concepts of capital and income are 'mere postulates devoid of any practical application' (Mises, 1949: 264; see also the excellent discussion in Murphy, 2015: 223–246).

Mises's discussion of capital is a discussion of how the institutions of monetary calculation work and how far they contribute to a rational allocation of production factors in capitalism. We are of the opinion that his take on capital is of interest to all economists who deal with the institutional foundations of capitalism and that Mises can therefore serve as a bridge between Austrian and institutional economists similar to the way that Frank Fetter can.

We also want to offer an interpretation about the potential contradiction in Mises's statements that capital is both, a *praxeological* concept and a historical institutional contingent concept. The former suggests that the concept of capital is ahistorical, but the latter that it can only be understood in a specific institutional framework – a market economy. It should be noted, however, that Mises's praxeology is not devoid of empirical assumptions (Zanotti and Cachanosky, 2015). Because for Mises praxeology is not 100% *a priori*, the historical concept of capital can still be reconciled with it. A charitable interpretation of Mises's reference to capital as a praxeological concept is that he is referring to capital as a mental tool that is necessary to understand the modern world. The fact that he calls capital a praxeological concept does not necessarily imply that it is not empirical, it means it is *a priori* only in the sense that he does not put

the concept of 'capital' to an empirical test but rather that he takes it as given in his theoretical and empirical studies. This interpretation means that there is not necessarily a contradiction on Mises's part by using historical or empirical regularities as part of the praxeological arsenal.

5. Toward a fuller theory of financial capital

Finance, understood as the study of investments, is a field that is specific to capitalist societies which have developed to a stage where large parts of investments are made on what is called the capital market. In the following sections, we show that the financial approach to capital by Menger and Mises can be fleshed out by means of concepts taken from this field. In particular, Böhm-Bawerk's (physical) concept of roundaboutness and the important role of time in production can be revitalized even if capital is defined as a historically specific value concept rather than as physical entities.

The roundaboutness of the production process, as emphasized by the Austrian theory of capital, has become particularly important in the Austrian analysis of another phenomenon that is specific to capitalist societies, namely the business cycle. As mentioned earlier, according to the ABCT, unsustainable investments in 'longer term' production processes, at the expense of 'shorter term' processes are at the root of the cycle. It is a matter of malinvestment. Yet, the theory has been hampered, both theoretically and, more so, empirically, by the impossibility of defining 'longer' or 'shorter' term. This ambiguity is the result of a neglect of the financial dimensions of capital. We will demonstrate that the concept of *duration* gives a precise meaning to this and suggests different possible theoretical and empirical approaches to the analysis of the business cycle, approaches based on financial measures of the length of production (investment).

Among the Austrians, it is most explicitly in the work of Eugen von Böhm-Bawerk, that the role of time in production is manifest though, of course, Hayek also worked extensively on this, work which culminated in Hayek (1941). In Böhm-Bawerk's terms, wisely chosen *roundabout*, that is, time-consuming, production processes are more productive than shorter ones.

But what does it mean to take 'more' time? Consideration of this leads one very quickly into difficult territory. To attempt to quantify the time-taken raises a whole host of well-known difficult questions. When does the 'time-period' begin – or end? It is not elapsed time *per se* that is taken. Rather it is work-time – the application of effort over time by different kinds of resources. So it is input time that is relevant and must be measured. In what units? And so on. In order to simplify the matter, and hopefully make it tractable, Böhm-Bawerk suggested the concept of the 'average period of production' (APP) – a conceptual measure of the 'average amount of time' taken in the production of any product.

The APP may succinctly express as follows:

$$T = \frac{\sum_{t=0}^n (n-t) l_t}{\sum_{t=0}^n l_t} = n - \frac{\sum_{t=0}^n t \cdot l_t}{N}, \quad (1)$$

where T is the APP for a production process lasting n calendar periods; t , going from 0 to n , is an index of each sub-period. Variable l is the amount of labor expended in sub-period t and $N = \sum_{t=0}^n l_t$ is the unweighted labor sum (the total amount of labor-time expended). Thus, T is a weighted average that measures the time on average that a unit of labor l is ‘locked up’ in the production process. The weights $(n-t)$ are the distances in time from the emergence of the final output. T depends positively on n , the calendar length of the project, but also depends on the *time pattern of labor* applied (the points in time t at which labor inputs occur) to the total amount of labor invested N .

Although Böhm-Bawerk’s APP, a concept designed to capture the role of time in production, is very limited in its applicability to real-world processes, the essential idea is important and is a precursor to much work on the nature of production in the modern world. Böhm-Bawerk tried to capture in *quantitative* terms *the average amount of time taken in any production project – a purely physical measure of physical capital*.

As can be easily shown, except for the most simple of cases, this is not possible. As soon as one considers the relationship between capital and time, *value* enters the analysis and a purely physical (quantitative) measure is impossible. The purpose of production is to get results in the form of *products that are useful to consumers, that are valued more highly than the combined value of what went into them*. And since production takes time, the relationship between value and time must be considered. This suggests that if ‘more’ time is to be taken to produce anything, there must be a reward. This comes in the form of a higher valued product. Böhm-Bawerk’s essential error lies not in his attempt to take account of time considerations in the mind of the investor/entrepreneur as expressed in some simple formulation, but, rather, in his attempt to do so by confining his attention to a *strictly physical* measure and ignoring the value considerations that underlie the physical production process.

In contrast to Menger (1888) and Mises (1949), who, in their discussions of the financial capital concept, do not delve into this problem of time and production, the modern theory of finance has much to say on this that is very useful to this discussion.

Modern financial theory, though adhering to the *financial* capital definition, has carefully considered the role of time in production and investment. For investment decisions in a monetary economy, we express the capital value (CV) of any investment (the present-value of expected future earnings (cash flows)) in

a familiar way.

$$CV = \frac{CF_1}{(1+d)} + \frac{CF_2}{(1+d)^2} + \dots + \frac{CF_n}{(1+d)^n} = \sum_{t=1}^n \frac{CF_t}{(1+d)^t} = \sum_{t=1}^n f^t CF_t, \quad (2)$$

where:

- CV = the *capital value* of the investment, being the net present value (*NPV*) of the investment.
- CF_t = the money-valued *cash flow* expected from the investment in period t ($t = 1, \dots, n$) – which is the net-value of earnings and outlays in that period and can be positive, negative or zero.
- n = the *time-horizon* of the investment or the number of periods for which the investor is planning from now until the investment is considered to end. It is the *planning period* of the investor. For a fixed-income investment like a bond, it is called the *term to maturity*.
- d = the rate of discount applied to any future value to reduce it to present value. As explained below, depending on the context, d , can be considered to be the rate of *time preference* of the investor, or it can be a market *interest rate* that determines the market price of the investment (as in the case of a bond), or something similar. We will refer to it as the *discount rate*.
- $f = (\frac{1}{1+d})$, which we shall refer to as the *discount factor*.

This equation expresses a universal arithmetic relating value and time as perceived by human actors. There are a large number of potential unknowns. For the equation to be of practical use, information must be supplied for all but one of the unknowns. So, for example, in the case of a fixed-coupon bond, everything except d is known. Barring default the bond-holder knows what the bond will pay per period and at the end of the investment period, n . The price to purchase the bond is thus given in the market. d is calculated given this information. It is that number that solves the equation, making the CV equal to the price. This procedure is used wherever financial assets are traded many times every day.

Other special cases, like premium bonds, discount bonds and perpetuities, are well known and need not be repeated here. The essential take-away point is the significance of d in connecting values over time. An investor purchasing the bond knows that each dollar of investment of P dollars will be *marked-up* by d percent in each sub-period of the investment period (Osborne, 2014). It is the essence of what is known as the *time-value-of-money*.

In a more general context, encompassing *any kind* of multi-period investment, the value of d that reduces the CV to zero is known as the *internal-rate-of-return*, i (or *IRR*) – it is that rate that reduces the expected income stream of the investment to its current price. At this rate-of-return, the cost of the project is

equal to its CV. Thus, i can be compared to current market interest rates (yields) to see if the investment per dollar covers its opportunity cost.⁴

Because of positive marginal time-preferences (including impatience and risk-uncertainty-aversion), investments will be made only if they promise to pay a premium. In a growing economy, this implies creating value. Resources are marshalled and combined in ways that promise to produce outcomes that consumers value enough to cover the costs of doing so. In common terms, the transformation of resources into more valuable uses is known as *production*, and the more value added the more *productive* this process is considered to be. It seems obvious that modern financial theory clearly echoes important elements of Böhm-Bawerk's approach to time and production as the essential features of capital.

But modern finance theory even uses a concept that captures the idea of Böhm-Bawerk's APP. Already John Hicks (1939: 186) pointed out as early as 1939 that a valid form of the APP does exist – he called it the *average period* (AP). It is exactly that same construct developed by Frederick Macaulay (1938)⁵ that is known as 'duration'. Duration (D) is most easily understood as '*the average amount of time for which one has to wait for \$1*' in any investment. It is a measure of the 'length' of the project – or, at least, some significant aspect of the length. It captures an important aspect of what is in the investor's mind as he contemplates his investment.

Specifically,

$$D = \sum_{t=1}^n \left(\frac{f^t C F_t}{CV} \right) t, \quad (3)$$

where the terms are as previously defined. D is a weighted average of the *time-units* involved in the project, starting from 1, the earliest, to n , the last, where the weights are the proportions of the present value of the investment received (or paid) in the time period ($f^t C F_t / CV$). It is the (present-) value-weighted amount of time involved in the investment. As such it is a *money-value of time* measure.

The logic is simple. The economic significance of the time involved in the investment, the amount of time for which one has to wait for payments to be made or received, depends on the relative size of the payments in each of the periods involved. The simple size of the calendar time, n , is not very informative. The same n can have very different significance to the investor depending on whether the payments occur sooner or later and in what proportions. The value-significance of the time involved must be considered. Given

⁴ It is well known that the *IRR* criterion is inferior to using the magnitude of *NPV* when deciding among exclusive investment projects and that there are instances when the two criteria give different rankings. Among available investments that cover the (the opportunity) cost of capital the investor should choose the one with the highest *NPV* at that cost. This does not affect our discussion.

⁵ See also Lewin and Cachanosky (2014; 2016) for a fuller discussion.

time-preference, other things constant, a longer AP (duration) should carry a higher markup.

6. Discount rate changes, time and the business cycle

It is well known in the financial literature that D also has a use different from the one of measuring the *time-intensity of the invested dollars*, namely as a measure of the interest-elasticity of the NPV (or CV) of the investment. This dual aspect of D is significant. Using equation (2), the sensitivity of the CV to changes in interest rates (more specifically to the rate of discount applied to the investment) is a key factor in investment appraisal. And financial specialists have long worked to develop tools to mitigate, if not completely *immunize*, investments from this risk.⁶

It turns out, as first indicated by Hicks (1939) that D is *also* a measure of the elasticity of the (present) value of the project with respect to the discount factor f . It measures how any estimate of net present value (CV) changes with a change in the discount factor, for small changes.

Hicks's formulation (1939: 186) proceeds as follows: The CV of any stream of n payments (cash flows) is given as before by equation (2):

$$CV = \sum_{t=1}^n \frac{CF_t}{(1+d)^t} = \sum_{t=1}^T f^t CF_t. \quad (2')$$

We may calculate the *elasticity* of this CV with respect to f , as

$$E_{CV,f} = \frac{E(CV)}{E(f)} = \frac{1}{CV} [1 \cdot f^1 CF_1 + 2 \cdot f^2 CF_2 + \dots + n \cdot f^n CF_n], \quad (4)$$

or

$$E_{CV,f} = \sum_{t=1}^n (t) \frac{f^t CF_t}{CV} \quad (3')$$

where E is the elasticity (or $d \log$) operator. This follows from the rule that the elasticity of a sum is the weighted average of the elasticities of its parts. A comparison of the two approaches to roundaboutness appears below in Table 1.

Based on the concept of duration, it is possible to frame the ABCT in financial terms. Note that equation (3)' is identical to equation (3). Importantly, $E_{CV,f}$ provides a measure of the sensitivity of the value of the project (investment)

⁶ We omit here discussion of difficulties in the practical use of D for immunization purposes owing to the inaccuracies produced by second order and higher effects that result from real-world discrete changes (when measuring CV sensitivity to discount rate changes), and also from consideration of the connection between the discount rate used by the investor and the structure of market interest rates. These complications have been extensively considered in the literature. Our purpose here is to highlight the *conceptual* cogency of D as a measure of time involved in any investment.

Table 1. Time in production/investment, alternative measures

Böhm-Bawerk – a physical capital concept	Hicks and Macaulay – a financial capital concept
$APP = n - \frac{\sum_{t=0}^n (l_t)t}{N}$	$AP = \frac{\sum_{t=1}^n (f^t CF_t)t}{CV}$
Labor-weighted average amount of time in production	Value-weighted average amount of time in investment and the discount-factor elasticity of capital value

to changes in the rate of discount, or (inversely) in the discount factor. So, anything that affects the discount rate applied to investments will affect their *relative valuations*. This implies that the perceived values of investment projects that constitute the components of the structure of production will be unevenly affected by monetary policy that systematically affects discount rates. Those components of existing production processes that have a higher E_{CV, f^t} ($= D$) will be relatively more affected – for example, a fall in the discount rate (perhaps provoked by a fall in the federal funds and other interest rates) will produce a rise in the value of high- E_{CV, f^t} ($= D$) projects relative to those with lower ones. D , thus serves the dual purpose of *measuring both ‘roundaboutness’ and the sensitivity of CV to changes in the discount rate (discount factor)*.

The application of finance, and especially of *duration*, to the problems discussed in the ABCT points to the fact that when discount rates are lowered below their equilibrium levels, the *ranking* of different investment projects change in a way that the present value of the cash flows with a larger duration increase more than lower duration cash flows. As we have argued, there is a crucial connection between the appraised value and the duration of investments on the one hand, and the structure of the production goods that underlie these investments on the other. This connection helps to reframe the ABCT in the following way: If a decrease of the interest rates affects the CV of different investment projects according to their duration, the production processes connected to projects with high duration will be expanded and those with low duration will be curtailed. A rebound of the interest rate by the monetary authorities, for example, as a reaction to inflation, will have the opposite effect on CV. However, the production processes, as opposed to the CV, will not be able to readjust in the same way and with the same speed. The specificity and complementarity of the production goods involved hinders them from being reallocated to other projects in a way that causes, according to ABCT, an economic downturn.

With the help of the concept of duration, it is possible to better quantify the influence of interest rate changes on investment projects and the underlying production processes. As an element of the ABCT, it furthermore provides a rationale for how the interest signal of the monetary authorities is transmitted to the production process. In this, it complements the analysis of the historically

specific financial capital concept employed by Mises and helps to shed light on the institutional background of the business cycles that happen to haunt capitalist societies for more than 200 years.

7. Conclusion

We provide evidence that Mises deviated considerably from other Austrian economists in that he employed a historically specific concept of capital that is based on the institutions of monetary calculation. We argue that his work on capital can therefore be seen as a bridge between Austrian and institutional economics. Furthermore, institutional economists do not necessarily have to be put off by Mises's adherence to a universal science of human action. We have seen that it did not hinder him from integrating the institution of capital accounting into his system.

It was important to us to point out where problems might arise in the interpretation of Mises's work and how it can be complemented by concepts from modern finance in order to get a richer picture of the role capital plays in capitalism. Specifically, we show that Mises conceptually distinguishes between capital goods and financial capital, what he refers to just as capital. These two concepts, as different as they are, are also very closely connected. This bridge, which is only hinted at by Mises and mostly unexplored, can be constructed with financial calculations. Financial calculation is, in addition, the type of calculations that investors *actually* do in the market economy. But financial calculation requires market prices. And therefore capital-accounting is possible only in a monetary economy.

The application of finance does not only connect physical capital with (financial) capital, it also offers a clear definition of the AP of production. Where there is a cash flow and a discount rate, there is a *duration* that measures the 'time involved' in the investment and this precisely captures the mental process of appraisal in the minds of investors as they contemplate (even if tacitly) the values of alternative investment prospects. Value and time weigh in their considerations and changes in the discount rates they use will influence these appraisals in predictable ways, in line with the claims of ABCT (see, for example, Cachanosky and Lewin (2014) and Lewin and Cachanosky (2014; 2016)).

Our analysis shows that the concepts of capital goods and financial capital are in no way mutually exclusive. Using a financial framework adds to the applicability and plausibility of ABCT which depends on a coherent understanding of the role of time in production and investment.⁷ We have demonstrated the parallels between the above analysis of the *financial capital concept* and the problem of roundabout production processes which Böhm-Bawerk tried to formalize with his APP. What we have to point out, however,

⁷ For a detailed discussion, see Cachanosky and Lewin (2016).

is that the *dual* meaning of capital has invited much confusion. We have shown that even Mises, although he is one of the authors where the distinction between capital goods and financial capital is strictly and explicitly made, had difficulties in expressing this distinction.

Acknowledgements

Lewin would like to acknowledge helpful discussions with Steven Horwitz and helpful comments from the members of the NYU colloquium on Austrian economics.

References

- Böhm-Bawerk, E. V. [1889](1930), *The Positive Theory of Capital*, trans. W. Smart, New York: G. E. Stechert & Co.
- Braun, E. (2015a), 'Carl Menger's Contribution to Capital Theory', *History of Economic Ideas*, 23(1): 77–99.
- Braun, E. (2015b), 'The Theory of Capital as a Theory of Capitalism – Hidden Austrian Contributions to a Historically Specific Approach to Capital', *TUC Working Papers in Economics*, paper 15, available at: <https://ideas.repec.org/p/tuc/tucewp/0015.html> (last accessed May 30, 2016).
- Cachanosky, N. and P. Lewin (2014), 'Roundaboutness is not a Mysterious Concept: A Financial Application to Capital Theory', *Review of Political Economy*, 26(4): 648–665.
- Cachanosky, N. and P. Lewin (2016), 'Financial Foundations of Austrian Business Cycle Theory', *Advances in Austrian Economics*, 20: 15–44.
- Diehl, K. (1926), 'Die zweite Auflage von Carl Mengers, Grundsätzen der Volkswirtschaftslehre', *Zeitschrift für die gesamte Staatswissenschaft*, 80(3): 433–446.
- Endres, A. M. and D. A. Harper (2011), 'Carl Menger and His Followers in the Austrian Tradition on the Nature of Capital and Its Structure', *Journal of the History of Economic Thought*, 33(3): 357–384.
- Fetter, F. (2008), 'Capital', *Journal of Institutional Economics*, 4(1): 132–137.
- Garrison, R. W. (2001), *Time and Money. The Macroeconomics of Capital Structure*, London and New York: Routledge.
- Hayek, F. A. (1935), *Prices and Production*, 2nd edn., New York: Augustus M. Kelly.
- Hayek, F. A. (1941), *The Pure Theory of Capital*, Chicago: Chicago University Press.
- Hennings, K. H. (1990), 'Capital as a Factor of Production', in J. Eatwell, M. Milgate and P. Newman (eds.), *The New Palgrave. Capital Theory*, New York and London: W. W. Norton, pp. 108–122.
- Hicks, J. [1939](1947), *Value and Capital*, 2nd edn., Oxford: Oxford University Press.
- Hodgson, G. M. (2008), 'Frank A. Fetter (1863–1949): Capital (1930)', *Journal of Institutional Economics*, 4(1): 127–132.
- Hodgson, G. M. (2014), 'What is Capital? Economists and Sociologists Have Changed its Meaning: Should it be Changed Back?', *Cambridge Journal of Economics*, 38(5): 1063–1086.
- Hodgson, G. M. (2015), *Conceptualizing Capitalism. Institutions, Evolution, Future*, Chicago and London: The University of Chicago Press.

- Hülsmann, G. (2007), *Mises. The Last Knight of Liberalism*, Auburn, AL: Mises Institute.
- Kirzner, I. M. [1976](2010), 'Ludwig von Mises and the Theory of Capital and Interest', in P. J. Boettke and F. Sautet (eds.), *The Collected Works of Israel M. Kirzner: Essays on Capital and Interest*, Indianapolis: Liberty Fund, pp. 134–146.
- Kirzner, I. M. [1966](2010), 'An Essay on Capital', in P. J. Boettke and F. Sautet (eds.), *The Collected Works of Israel M. Kirzner: Essays on Capital and Interest*, Indianapolis: Liberty Fund, pp. 14–133.
- Lachmann, L. M. (1978), *Capital and its Structure*, 2nd edn., Kansas City, MO: Sheed Andrews and McNeel.
- Lewin, P. (1998), 'The Firm, Money and Economic Calculation', *American Journal of Economics and Sociology*, 57(4): 499–512.
- Lewin, P. (2011), *Capital in Disequilibrium*, 2nd edn., Auburn, AL: Mises Institute.
- Lewin, P. and N. Cachanosky (2014), *The Average Period of Production: The History and Rehabilitation of an Idea*, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2479408 (last accessed May 30, 2016).
- Lewin, P. and N. Cachanosky (2016), *What is Capital? (Again): Contributions from Finance and Economics*, <http://ssrn.com/abstract=2613469> (last accessed May 30, 2016).
- Macaulay, F. R. (1938), *The Movements of Interest Rates. Bond Yields and Stock Prices in the United States Since 1856*, New York: National Bureau of Economic Research.
- McCulloch, J. H. (2014), 'Misesian Insights for Modern Macroeconomics', *Quarterly Journal of Austrian Economics*, 17(1): 3–18.
- Menger, C. (1888), 'Zur Theorie des Kapitals', *Jahrbücher für Nationalökonomie und Statistik*, 17: 1–49.
- Menger, C. [1871](2007), *Principles of Economics*, trans. J. Dingwall and B. F. Hoselitz, Auburn, AL: Mises Institute.
- Mises, L. V. (1949), *Human Action – A Treatise on Economics*, New Haven: Yale University Press.
- Mises, L. V. [1922](1951), *Socialism: An Economic and Sociological Analysis*, transl. J. Kahane, New Haven: Yale University Press.
- Mises, L. V. [1912](1953), *The Theory of Money and Credit*, trans. H. E. Batson, New Haven: Yale University Press.
- Mises, L. V. [1931](2003): 'Inconvertible Capital', in L. V. Mises, *Epistemological Problems of Economics*, 3rd edn, transl. G. C. Reisman, Auburn, AL: Mises Institute, pp. 231–246, available at <https://mises.org/library/epistemological-problems-economics>.
- Mises, L. V. [1920](2012), *Economic Calculation in the Socialist Commonwealth*, trans. S. Adler, Auburn, AL: Mises Institute.
- Murphy, R. (2015), *Choice: Cooperation, Enterprise and Human Action*, Oakland: The Independent Institute.
- Osborne, M. (2014), *Multiple Interest Rate Analysis: Theory and Applications*, Houndmills, Basingstoke, UK: Palgrave.
- Rothbard, M. N. [1962](2009), *Man, Economy, and State: A Treatise on Economic Principles*, 2nd edn., Auburn, AL: Mises Institute.
- Samuels, W. J. (1989), 'Austrian and Institutional Economics: Some Common Elements', *Research in the History of Economic Thought and Methodology*, 6: 53–71.
- Samuelson, P. A. (1966), 'A Summing Up', *The Quarterly Journal of Economics*, 80(4): 568–583.
- Skousen, M. (2007), *The Structure of Production*, New York and London: New York University Press.

- Strigl, R. V. [1934](2000), *Capital and Production*, transl. M. R. Hoppe and H.-H. Hoppe, Auburn, AL: Mises Institute.
- Veblen, T. (1908), Professor Clark's Economics, *Quarterly Journal of Economics*, 22(2): 147–195.
- Wynarczyk, P. (1992), 'Comparing Alleged Incommensurables: Institutional and Austrian Economics as Rivals and Possible Complements?', *Review of Political Economy*, 4(1): 18–36.
- Zanotti, G. J. and N. Cachanosky (2015), 'Implications of Machlup's Interpretation of Mises's Epistemology', *Journal of the History of Economic Thought*, 37(1): 111–138.