

A Theory of Interest Rates ^{*}

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Abstract

The theory contained in this essay builds on Hülsmann's theory of interest and the capital theory of Lachmann and Kirzner. The combination of these theories yields a praxeological theory that explains the rate of interest. In particular, it is shown that the interest rate corresponds to the (properly defined) marginal productivity of fixed capital, which contrasts with the pure time preference theory of interest. The results rather resemble those of Böhm-Bawerk.

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1 Introduction

The theory of interest is, in a manner of speaking, the “Mecca” of economic theory. Every self-esteeming economist has gone there, at least once in his lifetime; some of them whole-heartedly, others with the best intentions, and again others because they deemed it appropriate to also embark on the subject. Nonetheless, the question as to what determines the rate of interest must be considered as hitherto unresolved. Ironically, the situation today is not much different from that of the days of Eugen von Böhm-Bawerk, who once wrote that

the present position of the theory (of interest) exhibits a motley collection of the most conflicting opinions, no one of them strong enough to conquer, and no one of them willing to admit defeat; the very number of them indicating to the impartial mind what a mass of error they must contain.¹

For example, the interest theory that is mostly endorsed by Austrian economists is the so called ‘pure time-preference theory’ of interest, which asserts that interest is the exclusive result of the time preference of human beings, i.e. their general preferring of things that are closer in time over things that are more distant in time (e.g. Mises, [1949] 2008, pp. 521). This theory however clashes with many other stances. Neoclassical economists, for instance, see the rate of interest as simultaneously determined by (and equal to) the marginal productivity of capital, the time preference of the representative agent, and the income share of the capitalists, whereas in the Keynesian account interest is seen as the price of money, mainly determined by liquidity preference.

Yet, even within the Austrian school we observe conflicting views. Some Austrian scholars like Murphy (2001, Ch.2) and Hülsmann (2002) challenge the pure time-preference theory altogether, stating that it is not even a praxeological theory, and among those defending the theory an incoherent picture emerges. While Kirzner ([1993] 2011, p.125) asserts that the pure time-preference theory addresses a question that is different from that of interest rate determination, Rothbard ([1962] 2009, p.400) maintains that the interest rate is solely determined by time preference and greatest disagreement is present when it comes to the effect of other factors on the rate of interest. Ingo Pelligahr, who devoted most of his research to reviewing this literature, describes the situation among the adherents of the pure time-preference theory as follows:

¹Böhm-Bawerk (1890, p.5).

Whereas Fetter predicts that [a rise in physical productivity] will lower the rate of interest, Rothbard asserts that [it] will not affect the rate of interest at all. Kirzner does not exclude that it will *affect* the rate of interest, whereas Garrison (adducing to Fisher's reason, not Fetter's) contends that it *might* actually lower that rate.²

Given Böhm's opening remark this calls for some elaboration. The goal of this essay is thus to solve the conundrum of interest rate determination using the praxeological method, as will be presented in Section 4.

Yet, before going there a few preliminaries will have to be undertaken. Section 2 will present the methodological framework of this paper and Section 3 will discuss the praxeological theory of interest as such, without addressing the question of the size of the rate of interest yet. Moreover, the remainder of this Section will clarify the concepts and terms involved. For interest theory is replete with unclear and even conflicting terminology.

Interest is therefore henceforth understood as the part of the spread between revenues and costs that cannot be competed away by entrepreneurial effort, not even in theory (cf. e.g. Mises [1949] 2008, p.521; Kirzner [1993] 2011, pp.100; Hülsmann 2002, p.92). In other words: There is, in the entire economy, a systematic spread between the total proceeds earned from the selling of products and the total expenditure paid for factors of production. This spread occurs over time, i.e. it is measured between the moment of investing and the moment of selling, and it occurs repeatedly, which is why it is sometimes considered as permanent. The part of this spread that can or could be dissolved in a process of competition is called entrepreneurial profit. The remainder is called interest.

An alternative but equivalent way of describing the phenomenon is given by Böhm-Bawerk. He introduces the concept of interest as follows.

Whoever is the owner of a capital sum is ordinarily able to derive from it a permanent net income. ... This income ... arises independently of any personal act of the capitalist. It accrues to him even though he has not moved a finger in creating it. ... It can be derived from any capital,

²Pellengahr (1996, p.63), emphasis in the original. The sources that he refers to in this passage are Fetter (1915, p.247), Rothbard ([1962] 2009, p.424), Kirzner ([1993] 2011, pp.119), and Garrison (1979, p.221).

no matter what be the kind of goods of which the capital consists, from naturally fruitful, as well as from barren goods, from perishable as well as from durable goods, from money as well as from commodities. And, finally, it flows without ever exhausting the capital from which it arises, and therefore without any necessary limit to its continuance. ... And so the phenomenon of interest presents, on the whole, the remarkable picture of a lifeless thing, capital, producing an everlasting and inexhaustible flow of goods.³

The difference between the two formulations only lies in the chosen perspective. The former definition takes on a rather aggregate view while the latter looks at the problem from the standpoint of an individual. Yet, they are nonetheless equivalent since it is precisely the spread between revenues and costs that cannot be competed away that repeatedly accrues to the capitalists without them becoming active. Moreover, in both cases the various forms of interest are only special cases of interest income in general.

We see from these definitions that interest theory is at the same time a theory of price relations between production factors and final goods and a theory of distribution, which is why interest theory is of central importance to economics in general. Historically, however, the focus has been on distribution and in particular on the question whether interest is a justifiable form of income. In more theoretic terms this means whether interest is a natural phenomenon in the economy. If we assume that it was not, i.e. that the capitalistic system worked to eradicate the entire spread between the revenues of businesses and costs of factors of production, then any interest income would imply that a loss of the same amount was incurred by another party.⁴ In other words, positive aggregate interest would then either emerge at the expense of the wage earners or it would entail a certain rate of bankruptcy in the economy. On the other hand, if we knew that aggregate interest is generally greater than zero then - given the fact that the free market economy is by definition a system of voluntary exchange - not all capitalist income must be attributed to various forms of exploitation.

However, a spread between revenue and costs is generally just some money that a businessman makes. Whether this money is interest or profit can empirically not be distinguished. The same is true when rent is obtained for the lending of a durable good

³Böhm-Bawerk (1959a, p.1)

⁴Provided the amount of money in circulation remains constant. In this paper we shall ignore the problems of monetary expansion throughout.

or when ‘interest’ is received on a loan. In all these cases interest is only a component of gross profit of unknown magnitude. Hence, interest and profit can in general only be separated on theoretical grounds.

Finally, one should note that, according to this definition, interest is not a price and in particular not the price of capital. Interest, by any of the above definitions, is a sum of money and the interest rate is defined via the ratio of these two amounts.⁵ The interest rate is thus a percentage without dimension. Prices, in contrast, are exchange ratios between two types of goods and therefore have a dimension. It follows also that interest rates can only be defined in the context of a monetary economy because only then are the amount invested and the amount returned of the same physical nature so that the rate of return can be defined.

2 Character and scope of the theory

In order for a theory to solve the question of interest rates indisputably and in an all-encompassing manner the theory must meet two conditions, a necessary condition and a sufficient one. The first and necessary one is stability. Any theory of interest must show that there actually is “room” for interest income to emerge, not at the individual level, but in the aggregate. Such a theory is provided by George Reisman who demonstrates that the capitalist system is inherently profitable and, thus, inherently interest-bearing.⁶ The inherent profitability stems from the fact that there are payments that firms generally make, which are not factor payments and which thus never show up as costs. Most notably, these are dividend payments and other forms of profit distribution. Those payments, just like wages, flow back to the households and are eventually spent. The total amount of money spent on the products of businesses is thus generally higher than the total amount spent on factors of production, which is sufficient to prove the point.

Reisman ([1990] 1998, p.726) illustrates this result with a table that is reproduced in Table 1, where he makes the simplifying assumptions that wage earners spend their entire income on consumer goods in each time period, i.e. they do not save and never

⁵See Equations (1) and (2) in the Appendix.

⁶Results equivalent to those of Reisman were obtained by Kalecki (1935, pp.45; [1952] 1969) and Robinson (1956, pp.43,75,255). In more popular form a similar argument has been presented by Woods Jr. (2013).

become capitalists.⁷ Under this assumption wage income is equal to the workers' spending on consumer goods (first row). Moreover, business to business transactions balance out within the business sector (second row). Yet, given the expenditure of the capitalists on consumer goods there is a systematic excess of revenue over costs in the business sector, which allows to effectuate dividend and interest payments without compromising the stability of the system.

Money spent on factors of production by businesses (costs)		Money spent on products of businesses (sales revenues)
Business expenditure on labor	Equality	Workers' expenditure on consumer goods
Business expenditure on capital goods	Identity	Business expenditure on capital goods
	Source of Excess	Capitalists' expenditure on consumer goods

Table 1: There is a systematic excess of revenue over costs in the business sector. Hence, the capitalist system is inherently profit-bearing and, as a corollary, interest can only be positive under the condition of scarcity.

To be sure, competition creates the tendency for such profits to decay over time, but in the present paper this need not concern us, since interest, by definition, cannot vanish as a result of competition. Once present, it is thus “automatically” sustained.⁸ The economy-wide occurrence of interest therefore does not lead to widespread bankruptcy nor does it necessitate the exponential accumulation of debt and a consequential system collapse. The accounting system just fully accommodates interest payments of any magnitude. Moreover, as long as businesses are predominantly run under the profit motive, which is given under the general condition of scarcity, distributed profits will

⁷This assumption can however easily be relaxed (Reisman, [1990] 1998, p.735, pp.750, p.803n15).

⁸If in a more dynamic scenario the level of interest can certainly change. In fact, it is disputable whether a “level of interest” even exists. Such changes, however, are necessarily accompanied with disequilibrium situations in which profits occur out of which additional interest payments can be generated without compromising anybody's income.

flow from firms to households so that interest cannot become negative.

All of this, however, does not show that interest actually is positive. The excess revenue that business make could still entirely be profit.⁹ A second element in the theory of interest is therefore needed. This second element can be motivated in several ways, but only one condition is sufficient to make the theory sound and unquestionable, namely that it be formulated in strictly praxeological terms. Praxeology is the study of the formal implications of the concept of action. Thus, being a form of conceptual analysis, praxeology belongs to the realm of analytic philosophy. Arguments thus derived are statements that are logically contained in the non-trivial concept of action. Mises ([1960] 2003, p.14) calls them categories of human action. One of those categories, for example, is that action implies the preferring of one state to another. Anybody who acts demonstrates such a preference. A statement expressing this notion is an analytic truth. Moreover, the logical structure of such a statement cannot be falsified through experience, which makes it true *a priori* (Mises, [1962] 2006; Long, 2004).¹⁰

The critical question, however, is whether praxeology is actually also capable to account for complex phenomena. Clearly, the analysis of one action alone cannot explain the occurrence of an economy-wide phenomenon such as interest. Since transcending the domain of simple praxeology is far from obvious, economists often escape to seemingly easier options. In particular, they often tend to analyze the content of actions, but thereby they automatically enter the sphere of psychology. For example, they analyze how people behave “on average” or “in general” and build theories around so called “stylized facts”. However, such reasoning clearly contains impermissible generalizations. For in making a psychological or behavioral assertion one must assume that people behave in a certain way, generally or under certain conditions, but the conditions are never equal and neither are human beings. No general knowledge can thus be achieved with this method. Statements thus derived are contingent on a certain behavior, which makes them descriptions *a posteriori*.

The ultimate reason for this contingency is that any two objects or any two states

⁹Reisman himself does not address this question. He always speaks of gross profit which comprises all kinds of capitalist income.

¹⁰The analytic character of praxeology is actually already implied in the term itself, which stems from the greek words *πρᾶξις* (praxis) and *λόγος* (logos). The term thus designates “studies in the logic of action” or even “studies in the *meaning* of action”. Mises also clearly conceived the praxeological method in that way ([1949] 2008, pp.38). A formal proof for the analyticness of praxeology is given by Oliva Córdoba (2017).

of an object are incommensurable. Apples cannot be added to pears. A book is open *or* closed. There simply is no common unit of measurement that would allow for such operations or comparisons. Furthermore, value only resides in action and is thus a trilateral relationship between two states (of objects) and one acting individual (see Hülsmann, 2003, pp.xxxiv). Hence, there is just no possibility that value can be measured from outside. Value must remain entirely subjective. Consequently, there is also no possibility to establish a relation between two actions, let alone compare them, be they actions of one and the same or of different individuals. Any theory that argues on the basis of comparisons of different ends (or bundles of goods) is necessarily heuristic and, as it deals with human conduct, necessarily psychological in nature.¹¹

By implication, *a priori* statements concerning complex phenomena can only be framed through the formal analysis of the interplay of human actions, which is the approach taken in this paper. The general principle is as follows. Each action is treated as an independent entity. Any form of averaging is explicitly ruled out. Value is only instantiated in moments of time and is not measured or otherwise assessed. Only the formal implications of these actions are finally combined into a coherent theory. If this combination is carried out in a consistent manner then the emerging theory will be sound and unquestionable.¹² In fact, it will be true *a priori*. The theory yet presupposes a world to which it can be applied, i.e. a world where scarcity is present and money is used as a medium of exchange. A hermeneutical *verstehen* is thus required in order to decide how to apply the theory to particular cases (Long, 2004, p.358).

This approach is what lies at the heart of the Austrian tradition. Already Menger

¹¹The pure time preference theory is explicitly included in this critique. When stating, as Mises ([1949] 2008, p.480) does, that

satisfaction in a nearer period of the future is preferred to satisfaction in a more distant period,

then this is clearly a comparative evaluation of a human behavior that consists of multiple actions. To be sure, the human psyche operates this way. It weighs and compares alternatives. But the outcomes of such weighting can only be known *ex post*. The pure time preference theory has therefore aptly been criticized for being contingent by e.g. Reisman ([1990] 1998, p.797) and Hülsmann (2002, pp.79).

¹²The problem with such a theory is obviously whether consistency is actually achieved. History shows that this possibility is oftentimes quite theoretic. It can thus be helpful to resort to mathematics in order to preserve and present the consistency of the argument. This use of mathematics is sometimes labeled mathematical structuralism and it is applicable in the present case, as shown in the Appendix to this paper. Such mathematical exposition must however not deceive about the fact that presented method adopts a process view and is entirely free of equilibrium-based reasoning.

emphasized the analytic (“exact”) and at the same time hermeneutic character of his theory (Menger, [1883] 1963, pp.44, p.59) . However, Gloria-Palermo (1999) reminds us that large parts of the Austrian theory are not formulated in this tradition, but rather in equilibrium-like fashion (Gloria-Palermo, 1999, Ch.5 *et passim*). She explains this observation by pointing to the progressive neglect that Menger’s ideas underwent after the turn of the century and the fact that much of the Austrian literature was developed before Mises and Hayek formulated the idea of praxeology and the theme of dispersed information. One of those theories that was coined and codified during that time was the theory of interest and it is for this reason that until today no praxeological theory of interest rates exists. Yet, to deliver such an argument is the purpose of this essay.

3 The praxeological theory of interest

In the Introduction it has been presented that the pure time preference theory of interest leads to an unsatisfactory state of affairs. Yet, among the outspoken critics of the pure time preference theory of interest Guido Hülsmann is the only one who presents an alternative theory that truly rests on Mengerian principles. At the heart of this theory lies the insight that there is, implied in the concept of action, a value difference between the means and the end of an action. This observation is a self-evident truth. One might say that this value difference is indeed the very motivation to act. Action, in general, is a consequence drawn from uneasiness, meaning that a less desired state is exchanged for a more desired one. Hence, by implication, there is a value difference between means and ends. Hülsmann calls this value difference *originary interest*.^{13 14}

The term originary interest, which was first used by Böhm-Bawerk, derives from the

¹³The reason why this praxeological category has been overlooked for decades lies, according to Hülsmann (2002, pp.88), in the fallacies and misunderstandings that surround the theory of imputation. Broadly put, this theory states that factor prices are determined by output prices and not vice versa. There are multiple ways in which this theory can be and has been formulated, but, indeed, if one assumes that the value of ends is fully imputed onto the means then there can be no value difference between them, which may have prevented researchers from analyzing the implications that ensue from this category.

¹⁴Originary interest is to be distinguished from another value difference implied in the concept of action, which Hülsmann calls *gain*. Gain, in this sense, is a result of choosing among alternative ends. In acting, people gain by pursuing the preferred option instead of a less valuable one. Note that both originary interest and gain conform to the definition of value as given in Section 2.

notion that all the various forms of interest can be traced back to a more ‘original’ form, one that arises directly from the economic activity of individuals and thus captures the essence of the interest phenomenon. There is however a certain ambiguity regarding the term. For Böhm-Bawerk, originary interest, *ursprünglicher Kapitalzins* in the German edition, is simply profit in general, as earned on *any* form of capital (Böhm-Bawerk, 1890, pp.7).¹⁵ Profit is “original” in the sense that interest is a derived component of it and in the sense that all types of interest, e.g. interest earned in money loans or in production, are only a special cases of it (see Section 1). For Böhm-Bawerk originary interest is thus a market fact to be explained. The explanation he provided was that there is an alleged difference in subjective value between present and future goods, which manifests itself in a price discount of the latter, thus leading to originary interest (Böhm-Bawerk, 1930, pp.237). Hülsmann, however, employs the term in a different way. First of all he introduces the notion that originary interest describes a value difference between two types of goods. In so doing he actually confounds the *explanans* and the *explanandum* in Böhm-Bawerk’s theory. And second, he identifies this difference between the value of means and ends of an action instead of present and future goods thus changing the meaning of the term but opening the door for praxeology.¹⁶

Being a category of action originary interest it is present in all actions independent of their character and scope. In particular, it is present irrespective of how far in the past or future the completion of a project lies. A pursued end is rarely attained in one single step, but mostly by multiple consecutive steps. Consumers, for instance, oftentimes have production plans in their minds that extend over several years, if not decades. On the other hand, it frequently occurs that the pursuit of the end temporally precedes the use of the means, as for example in the case of a consumer

¹⁵Note that William Smart, in the translation of the first edition, which is here referenced, translated *ursprünglicher Kapitalzins* as “natural” interest throughout. This may add to the confusion since natural interest is nowadays rather understood in a Wicksellian sense, i.e. as a level of interest that conforms with price stability.

¹⁶Stating that the value difference between means and ends is a value difference between goods is praxeologically not unproblematic. Value is generally bound in action and is clearly to be distinguished from the objects to which value may be attributed. Therefore, means and ends should be treated as elements of an action. Strictly speaking, if we say that the cost of an entrepreneurial endeavor are valued lower than the prospective receipts then the costs are the *giving up* of some initial amount (not the amount itself) and the end is the goal to *obtain* a greater amount in the future, but it is permissible to say that in the context of such an action the initial amount (the good) is employed as a means in the context of that plan and that the final amount is the end pursued.

loan (cf. Hülsmann, 2002, p.95). But none of that changes the fact that there is a value difference between means and ends. Ordinary interest is simply present in all actions, independent of their duration and their apparent complexity, most notably also in the actions of entrepreneurs. Under the conditions of scarcity a production plan is adopted by an entrepreneur if the estimated revenue exceeds the expenses for the factors of production. Consequently, an excess of revenues over costs does not come into being accidentally, but rather because the entrepreneur organized his actions so as to bring this excess about. Plans that do not fulfill this requirement, at least in expectation, simply never see the light of day. Clearly, among those plans which do bear ordinary interest an uncountable number fail, but given the inherent profitability of the capitalist system (Section 2) it is certain that *some* entrepreneurial plans are successful and it is also certain that aggregate losses cannot outweigh aggregate profit. The phenomenon of profit is thus the observable result of entrepreneurial effort. Moreover, as explained by Lachmann (1978, Ch.IV), the price system in its signaling function works to the effect to stabilize the structure of entrepreneurial plans, which means that entrepreneurial success is oftentimes a lasting phenomenon.

We thus see that “Hülsmann-type” ordinary interest is present in actions and that this leads to monetary profit in individual enterprises, but it remains to establish how this leads to the occurrence of economy-wide interest. This step, however, comes natural if we consider the interplay of different and competing entrepreneurial plans. Indeed, competing entrepreneurs can only eradicate the money spread earned in a certain project by bidding up the prices of factors of production or by bidding down the sales price, but it has to be understood that such competitors act under ordinary interest themselves. They would not let the (expected) money spread fall below a certain level and in any case this spread will be positive (Hülsmann, 2002, p.98). In Hülsmann’s (2002, p.100) own words:

Money interest is that component of observable spreads between selling receipts and cost expenditure that cannot be eradicated without entailing personal disadvantages for those who undertake this eradication.

Competition therefore does not dissolve the general existence of money spreads but can only change the projects in which they are earned. In the economic system as a whole a certain spread is thus always preserved, which is the point to be proven. This result is formally implied in the concept of action under the conditions of division of labor and monetary exchange.

Two more remarks: First of all, it should be noted that money interest, as here derived, fully contains the compensation for the entrepreneur's own labor. This contrasts with Mises ([1949] 2008, p.532), who sees interest and entrepreneurial (managerial) wages as catallactically disparate items. Of course, the Hülsmann view does not preclude that entrepreneurial labor is compensated at market value, but it allows that non-material forms of compensation like self-fulfillment may also be factored in when making entrepreneurial decisions (cf. Hülsmann, 2002, p.97). If, consequentially, we conceive of wages as a form of payment and of ordinary interest as a form of compensation then an entrepreneur simply does not earn a managerial wage. Such understanding also fits well with etymological considerations of Hülsmann (2002, p.87n) who explains that the term "interest" is commonly used to express an *interest in doing something*. Thus, for example, the prospect of interest income is in fact the incentive to lend, i.e., the monetary compensation is someone's "interest" to lend.

Second, also the bearing of uncertainty is fully compensated through ordinary interest. In particular, this holds independent of whether economic agents operate in the product market or the financial market. There is nothing inherently different in the actions of the individuals involved and, thus, interest on loans may well be free of entrepreneurial profit. This again contrasts with Mises ([1949] 2008, p.533), who claims that every interest stipulated and paid in loans includes not only ordinary interest but also entrepreneurial profit. The reason for this dissent lies in the fact that for Hülsmann interest is not an equilibrium phenomenon, while for Mises it is one. Mises, this time in Böhm-Bawerkian tradition, sees interest as a phenomenon that permeates the entire economy in the form of a general discount, thus determining relative prices and the various income shares. For him, the tool to distinguish between entrepreneurial profit and interest is the concept of the evenly rotating economy, where the absence of uncertainty is the characteristic feature (Mises, [1949] 2008, pp.247, p.533). This is why, for him, uncertainty bearing is a clear sign of the presence of entrepreneurial profit. Hülsmann's theory however assumes a process view and as such it explicitly includes uncertainty. Consequently, from this theoretical point of view we would refuse the notion that any loan contract necessarily includes a margin of entrepreneurial profit on top of interest. However, whenever innovation takes place and risk premia on loans are being paid or wherever there is a lack of competition, stipulated interest rates clearly contain a component of entrepreneurial profit.¹⁷

¹⁷Note that this view is very much in line with Böhm-Bawerk (1890, p.7), who sunders risk premia from ordinary interest and thus considers them as part of entrepreneurial profit of creditors.

4 The praxeological theory of interest rates

One important reason why the praxeological method is suited to establish economic theory lies in the fact that the concept of action not only allows for an analysis of human endeavors, but also for an understanding of the nature of capital. This field of praxeology is also called the subjectivist theory of capital, which was most clearly elaborated by Ludwig Lachmann and Israel Kirzner, but is in fact characteristic to the entire Austrian tradition. The central tenet of this approach is that the nature of capital can only be understood teleologically, that is, capital cannot be considered a meaningful concept unless it is evaluated by an entrepreneur. Only by virtue of human interpretation is it assigned a certain meaning, whereas otherwise it is just a mesh of physical objects for which no method of intellectual assessment is known to man (Kirzner 1966, pp.116, Mises [1949] 2008, p.92). The functions that human beings ascribe to capital are however always bound-up in a certain situation. They are different depending on who ascribes them and also at different points in time. Consequently, the image that the subjectivist approach portrays is highly dynamic. In this view the world is populated by countless individuals who are constantly reformulating their unfinished plans thereby reassigning new functions to the physical objects under their control (cf. Menger ([1871] 1950, pp.80), Lachmann (1978, Ch.3 *et passim*)).¹⁸

The primordial concept in the subjectivist theory of capital is, hence, the concept of a production plan (Lachmann, 1978, p.54 *et passim*). A production plan is an intention or a consideration to combine certain production factors in order to produce a certain product, which is subsequently used as a means to attain other ends. Thus, production as here understood is not an end in itself, which makes it distinct from consumption. Each production plan has a certain duration, i.e. a time period of production, which, as Mises ([1949] 2008, pp.476) explains, is a category of human action and thus subjectively measured. In the present context this time period is here marked by the point of investment and that of the final sale.¹⁹

Since a production plan is in any case a human action, it follows that production plans always include the use of human labor. A production plan without human intervention is not conceivable. Labor is thus the ultimate complement in any production process.

¹⁸The same idea obviously underlies the pure time preference theory of interest, but, in contrast to its own ambition, this theory only applies to stationary scenarios and is thus explicitly negligent of the heterogeneity of goods (see Murphy, 2003, Ch.2).

¹⁹See Equation (1) in the Appendix.

Furthermore, a production plan is always characterized by certain production coefficients, which is a corollary of the purposefulness of human action. A pondering about production that disregards definite proportions in which the production factors are put to use is not considered a plan, but only a pre-stage of it (cf. Lachmann, 1978, p.35). Beyond that, the comparison between different production plans, as effectuated by entrepreneurs, is always based on monetary calculation, such as any other action in the market economy (Mises, [1949] 2008, pp.230). Hence, in order to decide between different production plans, not only the production coefficients, but also the prices of the production factors as well as the anticipated price of the product have to be known (Kirzner, 1966, pp.113).²⁰ Ultimately, an entrepreneur will then choose the plan that seems most profitable to him, which can be praxeologically explained by the principle of economizing (Mises, [1949] 2008, pp.241).

Evidently, the subjectivist theory of capital is fully compatible with the interest theory presented in the previous section. The combination of the two will however allow us to incorporate the determining factors of the rate of interest into the theory.

It will be expedient for our purposes to distinguish between two sorts of capital goods, namely circulating and fixed capital goods. Following the subjectivist approach we use a teleological approach to make this distinction. Intermediate goods are thus goods that are intentionally transformed in a production process, whereas fixed capital goods are those that the planning individual intends to preserve. In other words, fixed capital goods are used in order to exploit the services that they provide, whereas intermediate goods are used for the sake of their physical substance. By implication, fixed capital goods can also be seen as goods that are designed to replace a certain amount of labor, which also distinguishes them from intermediate goods. For example, a carpenter may decide to employ a tool to process wood and therefore dismiss a number of his assistant employees, but he cannot purchase wood or any other material in order to reduce the labor input. In fact, he would need more workers if he chose to increase the intake of intermediate products.²¹

²⁰To avoid misunderstandings: This does not mean that all entrepreneurs are price takers in the factor markets. Those known prices can be the result of a negotiation process, but production plans are always made on the basis of where such negotiations currently stand.

²¹The exact same reasoning applies to cases in which a fixed capital good and certain supporting materials replace some amount of labor and a number of associated capital goods. This more general case is in fact the regular one. For the sake of simplicity we will however focus on the isolated case of labor and one fixed capital good in this essay.

Now, the main point for the argument to be made is that fixed capital goods, in spite of their different character, generally need the same input factors as intermediate and consumer goods do, at least to a certain extent. Such nonspecific input is most and foremost labor. Strictly speaking, all factors are *ex ante* nonspecific and it is only through entrepreneurial action that they assume a specific character (Lachmann, 1978, p.16, p.53), but labor is clearly the least specific of all. At the same time, however, it is precisely the factor that is least specific which is also used in every production process and, hence, the price of that factor, as determined within the confines of arbitrage possibilities, assumes economy-wide relevance. In other words, the universal and nonspecific character of labor gives rise to a certain, interconnected price structure. Mises puts it as follows:

The fact that one factor, labor, is on the one hand required for every kind of production and on the other hand is, within the limits defined, nonspecific, brings about the general connexity of all human activities.²²

However, in order to assess what type of price-structure effect this double characteristic of labor entails it is important to note that the quantity of labor that is needed to produce a fixed capital good is less than the quantity of labor that the capital good is designed to replace. For otherwise it would not be used – it would just not *be* capital. Our carpenter, for example, is unlikely to build a machine for a very specific task that he only carries out once per year because building the machine is even more of a specific and complicated task. Fixed capital goods are substitutes only for labor routine.

In general, the most characteristic feature of capital is that it enables man to produce more goods and services than by using manual labor. Thus, it is oftentimes asserted that the use of capital enhances the *productivity* in an economy. Yet, such a statement is in fact quite broad. At the microeconomic level it is not obvious at all what “productivity” actually means and it is clearly too simplistic to assert that the use of capital goods simply raises output. Rather, the addition of a capital good often leads to a reduction in the use of other goods and possibly to a total reorganization of the production process. It is therefore more to the point to characterize the accumulation of capital by a concomitant change in the composition of capital and not by the building up of a stock, as Lachmann (1978, p.37) lucidly points out. In fact, Lachmann (1978, p.80) explains that it is the introduction of *additional indivisibilities* into the

²²Mises ([1949] 2008, p.389)

capital structure, i.e. an increase in the division of capital, and not the mere adding of capital goods, which ultimately enables an economy to raise its production record. This view, however, raises substantial difficulties regarding the definition and measurement of productivity. First, it cannot simply be held that an increase in capital use leads to a definite increase in output since the use of a capital good (or its production) will always necessitate a reduction of output in those parts of the system where the corresponding resources were previously employed. Second, the productivity of a capital good depends on the context of complementary factors into which it is put. And third, a capital good as such, when it is used, does not make a certain *contribution* to production since the entire production is contingent on its use. Hence, disaggregate ways for the description of productivity have to be sought. And again, the concept only becomes meaningful in the context of a production plan, which is what Kirzner (1966, pp.113) refers to as the forward-looking measurement of capital.

By general definition, productivity is defined as the ratio of output over input. The dimension of physical productivity is therefore a ratio of the units in which output and input goods are considered. Since, however, different goods and services are incommensurable physical productivity must genuinely be formulated in partial terms. That is, one may separately consider the physical productivity of one factor given a certain process in which the factor is used, but the total physical productivity of a production plan can only be written as a juxtaposition of ratios.²³

Furthermore, the *marginal* physical productivity of a production factor is most adequately defined through a comparison of two production plans that serve the same end.²⁴ Mises ([1949] 2008, pp.127) and (Rothbard, [1962] 2009, pp.33), when stating the law of returns, define marginal productivity using a *ceteris paribus* clause and based on a comparison of different output levels, but such considerations are of limited relevance to practitioners. The insertion of a certain good into a given production plan is likely to change the production coefficients of most if not all other input factors. The (hypothetical) reorganization of resources that are associated with such a change are in first instance what matters to entrepreneurs. Hence, the elementary question in business operations is not how to scale up a business keeping all but one production factor constant, but to choose among the various ways in which production can be carried out. In other words, the selection of “optimal” factor combinations is much more an economic problem than a technical one. We shall therefore define marginal physical

²³See Equation (8) in the Appendix.

²⁴See Equation (9) in the Appendix.

productivity based on the changes that the adding of one unit of a production factor necessitates in the production of a *given* product. Marginal productivity so defined again takes on the form of an array of ratios, each pertaining to one of the input factors used, yet it is determined not by what is produced in addition, but by what is no longer used in production once a unit of a considered factor is added. For those goods are set free for other possible uses and they are hence the output of the considered change. This output remains unseen in the production process under consideration, but it is no less real than what is produced in that process, since in saving those factors they are made available to society (Bastiat, [1848] 1995). Consequently, the marginal productivity of a given factor of production is defined as an array of ratios with the negatives of the changes in quantity in the other production factors in the numerators and the change in quantity in the considered factor in the denominators. For example, if in the production plan for a car the introduction of a machine replaces three workers and leaves all other factors unchanged, then the marginal productivity of the machine is three workers per machine and zero for all other factors.²⁵

Things are conceptually similar when value productivity instead of physical productivity is considered. The difference lies only in the fact that the production factors are then regarded in combination with their prices and that the input-output relation is here a cost relation, with input as costs incurred and output as costs saved. Since the production plans are thus formulated in monetary terms the various productivities are now expressed as percentages without dimension. It is in this case even possible to find a scalar expression for total factor productivity, which is the ratio of the prospective revenue over the total amount of expenses that the input factors afford. Analogously, the *marginal* value productivity of a factor also takes on the form of a single percentage, where the numerator consists of the sum of all saved expenses that the addition of the considered factor provokes and the denominator is the considered factor times its price.²⁶

All of this has to be understood in context. Just as the production plan of an entrepreneur depends on the circumstances, so does (marginal) productivity. A newly constructed road, for instance, may possibly affect all production coefficients that certain producers had hitherto employed. Also, if some producers change their ideas about the quantity or the quality of the products to be produced then entire production arrangements need to be re-evaluated and new productivity relations arise. In fact, in the

²⁵See Equation (9) in the Appendix.

²⁶See Equations (6), (10), and (11) in the Appendix.

real world the producers will find themselves in a constant process of revision so that all these productivity relations have a temporary, if not imaginary, character. This, however, does not affect the arguments to be made in the slightest way. Productivity relations are of the utmost importance to planning entrepreneurs, it is precisely in terms of such relations that entrepreneurs calculate and they are thus sufficiently real to enter a catallactic theory.

Moreover, the fact that the value difference of ordinary interest, which is present in all production plans, is subjective does also not undermine the formal definitions suggested above. Since marginal productivity was defined via the comparison of two production plans that serve the same end, ordinary interest, so to say, cancels out. That is, marginal productivity was here defined under the assumption that the subjective interest that an individual has in the completion of a project is independent of how the result is achieved. With this condition in place production plans can indeed be analyzed based on the objective quantities involved. Furthermore, the fact that certain goods are durable also does not pose a problem to these concepts, since all producers are generally in the position to resell their production factors. If the lifespan of a considered production factor exceeds the planning period then the calculations can be made using the expected depreciation costs of that factor instead of the actual expenses. Finally, as a side remark, for these concepts to apply it is also irrelevant whether the considered factors are capital goods, in the sense of produced means of production, or whether they are of another type such as, e.g., land. For only the prospective use of a resource matters to the entrepreneur and not its origin (cf. Lachmann, 1978, p.11).

We are now in the position to consider how all this integrates with the theory of interest. We have seen that all production plans are made conditional on the envisaged output price and the known prices of input factors. Furthermore, fixed capital goods are designed to replace a certain amount of labor (and other factors) and entrepreneurs employ them if they expect to derive a cost advantage from doing so.²⁷ Consequently, the willingness to pay for a fixed capital good is always bounded from above by the amount that can be saved through its usage. At the same time, and this is the key point, to the extent that fixed capital goods and the factor combinations they replace require the same non-specific input their cost of production are equal. Since, however, fixed capital goods require *less* of that nonspecific input, there exists, hence, an excess of the willingness to pay for these goods over their cost of production. This excess always

²⁷Such cost advantages may include risk reduction of any type.

finds a manifestation in the cost structure of an economy and it cannot be competed away. It is thus interest. In summary, the non-specificity of labor guarantees that marginal physical productivity always translates into a marginal value productivity.

The way in which this interest arises depends on the way fixed capital goods are financed. If a company finances an investment in fixed capital goods internally, i.e. from its reserves, thus replacing some labor, then it will produce its products at lower cost as compared to the less capital-intensive mode of production, while its sales price remains unaffected. Interest thus accrues to the owners of that company as part of their net proceeds. If, alternatively, fixed capital goods are financed via the capital market then interest accrues to the owners of liquid funds who are willing to lend. Under conditions where loanable funds are scarce it may well occur that the creditors capture the entire interest margin that arises through the use of the fixed capital good, but in general this margin is split between the debtor and the creditor, of course respecting the ordinary interest requirements of the latter. The last way in which this form of interest may arise, which is however mostly hypothetical, is that it accrues to the owners of the firms that produce fixed capital goods. This will occur if the supply of fixed capital goods is for some reason naturally limited so that these goods can be sold above the sum of their cost of production plus the margin compensating for the ordinary interest of their producers. However, independent of the way in which interest arises, the amount of interest that ensues is always equal to the gap between the amount saved and the actual expenses that fixed-capital investments entail. From there it follows algebraically that the rate of interest will always be equal to the marginal value productivity of the fixed investment under consideration.²⁸

All this does not mean, however, that the investment motive for fixed capital is generally the most powerful motive in an economy. There may occur situations in which the demand for resources is driven by consumers or by the entrepreneurial need for intermediate goods. In such cases the rate of interest is not linked to the marginal value productivity of any type of good, but rather emerges from the sets of alternative ends that people pursue and the corresponding willingnesses to pay, as described by Hülsmann (2002). This means that the theory just presented is fully complementary to that of Hülsmann. In fact, the level of interest that is associated with marginal value productivity of fixed capital is a level over and beyond the level that Hülsmann explains. In a world where investment in fixed capital is absent Hülsmann's theory fully

²⁸See Equations (12) to (14) in the Appendix.

applies and as soon as fixed capital investments are introduced the level of interest is elevated above its original level.

5 Discussion

In this essay it has been shown that interest rates are determined by the marginal productivity of fixed capital, which also means that in an unhampered market economy the average marginal productivity of capital would be captured and measured by the going rate of interest. These insights were formulated with the help of the praxeological method.

Given this result it is certainly worthwhile to consider Eugen von Böhm-Bawerk, who once treated the topic of interest from an entirely different angle, namely that of an empirical marginalist. In his theory he explained the phenomenon of interest via a general discount of future vs. present goods and he attributed this discount to three different causes. One, the relative scarcities of present goods, two, subjective time preference, and three, the technical superiority of roundabout modes of production (Böhm-Bawerk, 1930, Bk.V). This has been criticized for various reasons, in particular for being grounded in psychology (Mises, [1949] 2008, pp.485), and by all means Böhm-Bawerk's theory is not praxeological. Nonetheless, Böhm-Bawerk (1930, pp.393) arrives at the remarkable conclusion that the overall marginal value productivity of capital determines the rate of interest, which quite accurately matches the results obtained in the above. To be sure, Böhm-Bawerk conceptualizes this marginal productivity in a different, macroeconomic way, namely as the last extension of the average time period of production permissible within a system of equilibrium constraints, and he does not distinguish between fixed and circulating capital at all, yet the similarity in the conclusion is striking. And this is not all. Regarding the interplay by which the three causes become effective Böhm-Bawerk declares:

Thus the various sanctions come alternatively into play. Where the first two are active the third is suspended: but where the first two are not active, or not sufficiently active, there comes in the action of the third.²⁹

This, in fact, is precisely what was established in the previous Section, namely that

²⁹Böhm-Bawerk (1930, pp.276).

originary interest alone dominates once fixed-capital investments are absent. The two theories are strongly congruent.

So what does this mean? First of all, the present theory rehabilitates two key results of Böhm-Bawerk's theory. We can now say that in many ways he was correct and his critics were wrong. Moreover, we see that finding these results is not bound to using a certain method.³⁰ And finally, it is interesting to observe with Schumpeter (1965, p.1133) that, on the one hand, Böhm-Bawerk's theory was overwhelmingly successful while, on the other hand, no leading economist ever considered it as definite. Both these aspects have reasons. His success can partly be explained by the fact that he was a brilliant theorist who managed to refute most criticisms that were held against him (Böhm-Bawerk, 1959b). Another reason, however, is certainly that his theory was relatively simple and easy to illustrate and that he framed his approach in a highly accessible manner, one that lent itself to further usage. His theory was a child of the marginalist age and the language that he spoke was that of his peers. The problem, however, that ultimately undermined the acceptance of his theory is that psychologizing is not "hard" economic science. After all, despite the fact that he was right, he was not able to defend his theory. He was criticized either for getting the psychological foundation wrong or for using psychology as a foundation at all and his theory was ultimately dismissed by many. In retrospect, there is hence a tradeoff to be observed in Böhm-Bawerk's work, a tradeoff between communicability and solidness and this may in fact also apply to the present theory. Praxeology clearly is the most solid methods of all. It is not the only one to find truth, but it is the privileged one as it develops the arguments from the core of all economic activity. The theory provided in the above can thus only be challenged based on internal inconsistency, which I hope has been avoided, but it will be hard to communicate this theory in the economic profession.

³⁰One may note in this context that Böhm-Bawerk (1930, p.394) credits Heinrich von Thünen for having found the correspondence between marginal productivity and interest with yet another method, which (Böhm-Bawerk, 1890, pp.164) classifies among the motivated productivity theories. Thünen's theory in fact employs the labor theory of value.

Appendix

A Mathematical formulation

The argument regarding the determination of the rate of interest can also be formulated in mathematical language. From an individual perspective, interest I is a difference between an amount of money M_1 invested at some date and another amount M_2 paid back at a later date. One may therefore write

$$I = M_2 - M_1 . \quad (1)$$

The rate of interest r is defined via the ratio of these two amounts, in particular as the rate of return:

$$r = \frac{M_2 - M_1}{M_1} \quad (2)$$

Furthermore, let

$$A + L_1 \rightarrow C \quad (3)$$

$$A + K \rightarrow C \quad (4)$$

be two production plans for the same product C . The letters here denote units of goods of the respective types. The fixed capital good K is hence a substitute for a certain amount of labor L_1 . We note, furthermore, that, to an extent, K must have been produced with the help of the nonspecific input factor L , however with less units, which follows from the definition that fixed capital goods are tools to save labor input. Thus,

$$\dots + L_2 \rightarrow K \quad \text{with} \quad L_2 < L_1. \quad (5)$$

The prices of all production factors as well as the envisaged price of the product are known to the planning entrepreneur, the former as data, the latter in expectations, which is here characterized by a hat. In money terms the production plans can thus be written as

$$p_A \cdot A + p_L \cdot L_1 < \hat{p}_c \cdot C \quad (6)$$

$$p_A \cdot A + p_K \cdot K < \hat{p}_c \cdot C , \quad (7)$$

where the inequality sign is the manifestation of originary interest.

The total physical productivity for those production plans, as defined in Section 4, is to be written, respectively, as

$$TPP = \left[\frac{C}{A}; \frac{C}{L_1} \right] \quad \text{and} \quad TPP = \left[\frac{C}{A}; \frac{C}{K} \right] . \quad (8)$$

The units in which the ratios contained in these arrays are measured are fractions of different types of goods. Beyond that, the marginal physical productivity of K is

$$MPP_K = \frac{L_1}{K} . \quad (9)$$

Analogously, the total value productivity of these plans is

$$TVP = \frac{\hat{p}_c \cdot C}{p_A \cdot A + p_L \cdot L_1} \quad \text{and} \quad TVP = \frac{\hat{p}_c \cdot C}{p_A \cdot A + p_K \cdot K} \quad (10)$$

and the marginal value productivity amounts to

$$MVP_K = \frac{p_L \cdot L_1}{p_K \cdot K} . \quad (11)$$

We can now use these definitions to derive the rate of interest. For an entrepreneur to engage in fixed capital investment the associated expenditure must be below or equal to his reservation expenditure. This means that the costs that can be saved through the investment need to be greater or equal than the amount to be paid for the capital good, plus financing costs if we assume that the investment is financed externally. Consequently,

$$p_L \cdot L_1 \geq p_K \cdot K + I . \quad (12)$$

In a competitive market system p_K will be higher than the associated unit cost of production because of the ordinary interest of the producers. Still, (12) holds with $I > 0$ because of $L_2 < L_1$.

After dividing (12) by M_1 one may write

$$\frac{p_L \cdot L_1 - p_K \cdot K}{M_1} \geq \frac{M_2 - M_1}{M_1} . \quad (13)$$

If we identify the amount M_1 with the financing need of the investment $p_K \cdot K$ it follows that

$$MVP_K \geq 1 + r . \quad (14)$$

Under conditions where credit is scarce this inequation will approach equality.

Note that in cases where the durability of the capital good exceeds the time horizon of the production plan the expenditure $p_K \cdot K$ would have to be replaced by the associated depreciation costs, measured as the difference between $p_K \cdot K$ and the anticipated resell revenue. Also note that if the investment is not exclusively financed externally, i.e. $M_1 \neq p_K \cdot K$, or if the system is not fully competitive then relation (14) is preserved but interest becomes a component of gross profit somewhere else in the system.

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