1 Introduction and Background

Austrian capital theory (ACT) suffers from its reputation. Among both scholars of Austrian economics and others who know about it, it is often considered to be an impenetrably complex subject. This is unfortunate. While it is true that the *capital structure* of a modern economy is, indeed, very complex, the *capital theory* that enables us to understand it in terms of the human actions that created it is not. ACT consists of a number of basic elements that, once carefully explained and connected, provide an accessible and very useful account of this theory. To provide such an explanation is the purpose of this Element. We aim to remove any impediment facing the interested scholar seeking to understand the elements of ACT or, indeed, of capital theory more generally.

The reason for ACT's unfavorable reputation lies in its historical development. One might say that the development of ACT suffered a series of unfortunate events. What has come down to us is an account in which the simple basic, commonsense elements of the phenomenon we call "capital" have been obscured as a result of the arcane discussions in its history. Our first order of business, therefore, is to outline these basic elements before turning to the historical development of ACT by examining the work of the theorists who introduced them.

1.1 What Is Capital?

To that end, in this work, for reasons that will become apparent, we promote the commonsense idea of "capital as money," such as when someone says, "This is the capital I can put up to start this business." This way of thinking about capital, as the origin of its name implies,[1] is the conception responsible for the introduction of the word into the language of business and economics.

Somewhere along the line, maybe with Adam Smith's work (1776; see Hodgson, 2014), the concept was broadened to include *physical items*, tools of production. In fact, economists today, when referring to capital, almost always mean the *physical means of production* – sometimes including land, but often excluding it and considering only the *produced* means of production, in other words, tools of production that have been produced by people and not simply inherited "from nature."[2] As a result of this development the relationship between capital as physical productive resources and their *value* in various

[1] From medieval Latin, signifying "head," used colloquially to imply "the start of" or "the top of."

[2] Indeed, this issue of whether or not to include natural resources in the definition of capital is just one that complicated the discussions in capital theory. There are important economic differences between resources produced by humans that require maintenance to remain productive and resources simply existing in nature on a permanent basis. And these differences will affect the decisions of the entrepreneur/investor in important ways.

contexts became obscured. A perusal of the literature reveals a frustrating ambiguity in the way that economists speak about capital, sometimes meaning physical equipment, sometimes meaning the financial value of that equipment or of the business as a whole, and often shifting from one to the other without warning. We will show why it is important to be clear about the distinct phenomena at play here, physical and financial.

We shall use an understanding of capital consistent with the following definition by Ludwig von Mises. See Section 7.2.

> 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, italics added; see also Braun et al., 2016 and Braun, 2017)

This definition is remarkably straightforward. Capital is understood as the money value of the "business unit" accounting for all assets and liabilities.[3] Productive activities employ *stocks* of durable and nondurable productive resources over time to produce a *flow* of valuable products or services for use or for sale and, importantly, the value of any combination of productive resources for these purposes depend exclusively on the value of the final goods or services they produce. In fact, there is no defensible way to think about the magnitude of capital except in terms of the flow of income over time that it represents. To attempt to characterize capital in the absence of the income flow that it represents is incoherent. Capital is the conceptual (accounting) tool that relates the value of the flow of final services to the ongoing business that produces them. Capital is the conceptual way to *calculate* (estimate) the value of that business, using finance and accounting conventions.

The value of any business is its *capital value*. Capital is not a physical phenomenon but rather a conceptual one, and as such is *subjective*. It is the result of subjective evaluation. Different evaluators will have different evaluations depending on their expectations relating to the use of the business's productive resources. Only in a comprehensive equilibrium, in which everyone's expectations are identical and correct, will capital values take on any kind of objective characteristics. And, indeed, we all know that a business evaluated

[3] The "business unit" can be understood as a shorthand for whatever combination of productive resources is being considered, be it a for-profit business, a nonprofit business, a business division, or even a household, whose productive resources include things like houses, household appliances, raw materials for the production of meals, etc. that are used to produce a stream of valuable services (shelter, comfort, nutrition, etc.) for the owner.

by different appraisers and entrepreneurs will have different values depending on the assumptions made by the appraisers.

It should be obvious that capital can exist only in economic systems that are based on private ownership of resources in which resources and final goods and services can be traded for money. Without private property and markets there would be no way to value productive activity. In short, capital presupposes private property, trade, and money prices. Karl Marx accordingly labeled such a system *capital*ist. In a capitalist system resources tend to move to their highest (capital) value uses. Without private property there is no way to know what the value of alternative uses is. In a socialist system of collective ownership of all resources, with comprehensive central planning, there could be productive resources, but there would be no capital. By understanding the calculative function of capital one can better understand the term "capitalism."

1.2 Financial versus Physical Capital

As mentioned earlier, the meaning of capital in history shifted from the one we have discussed in the foregoing to one connoting the set of physical production goods, or *capital goods*, as they came to be called. Until recently, this was the common conception of the nature of capital in ACT. For example, Eugen von Böhm-Bawerk, the most well-known Austrian capital theorist of his time, focused considerable attention on how to calibrate the "amount of time" taken by any production process, accounting for the production of production goods, while F. A. Hayek and Ludwig Lachmann in different ways concentrated on decisions relating to the *composition* of the produced means of production (production goods[4]) assembled by the producer/entrepreneur. It is not that they ignored the value dimension of capital. Rather, value appears somewhat "in the background" as it were.

A helpful way to think of this is in terms of capital having three different but inseparable "dimensions": value, quantity, and time.[5] There are physical

[4] It is important to note that in this Element we use the terms "production goods" and "capital goods" interchangeably.

[5] Strictly speaking there are only two "compound dimensions," quantity and value, both occurring together *in time*. There is *value time* and *quantity time*, and whereas prior work has concentrated markedly the latter, we here promote the former as being the most logical and helpful way to think about the role of time in production and investment (employment) decisions, which is discussed in further detail in the text that follows. Mathematically, this means we are always dealing not so much with magnitudes of single-valued variables such as outputs of q, produced by inputs of l, valued at price p, as with functions of vectors (or time functions), where the stream of outputs $\boldsymbol{q}_t$ valued at prices $\boldsymbol{p}_t$ is produced by a flow of services $\boldsymbol{l}_t$, etc. This is something with which Hayek (1934, 1941) grappled in trying diagrammatically to portray the dimensions involved.

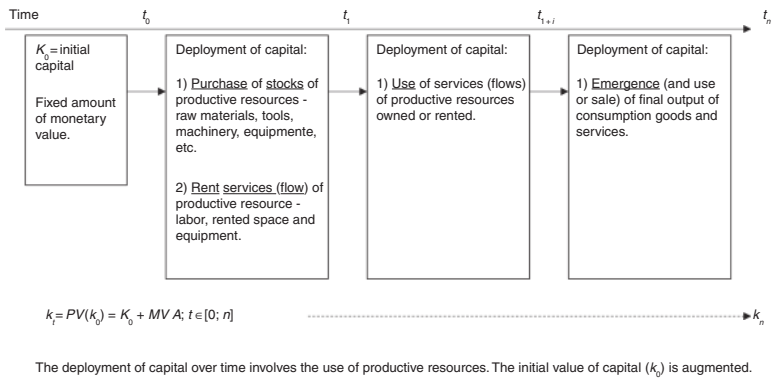

Figure 1 The deployment of capital over time.

quantities of heterogeneous production goods that are combined over time by the producer to produce valuable outputs. These "capital combinations" thus have a value, derivable from the value of the outputs they produce. This is the relationship between the physical components of any production process and the capital (financial)value of that process. We shall explore this in some detail.

The foregoing discussion has focused on the elusive question of *what* capital is. Capital theory, however, is also concerned with *how* capital is used or applied in the production process. We may imagine the "deployment" of capital to occur in a fashion depicted in Figure 1.

From an initial amount of seed money, K_0 capital is deployed over time to create economic value. The initial investment is enhanced (if the venture is successful) by the the market value added (MVA, the present value of all future economic value added [EVA] in each period). This happens as a result of the transformation of resource service flows into valuable consumption goods and services. Productive resources consist of *stocks* of labor and production goods of many kinds (heterogeneous labor and production goods). Production goods can be owned or rented (their *services* purchased). Labor can be rented for its services, the purchase of which constitutes the flow of wages, but cannot be owned (Rothbard, 2009 [1962]: 488–495). At any moment in time from t_0 to t_n the capital value of the production process (the business venture), k_t, can be derived from the estimated future value of the flow of valuable consumption goods over the life of the business – it is the discounted value of this flow, and will differ from the initial outlay K_0 by the MVA over the production period.

We will expand on this in some detail in Section 9. But first, in Sections 2 through 8, we provide an account of some of the important aspects of the history of the ATC. We do this not merely as an exercise in the history of

economic thought, but, more importantly, to reveal how the various components that now make up different perspectives of ACT (as developed by different theorists) – easier to understand in their historical context – ultimately fit together in the new framework that we present in Section 9.

2 Carl Menger and the Structure of Production

2.1 Carl Menger: Free Goods and Economics Goods; Consumption Goods and Services and Production Goods and Services; Stocks and Flows

Carl Menger, the founding theorist of the Austrian School of Economics, suggested that the material world was composed of goods and services and considered the end of all economic activity to be the consumption of valuable services produced by goods of various "orders." He divided goods into two exclusive kinds: free goods and economic goods. Free goods are those for which, at a zero price, less would be desired than is available. By contrast, economic goods are those for which, at a zero price, more would be desired than is available. Economic goods are scarce, have value, and will command a positive price if freely traded. Economic goods have value because they yield desirable services. These services provide consumers with utility.

Economic goods may, in turn, be divided into two types: those whose services yield utility directly, first order or consumption goods, and those whose services provide utility indirectly, production goods, or higher-order goods. Production goods provide services that are used in the production of other production goods successively in a supply chain leading to the emergence of consumer goods that provide services yielding utility. Thus, the value of all goods derives ultimately from the utility of the services of consumer goods (Israel Kirzner has called this "Menger's Law").

The distinction between stocks and flows is fundamental and important and often neglected. People do not desire goods "in themselves"; they desire what flows from having or renting them. It is the services of goods that are the ultimate objective of economic action. As Menger points out, these can be obtained directly from nature or indirectly by production, using produced instruments of production, production goods.

2.2 Production Takes Time

Menger talks of higher-order goods being sequentially "transformed" until their emergence as consumption goods. At an early stage in the development of civilization people learn that they can do more than simply "gather the goods of lowest order that happen to be offered by nature" (1871: 75) and can

deliberately and carefully fashion more productive means of production, production goods. Doing so, however, takes time.

> The transformation of goods of higher order into goods of lower order takes place, as does every other process of change, in time. The times at which men will obtain command of goods of first order from the goods of higher order in their present possession will be more distant the higher the order of these goods. (Menger, 1871: 152)

Production goods thus exist at any moment in time in a *structure of production*. The structure of production reflects the fact that production takes time. Some production services must be used sooner than others, and some production services must be used together as complementary inputs. Because production takes time, and because time is valuable, the "longer" the process of production the more productive of utility it must be in order to be economically justifiable. And the longer one takes in production, the more opportunity is available to perfect the quality and/or increase the quantity of what is being produced.

> [B]y making progress in the employment of goods of higher orders for the satisfaction of their needs, economizing men can most assuredly increase the consumption goods available to them accordingly—but *only on condition that they lengthen the periods of time over which their activity is to extend* in the same degree that they progress to goods of higher order. (Menger, 1976: 153, italics added)

Economic development is characterized by an increasing "lengthening" of production processes. We see this as the increasing accumulation of sophisticated production goods (machines) and production processes. Thus, economic development has been accompanied by the improvement of production technology over time. People have learned to do things better by using increasingly specialized production goods. At any point in time, however, the knowledge that men have of the value of their production projects will be less than complete. As production occurs in time, and as the passage of time necessarily implies the existence of uncertainty, investors/entrepreneurs will be uncertain as to both the viability of certain kinds of production processes and their economic value in terms of the utility they will ultimately yield. Error is inevitable and is a necessary part of the learning process.

As Adam Smith realized, the degree of specialization in production depends crucially on the size of the market for the final product. The size of the market is measured by the number of units of product that can be sold. Menger realized that the size of markets, given by the number of the transactions they facilitate, depends crucially on the use of a medium of exchange. He explained how goods of high marketability have evolved into money (Menger, 1871, 1892).

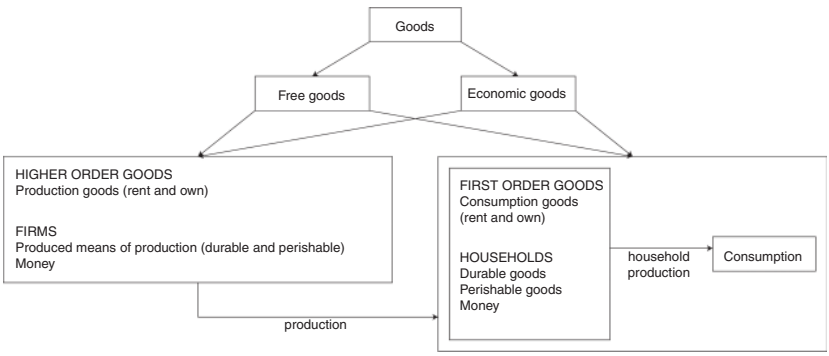

Figure 2 Menger's world of goods and services.

The use of money multiplies exchange and specialized production. And money, as a unit of exchange value in all market exchanges, serves also to *measure* the value of production and exchange. In any exchange the money price of the good or service being exchanged is a reflection of the utility to both the buyer and the seller. In fact, as money facilitates production and exchange we may regard it as a higher-order good in the service of producing consumer utility. It is, however, a rather special kind of higher-order good, as it is traded in all markets (see Figure 2).

Menger affirms the crucial distinction between stocks of useful goods and the flow of their services. The object of human action is not the goods themselves but rather the services they yield, directly (consumption goods) or indirectly (production goods). It may actually be more sensible to regard all goods, which may be durable (such as machinery and household appliance) or perishable (such as raw materials and food items), as types of production goods producing, directly or indirectly, consumption services. Production goods thus exist both in firms and in households. For example, the purchase of a house, which is a durable asset, is the purchase of a good that produces consumption services (residence, shelter, etc.) over a long period of time. (See Figure 2 .)

2.3 Menger's View of Capital Is Implied by His View of Subjective Value

This theory of capital in Menger's founding work is completely consistent with his seminal contribution to the subjective theory of value that was a paradigm shift in economics, completely transforming the discipline from one focused on the study of wealth, perceived to be objective (plutology), to one based on exchange (catallactics) (Lachmann, 1986: 145).

> Classical economics was, at least originally, a pragmatic discipline. Its aim was to study means to increase the "wealth of nations". Its orientation is thus to a macroeconomic magnitude. It needed a measure of wealth, and the classical notion of value was primarily designed to serve this need. Production and distribution of wealth was what really mattered. The consumer was an outsider, not an economic agent . . . . Markets, in classical doctrine, contained producers and merchants only. All this changed when subjective utility replaced objective (and measurable) cost of production as the source of value.
>
> Economics now had to find a place for the consumer. It was he, after all, who now bestowed value on objects. All non-consumer goods were now shown to have at best purely derivative value. . . . each consumer as an individual would now assign value to objects which become economic goods as a result of his action. (Lachmann, 1986: 145)

The ACT is nothing less than the *subjective* theory of capital value. All value emanates from the preferences of individual consumers acting and interacting on the basis of those preferences. Menger realized that trading prices represented the *marginal value* to each trading partner. It represents a value at least as high as the best alternative the buyer could have purchased with the money price, and to the seller the money price represents the value of something he can purchase that is at least as great as what he has given up. And on this basis a whole new economics was forged. Consumers value the services flowing from stocks of consumer goods. Thus, those stocks, and the stocks of producer goods used to create them, have value only because consumers value those consumption flows.

3 Böhm-Bawerk's Labor Arithmetic

Menger's disciple Eugen von Böhm-Bawerk produced a voluminous work elaborating, as he saw it, Menger's original vision on capital. However, in the process of this elaboration, Böhm-Bawerk strayed from the subjectivism of Menger's vision.

3.1 Böhm-Bawerk and the Productivity of Roundabout Production

Böhm-Bawerk (1890) picked up on Menger's insight that time plays a crucial role in production and in economic growth and development. As economic growth and rising incomes allow producers to take more time in the development of better and more efficient production techniques, production becomes more "roundabout," more complex. Roundabout methods of production will be chosen only if they are more productive of value (utility). Complex production

goods and techniques (and the same might be said of labor services) are developed.

This can sometimes be confusing. Looking at production in a modern economy at any point in time, it is true that the production of most things is done more "quickly" in the sense that, *once specialized equipment is in place,* it takes *less time* to produce anything. Time is saved by having the right tools. But this is true only because, in another sense, *more time* was taken at some point in the past to produce those specialized tools. It is in this latter sense that Böhm-Bawerk considers roundabout production to be more time-consuming. The setting up of complex production equipment and networks requires savings (abstaining from consumption) and time. But once in place, the reward is quicker, more reliable production processes. The division of labor, essentially a division of function and knowledge, is an organizing principle (in large part spontaneous), which has resulted in massive increases in the volume and variety of useful consumption goods produced.

Böhm-Bawerk considered more "roundabout" production methods to be, *ceteris paribus*, more productive of output, but also imagined that as the length of production was extended, increases in productivity would be subject to diminishing returns (presumably as long as technology remains unchanged).

3.2 Böhm-Bawerk and the Problem of Measuring the Average Period of Production

In referring to roundabout production, Böhm-Bawerk wanted to highlight the role of time, namely the intuition that complex, specialized production processes have come to embody "more" time. Requiring more time is an important aspect of a project that the potential investor must take into account in appraising it. If one has to wait longer on average for its rewards, one must be compensated for the wait. But what exactly does it mean to say "wait longer"? It was this that Böhm-Bawerk sought to answer with his construction of the average period of production, the APP.

Böhm-Bawerk tried to find a measure of the amount of time embodied in any project, looked at from any perspective, in the sense of how much time it would take to set up that project from scratch (tracing the components all the way back to the original nature-given substances and labor it would hypothetically take to build everything that is needed). In pushing this line of reasoning, the more precise he endeavored to become, the more ambiguous and elusive his essential point became. We may explain this briefly as follows.

Realizing that some arbitrariness attached to the period over which any productive combination extends, from the original labor (and land) to the

final product – having to contemplate points far back in time – Böhm-Bawerk proposed a more tractable measure of time that he called the *average period of production* (APP). The APP is the labor-weighted average of the amount of time applied in the project. It is an input-weighted average. It relies on the ability to add up units of labor – that is, it presumes that labor services are homogeneous and can be used to gauge the intensity of time applied (labor hours).

Böhm-Bawerk considers only labor, ignoring the contribution of the "original" resources of land (nature), which he considered to be an innocuous simplification in the modern world. He wanted to capture the idea that production processes that use produced means of production, such as machines and raw materials, take a great deal of time if one considers the time and effort necessary to produce not only the final product with their help, but also to produce those produced means of production themselves as well. He wanted to conceptually reduce all produced means of production to their original labor inputs and then to add up the amount of labor time involved and to use the measure of labor time to weight the significance of the time involved in production.

By way of explanation we provide an example in Table 1 (see Böhm-Bawerk, 1890: 87). Table 1 depicts a production process that takes 10 periods from the start to the finish (at which point the final product emerges). The period number is tabulated in column 1. In each period labor is applied to the unfinished product. The labor applied in any period, l_t, (column 2) is "embodied" in the production process for a period of time equal to the number of periods remaining in the production process, $n - t$ (column 3). Column 4 contains the weighted labor input for each period, calculated as the product of columns 2 and 3, divided by the total (unweighted) amount of labor input, 90 units, the total of column 2). The total of this column (column 4) is the APP (6.39 periods). If we use the symbols at the top of the columns, the formula for the APP is as in equation 1,

$$\text{APP} = \sum_{t=1}^{n} \left\{ \underbrace{\frac{l_t}{\sum_{t=1}^{n} l_t}}_{\text{weight}} * \underbrace{(n-t)}_{\text{time}} \right\} \tag{1}$$

This has a straightforward interpretation. Each time period, $n - t$ (amount of time), involved is weighted by the relative amount of labor applied in that period, and added up. The APP is the total amount of time measured by the amount of time in production, adding up the periods, weighted by the relative