

IS EQUILIBRIUM ENOUGH AND WAS STIGLER WRONG?:  
VALUE THEORY IN THE BÖHM-BAWERK/ FISHER  
CONTROVERSIES

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Comments Welcome

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## ABSTRACT

Of

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The interest-rate controversies between Böhm-Bawerk and Fisher have attracted little attention and, in the opinion of most commentators, justifiably so. Böhm-Bawerk and Fisher argue over what appear to be two minor issues – Böhm-Bawerk's claims that his third cause of interest (productivity of roundabout production processes) is independent of his other two subjective causes of interest and that simultaneous equations models involve circular reasoning and fail to provide a "causal" explanation of interest. The issues not only appear unimportant, their resolution seems clear – Böhm-Bawerk was wrong in both cases. Subsequent commentators, including Stigler, have taken Fisher's side, arguing that Böhm-Bawerk "fails to understand some of the most essential elements of modern economic theory, the concepts of mutual determination and equilibrium (developed by the use of the theory of simultaneous equations)." I propose a radically different assessment, arguing that post-1870 debates over the extension of the subjective marginal utility theory of value to production and distribution, coupled with classical elements in Böhm-Bawerk's theories and his "outsider" status as an Austrian, fuelled the Böhm-Bawerk-Fisher controversies. Böhm-Bawerk was reacting to Fisher's gross exaggeration of subjective (versus objective) elements in his interest theory and wanted a causal explanation of prices in addition to well-understood simultaneous determination. Value theory debates explain both Fisher's exaggerations and Böhm-Bawerk's refusal to be satisfied with equilibrium alone.

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“Böhm-Bawerk fail[s] to understand some of the most essential elements of modern economic theory, the concepts of mutual determination and equilibrium (developed by the use of the theory of simultaneous equations).”

– Stigler (1941, 181)

“There are certain unsettled questions in economic theory that have been handed down as a ... legacy from one generation to another. The discussion of these questions is revived twenty or ... a hundred times ... a decade, and each time the disputants exhaust their intellectual resources ... to impress their views upon their contemporaries. Not unfrequently the discussion is carried far beyond the limits of weariness and satiety, so that it may well be regarded as an offense against good taste to again recur to so well-worn a theme. And yet these questions return again and again, like troubled spirits doomed restlessly to wander until the hour of their deliverance shall appear. .... In this class we find the question – What is the ‘ultimate standard [or determinant] of value?’”

– Böhm-Bawerk (1894, 1-2)

## 1 INTRODUCTION AND CHRONOLOGY

While the “marginal revolution” is identified with the 1870s works of Jevons, Menger and Walras, the full triumph of the utility theory of value over the classical cost-of-production theory of value took another half a century. The ensuing battles over value theory are, I will argue, essential context for explaining the interest rate controversies between Eugene von Böhm-Bawerk and Irving Fisher from 1891 to 1930.

Those controversies have attracted little attention and, according to most commentators, justifiably so. Böhm-Bawerk and Fisher argue at great length over two apparently minor methodological issues. The first is Böhm-Bawerk's claim that his third cause of interest – the productivity of roundabout production processes – is independent of his other two subjective causes of interest. Fisher contends that the third cause is *not* logically sufficient to yield a positive rate of interest, but is effective only in conjunction with the other two causes. The second issue is Böhm-Bawerk's critique of Fisher's equilibrium model of interest rate determination. Böhm-Bawerk claims that simultaneous equations models involve circular reasoning and thereby fail to provide a "causal" explanation of interest. These two issues not only appear to be unimportant, their resolution seems clear – Böhm-Bawerk was wrong on both counts. Fisher demonstrates convincingly that Böhm-Bawerk's third cause is not independent, and dismisses Böhm-

Bawerk's critique of simultaneous equations as the misunderstanding of a mathematical innocent.

Subsequent commentators have taken Fisher's side. Stigler (1941, 215-216) says that “the question of the independence of the ‘third ground’ is unimportant” and describes Böhm-Bawerk's argument as nothing but a “long and confused polemic.” Kuenne (1971, 35) claims that Böhm-Bawerk did not “understand the idea of simultaneity of variation,” “believed models which featured it to be presenting circular arguments,” and assesses these beliefs of Böhm-Bawerk as the “most punishing deficiency of his analytical vision.” Stigler, in the opening quotation, is no more charitable. In an accompanying footnote, Stigler (1941, 181) adds that “Böhm-Bawerk was not trained in mathematics.” The Böhm-Bawerk-Fisher controversies appear to be, as the second opening quotation suggests, a discussion “carried far beyond the limits of weariness and satiety.”

But a value theory perspective provides a radically different assessment of the controversies, revealing deep theoretical and methodological issues underlying the seemingly trivial controversies. Debates over theories of value, triggered by the marginal revolution, fuelled the Böhm-Bawerk-Fisher controversies. While the neoclassical subjective utility theory of value quickly triumphed in explanations of exchange ratios and demand, attempts to extend utility theory to explanations of production and factor prices – the stronghold of the classical objective cost of production theory of value – took longer.

Fisher, in the controversy over the independence of the third cause of interest, rejected the remaining classical, objective, production elements in Böhm-Bawerk's theory in favour of an ascendent neoclassical emphasis on both subjective elements and a conception of production as exchange with nature. The simultaneous equations controversy stemmed from fundamental differences between Böhm-Bawerk and Fisher on the need for value theory, as opposed to price theory, for a complete explanation of economic phenomena.

The chronology of the controversies appears in Table 1. The controversies originate in Böhm-Bawerk's *Positive Theory of Capital* (published in German in 1889 and translated into English in 1891). Fisher's *The Rate of Interest* (1907) contains a critique of Böhm-Bawerk (1891), to which Böhm-Bawerk responds in an essay appended to the third edition of *Positive Theory* (1912). Fisher responds again in *The Theory of Interest* (1930a). Frank Fetter (1902), Henry Seager (1912), and Harry Brown (1913) make other, minor contributions to these debates.<sup>1</sup>

**TABLE 1** Chronology of the Böhm-Bawerk/Fisher Interest Rate Controversies

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1889	Böhm-Bawerk, <i>Positive Theory of Capital</i> (English translation 1891)
1902	Fetter, "The 'Roundabout Process' in the Interest Theory"
1907	Fisher, <i>The Rate of Interest</i> (critique of Böhm-Bawerk 1891, incorporating Fisher 1896, 1897a, 1897b, 1906)
1912	Böhm-Bawerk, "On the Relationship between the 'Third Reason' for Higher Valuation of Present Goods and the Two Other Reasons," originally in 3rd edition (2nd volume) of <i>Positive Theory of Capital</i> (Response to Fisher 1907)
1912	Seager, "The Impatience Theory of Interest"
1913	Brown, "The Marginal Productivity vs. The Impatience Theory of Interest"
1930	Fisher, <i>The Theory of Interest</i> (response to Böhm-Bawerk 1912)

The paper is organized as follows. Sections 2-4 set the context for the controversies, presenting a primer on value versus price theory, and synopses of Böhm-Bawerk's and Fisher's respective interest theories. Section 5-6 present the controversies over the independence of Böhm-Bawerk's 3<sup>rd</sup> cause of interest and over simultaneous equations. Section 7 draws conclusions.

## 2 VALUE THEORY VERSUS PRICE THEORY

A distinction between value theory and price theory sounds antiquarian to most economists today, who view *value* and *price* as synonyms – Debrue’s (1959) *Theory of Value* is about the determination of relative prices. But today’s consensus about the validity of the neoclassical utility theory of value did not exist during these controversies. The value/price distinction was essential.

Value theory is a more philosophical attempt to provide an *underlying* or *ultimate* explanation of *why goods have value*. Schumpeter (1954, 590) describes value theory as an attempt “at indicating the factors that account for a thing’s having exchange value,” and as “views on the problem of causal explanation of the phenomenon of value” (1954, 309). It identifies a price-independent parameter which is the *source* of price (Lowe, 1981, p. 803). There is a simple, one-direction linkage from underlying cause to effect on price.<sup>2</sup> *Underlying*, *ultimate*, and *causal* are value theory words.

In the classical – especially Ricardian – cost-of-production theory of value, labour is the ultimate source of value that explains natural prices. While utility is a prerequisite for value, increases in prices are ultimately caused by increases in the quantity of embodied labour. In the neoclassical theory coalescing with the marginal revolution, utility – determined at the margin by scarcity – is the ultimate source of value that explains relative prices. Increases in prices are ultimately caused by increases in (marginal) utility.

In contrast to the one-directional cause-and-effect of value theory, price theory stresses simultaneous determination and interdependence. Price theory explains more precisely how price are determined in markets, capturing how the interdependence of production, consumption, distribution and exchange determines relative prices. *Simultaneous*, *determine* and *interdependence* are price theory words. There were many variations of classical price theory – even for Ricardo, relative prices were only 93 percent determined by labour values, once the interdependence of prices was taken into account (Stigler 1958, Cohen 1993). But classical price theory was not at issue in these controversies, and we will leave it aside. The focus was on neoclassical prices, which depend on given preferences, endowments and the technology. Using simultaneous equations, relative prices are *determined* as the equilibrium outcome

of interdependent utility (and profit)-maximizing agents.

### 3 BÖHM-BAWERK'S THEORY (1889/1891)

For Böhm-Bawerk, a complete theory of interest must answer two separate, but related questions: 1) *why* does interest exist? and, 2) *how* is the market rate of interest determined? Why interest exists is a *value theory* problem while the determination of the rate of interest is a *price theory* problem.

Böhm-Bawerk, like most economists after marginal revolution, subscribed to the utility theory of value, in which usefulness and scarcity of a good are the source of its value. Utility and quantity, both of which are price independent, cause a good to have value. Böhm-Bawerk (1959, v.2, 143) expresses “the crux of our theory of value” as the proposition that “*The value of a good is determined by the magnitude of its marginal utility.*”

For Böhm-Bawerk, a value theory explanation of interest must be grounded in subjective utility. His quest was for a one-directional explanation of interest rooted in Menger's value theory. He wanted "to trace the phenomenon of interest back to the beginnings which are among the simplest natural and psychological fundamentals of our economic system, and then to proceed onward through the phenomena of value" (Böhm-Bawerk 1959, v.2, 381). “Any tenable explanation of interest must go back to this ultimate source,” namely “the relation of human needs to the means of satisfying them” (Böhm-Bawerk 1959, v.1, 94).

Value and price theory are connected for Böhm-Bawerk. Price theory demonstrates how the theory of value is *manifest* is the operation of the economy. Market mechanisms determining the rate of interest – which Böhm-Bawerk develops in a subsistence fund model – must be consistent with the self-interested, utility maximizing actions of individuals.<sup>3</sup>

## Value Theory: Three Causes Why Interest Exists

For Böhm-Bawerk (1959, v.2, 259), interest exists because "present goods are as a general rule worth more than future goods of equal quality and quantity." His explanation for the existence of a premium (*agio*) of present over future goods consists of three causes: 1) relative underprovision of present versus future income, 2) perspective undervaluation of the future, and 3) the increased productivity of more roundabout or time-using methods of production.<sup>4</sup>

The first cause is the diminishing marginal utility of income over time. Since most people expect more income in the future, they value a dollar of (relatively scarce) income today more than a dollar of (relatively plentiful) income tomorrow. The second cause – purely psychological positive time preference – is attributed to underestimation of the intensity of future want, limited will power to delay gratification, and concerns about the shortness and uncertainty of life.<sup>5</sup> Expected marginal utility declines as the time before consumption increases.

The third cause adds a production explanation to the previous endowment and preference explanations of interest. Böhm-Bawerk ultimately attributes all production to labour and land (land represents all contributions of nature) – the only two "elemental" or "originary" factors of production. They can be combined directly to produce consumption goods, or indirectly, using capital. Capital is defined, alternatively, as "capital goods," "intermediate products," and "produced means of production" (Böhm-Bawerk 1959, v.2, 14, 32, 61). In indirect, or capitalist production, labour and land are first combined to produce capital goods, which are subsequently combined with additional labour and land to produce consumption goods. The third cause asserts that investment in more roundabout, time-consuming production processes will increase physical productivity, although at a decreasing rate.<sup>6</sup>

Böhm-Bawerk (1891, 277) presents examples of individuals with differing income-streams and psychological characteristics, arguing that as long as any one of the three causes is "active" then "every one, whatever his economical position, and ... economical temperament, has some ground for valuing present goods more highly than future." He seems to claim that any one of the three causes is sufficient to produce a positive rate of interest. The three causes, "each of which, independently of the other, is

adequate to account for a difference in value between present and future goods in favour of the former” (Böhm-Bawerk 1891, 273).

Böhm-Bawerk makes a peculiar argument for the independence of the third cause. He assumes that the first two causes are absent, with the apparent intention of showing that the third cause alone will yield a positive rate of interest. Instead, he proceeds to argue that the third cause will force the emergence of the first cause, as roundabout production creates abundance in the future and scarcity in the present. It is important to quote Böhm-Bawerk at length, given Fisher's subsequent attack on this passage.

If the value of the unit of product were to be the same in all periods of time, ... the most abundant product would ... be the most valuable. But since the most abundant product is obtained by the most lengthy and roundabout methods of production ... the economic centre of gravity ... would ... be found at extremely remote periods of time – which is entirely contrary to all experience. And, besides, if such a state of things were to emerge ..., it would immediately bring its own correction. ... [M]en would withdraw their stocks of goods ... from the service of the present, and direct them to the more remunerative service of the future. But this would immediately cause an ebb-tide in the provision for the present, and a flood in the provision for the future .... Thus the difference in the circumstances of provision ... would recur of its own accord (Böhm-Bawerk 1891, 269-70).

Without justification, Böhm-Bawerk claims this demonstrates the independence of his third cause from the first cause. He considers his example “the best proof” that the third cause

is independent of differences in the circumstances of provision: so far from being obliged to borrow its strength and activity from any such difference, it is, on the contrary, able, if need be, to call forth this very difference. – Thus we get, ... the assured conviction of two things; – first, that the productive superiority of present goods assures them, not only a surplus in product, but a surplus in value, and, second, that ... we have to deal with a third cause of the surplus value, and one which is independent of any of the two already mentioned (Böhm-Bawerk 1891, 270).

Böhm-Bawerk fails to demonstrate independence in the sense of the third cause being *sufficient* to produce a positive rate of interest. Elsewhere he emphasize *interaction*, not independence, of the three

causes:

The statement of how the productivity of capital works into and together with the other two grounds of the higher valuation of present goods, I consider one of the most difficult points in the theory of interest, and, at the same time, the one which must decide the fate of that theory (Böhm-Bawerk 1891, 277n).

### **Price Theory: The Subsistence Fund Model Of Interest Determination**

Böhm-Bawerk's answer to the second question of *how* the market rate of interest is determined involves a dramatic change in approach, upon which many have commented. Only in the last 95 pages out of the 380 pages of *Positive Theory of Capital* does he develop his subsistence-fund model of the market determination of the interest rate, and it appears relatively unconnected with what has come before.

Whereas before capital means concrete, heterogenous capital goods, in the subsistence-fund model capital become a homogenous fund of value. Böhm-Bawerk's emphasis on the interaction of the three causes of interest, gives way to an emphasis on the third cause –productivity of roundabout production methods – and relative neglect of the first two causes. And last, but certainly not least, one-way causal claims give way to simultaneous determination in Böhm-Bawerk's model of interdependent variables.

Following Wicksell's recounting of a 1911 conversation with Böhm-Bawerk (Stigler 1941, 194), most commentators have attributed this apparent dichotomy in *Positive Theory* to Böhm-Bawerk's own admission that he ran out of time on the first edition. Wicksell (quoted in Stigler 1941, 194-5) reads *Positive Theory* as “flowing not from *one* mould, but much rather coming from several parallel-running lines of thought.” Stigler (1941, 194) sees “two separate and unrelated ... explanation[s] of interest.” The first half of the book was already at the printers when Böhm-Bawerk was “confronted by difficulties of a theoretical nature” in developing the subsistence fund model. Even in subsequent editions, Böhm-Bawerk's responsibilities as Finance Minister and other factors prevented him from substantially revising the book. Others simply attribute the apparent dichotomy to Böhm-Bawerk's mathematical and theoretical shortcomings.

There is no doubt time pressure created inconsistencies between the two parts of *Positive Theory of Capital*, and that Böhm-Bawerk's work contains mistakes. However, the value/price theory distinction illuminates a previously unnoticed connection between parts. For Böhm-Bawerk, an adequate value-theory explanation of interest must originate in the subjective evaluations of individuals and be traced linearly back to the original factors of production, labour and land. But to answer the second, price theory question of the market determination of the rate of interest, one must show how the three causes of interest are operationalized in the relevant markets. His subsistence-fund model of interest determination focuses on that market determination. In introducing the model, Böhm-Bawerk describes the shift from value to price theory in the claim that he will show how the three causes of interest “actually manifest themselves ... with such cogency that the inescapable result of determination of price must necessarily and always be a [positive rate of interest]” (Böhm-Bawerk 1959, v.2, 307-8).

The model of market determination of the interest rate incorporates the (flawed) concept of the period of production, but adds the crucial concept of the subsistence fund. Since labour and land are the only *originary* means of production – capital goods are intermediate products produced by labour and land – Böhm-Bawerk (1959, v.2, 308) claims that “the determination of *their* prices really constitute the deciding factor for the genesis of originary interest.”

Böhm-Bawerk's quantitative model for determining the interest rate is a variation of a classical wages-fund model. He simplifies by assuming that labour is the only originary factor of production and capital become advances of means of subsistence to labour, denominated in money. Entrepreneurs demand labour services to exploit the potential productivity of production, and workers supply labour in exchange for subsistence. The assumptions include (Lutz 1967, 12): a given subsistence fund, homogeneous labor as the only factor of production, no durable production goods, only one (consumption) commodity, even-flow production, unchanged technology, and increased roundaboutness increasing productivity at a decreasing rate. The model determines simultaneously four unknowns; the wage rate, period of production, quantity of output, and interest rate. The assumptions of a fixed subsistence fund together with competition between workers for jobs and between capitalists for workers

simultaneously determines the wage and the optimal period of production. The combination of the level of employment, the production function, and the length of the period of production determines output and the interest rate (*agio*).

Böhm-Bawerk describes the adjustment to equilibrium with a stability story that focuses on the wage. If, relative to equilibrium, the wage is set too high, capitalists will utilize an overly-roundabout production process (substituting time/capital for relatively expensive labour) and will not employ the full labour force. Competition between workers for scarce jobs will lower the wage, inducing adoption of less roundabout production processes which employ more present labour. Conversely, if the wage is set too low, capitalists will utilize an overly-direct production process and will demand more labour than is available. Competition between capitalists for scarce workers will raise the wage, inducing adoption of more roundabout production processes which employ less present labour.

The equilibrium interest rate is the internal rate of return of the production process, “determined by the surplus product of the last prolongation of the production process that is still permissible” (Böhm-Bawerk 1959, v.2, 361). With decreasing marginal productivity, when the *wage falls* from too high a level, the adoption of less roundabout production processes *increases the interest rate* to its equilibrium level. Conversely, when the *wage rises* from too low a level, the adoption of more roundabout production processes *decreases the interest rate*.

Böhm-Bawerk then performs comparative statics exercises of how changes in the parameters of the subsistence fund, the labour force and the technology, influence the unknowns – especially the period of production and the interest rate.<sup>7</sup> An increase in the subsistence fund increases the period of production and decreases the interest rate (together with increases in both the wage rate and output). An increase in the labour force has the opposite effects; a decrease in the period of production and an increase in the interest rate (together with decreases in both the wage rate and output). Finally, an increase in the productivity of roundabout methods of production increases the optimal period of production, the interest rate, output, and decreases the wage rate.

Blaug (1997, 487-88) provide the clearest account of how the interaction of Böhm-Bawerk's three reasons determines the interest rate<sup>8</sup>:

Since any further roundaboutness always promises a further increase in the value of the total product, a zero rate of interest would encourage an unlimited increase in the period of production. This would mean a scarcity of present goods, leading via the first or second reason to the reemergence of interest and the reversal to direct methods of production. The true function of a positive rate of interest then is to act as a brake on the tendency to neglect present wants by overextending the period of production. The interest rate rations the limited supply of present goods among individuals in accordance with the community's estimation of the relative value of present and future goods.

#### **4 FISHER'S THEORY (1907/1930)**

Fisher's theories of capital and the real rate of interest were developed in series of articles (1896, 1897a, 1897b) and books (1906, 1907). *The Rate of Interest* (1907) was rewritten and published in 1930 as *The Theory of Interest*. The 1907 version is most relevant for the controversies with Böhm-Bawerk. Fisher's 1907 book was dedicated to John Rae, whom Fisher felt was the first to state the principles underlying Fisher's own interest theory, and who had been largely ignored in the historical literature, especially by Böhm-Bawerk.<sup>9</sup> However, Fisher's (1930a, v) rewrite of the 1907 book was dedicated to both Rae and Böhm-Bawerk "who laid the foundations upon which I have endeavored to build."

Interest for Fisher, like for Böhm-Bawerk, is a premium or *agio* on present versus future goods. Fisher (1907, vii) defines the rate of interest as "an index of the preference ... for a dollar of present over a dollar of future income." What distinguishes Fisher's *agio* theory from Böhm-Bawerk's is the prominent role of income-services.

Fisher's interest theory is based on his theory of capital and income. He begins by applying a stock/flow distinction to physical quantities. Capital-wealth is the aggregate stock of physical objects, which is "not a sum but an *inventory*" (Fisher 1897a, 204). Income-services are the flow of real

consumption services from the capital stock such as “nourishment, clothing, shelter, amusements, the gratification of vanity” (Fisher 1907, 90).

Interest emerges from the exchange over time of capital against income. But capital-wealth and income-services “are quite incommensurable, ... therefore no ‘interest rate’ can exist between them until both are reduced to a common standard” (Fisher 1897b, 526). To compare capital and income, the analysis must shift from physical quantities to values. With that shift, the causal linkages between capital and income are reversed, as in Fisher's (1907, 14) table.

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	Present Capital		Future Income
Quantities . . . . .	Capital-wealth	→	Income-services
Values . . . . .	Capital-value	←	Income-value

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Present capital-wealth produces future income-services. Those services are priced in the periods in which they occur to yield future income value. Future income-value is then discounted at the rate of interest to yield present capital value.

The statement that "capital produces income" is true only in the physical sense; it is not true in the value sense. ... *capital-value does not produce income value*. On the contrary, income-value produces capital-value. It is not because the orchard is worth \$20,000 that the annual crop will be worth \$1000, but it is because the annual crop is worth \$1000 that the orchard will be worth \$20,000. The \$20,000 is the discounted value of the expected income of \$1000 per annum; and in the process of discounting, a rate of interest of 5 per cent. is implied (Fisher 1907, 13).

To be able to compare the value of income-streams with the value of capital, Fisher assumes that the prices of the heterogeneous components of the income-streams are given and independent of the rate of interest. These prices, Fisher (1907, 99) claims, “do not ... embarrass us by direct dependence on the

rate of interest which we are seeking to solve.” Fisher’s partial equilibrium theory, with given prices of goods and services, allows him to treat income-streams “as a homogeneous quantum,” as though they are composed of only one-commodity.

The rate of interest used to discount future income-services has two determinants: 1) subjective *impatience* and 2) objective, technical conditions determining *investment opportunity*.

### **Impatience**

The *impatience* or *time preference* determinant of Fisher's theory repackages Böhm-Bawerk's first two causes of interest. Fisher (1907, 88) acknowledges that his time preference is “very nearly what Böhm-Bawerk [cause 2] calls the 'perspective undervaluation of the future'.”

The actual rate of time preference depends on the “time-shape of the income-stream” (Fisher 1907, 92), which Fisher claims “is practically identical” with Böhm-Bawerk’s first cause “for the superiority of present over future goods” (1907, 98). Fisher considers the time-shape of the income stream to be the dominant determinant of time preference, more important than the relatively constant psychological traits of cause 1 (1907, 103).

Fisher develops a pure exchange model of interest determination (his "First Approximation"), in which future income is fixed and there are no production/investment decisions. Each individual possesses a given income stream and is free to exchange any present or future part of it in the market for loanable funds. The aggregation of all individuals' time preferences, as expressed in the demand and supply of loanable funds, determines the equilibrium rate of interest. In this pure exchange model, positive time preference – “the psychological element of human choice” (Fisher 1907, 37) – is a sufficient condition for a positive rate of interest.

### **Investment Opportunity**

In his "Second Approximation", Fisher relaxes the assumption of given income streams. In addition to exchanging income streams in the market for loanable funds, individuals can now choose among alternative investment opportunities that modify the time-shapes of their income streams. The criterion for choice is maximum net present value.

Fisher introduces the concept of the *rate of return on sacrifice* as part of the maximum present value decision. The concept, which becomes the *rate of return over cost* in Fisher (1930a), is described two ways. First, it is the rate of interest which equalizes the present values of two alternative investment streams. The second, more important description emerges from an example of a farmer considering alternative capital intensities of cultivation. In comparison with a base level of intensity (technique A), the rate of return on sacrifice for technique B is the ratio of the addition to the future income stream to the one-time sacrifice of present income. Since prices are given, this ratio is equivalent to a ratio of physical quantities: the additional quantity of output from investment in technique B divided by the quantity of sacrificed income that produced it. Fisher further assumes diminishing returns to increasing capital intensity, so

each successive choice, ... shows a *law of decreasing returns for additional sacrifice*. .... [E]ach successive option is chosen as long as the rate of return on sacrifice ... is greater than the rate of interest ... The intensiveness of his farming is thus determined by the rate of interest. He chooses that degree of intensiveness which gives his income-stream the maximum present value – which is the same thing as choosing that degree at which the rate of return on sacrifice is equal to the rate of interest (Fisher 1907, 157).

Given the physical equivalence of these ratios, Fisher's law of decreasing returns for additional sacrifice is tantamount to diminishing physical marginal productivity of capital. He acknowledges that the rate of return on sacrifice admits “into our theory the elements of truth contained in some of the claims of the productivity theories, the cost theories, and Böhm-Bawerk's theory of the technique of production” (Fisher 1907, 159). Fisher's law is equivalent to Böhm-Bawerk's diminishing returns to increasing roundaboutness of production.

### **Fisher's Theory of Interest**

Although the opportunity/productivity side of Fisher's theory of interest appears in his "Second Approximation," he never combines it with the impatience side anywhere in the main text of *The Rate of Interest*. The combination appears only in the fifth of seven appendices to the book – “Appendix to

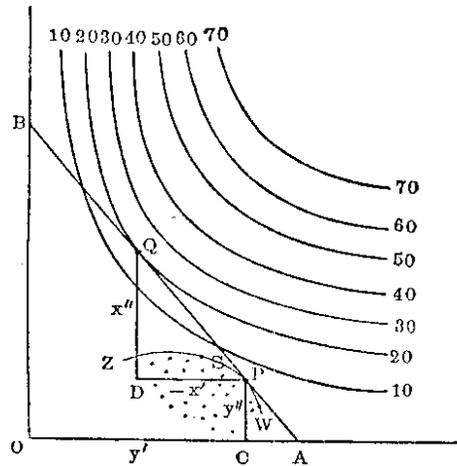
## Chapter VIII. Second Approximation.”

Fisher constantly emphasized the impatience side of his theory to the neglect of the opportunity side. In summarizing his 1907 book in a 1911 article titled "The 'Impatience Theory' of Interest: A Study of the Causes Determining the Rate of Interest," Fisher devotes only one sentence in a 20 page article to the opportunity side of his theory. His 1912 textbook, *Elementary Principles of Economics*, has three chapters on the interest rate titled "Impatience for Income the Basis of Interest," "Influences on Impatience for Income," and "The Determination of the Rate of Interest." The opportunity/productivity elements of this theory are not only absent from chapter titles, they are given only one out of 45 pages on interest theory. Even in that one page, the strongest statement Fisher makes is a bare mention that “the choice between different uses of capital is one of the influences determining the rate of interest” (Fisher 1912, 401). The bulk of the chapters are filled with statements like “It is futile to derive the rate of interest from the productivity of capital” (Fisher 1912, 368), “The essence of interest in impatience” (Fisher 1912, 371), and “Interest is ... human impatience crystallized into a market rate” (Fisher 1912, 371).

Despite being buried in an appendix, Fisher's combined theory of impatience and opportunity does appear in 1907. In expanding on his farming example, Fisher describes the “effective range of choices” facing the farmer which is a concave production possibilities boundary. He acknowledges that “the technical conditions of the industry” determine the shape of the boundary and thereby “show their influence upon the rate of interest” (Fisher 1907, 404).

In the famous diagram below, Fisher combines production possibilities boundary  $WPZ$  with "desirability" (indifference) curves reflecting subjective rates of time preference. In now familiar fashion, the rate of interest is determined by the tangency between the two. Production occurs at  $P$  (the income stream of maximum present value), but by “modifying his income-stream” in the loan market, the farmer can consume at  $Q$  (the income stream of maximum desirability).

Figure 29 (Fisher 1907, 409)



Fisher's refers to the diagram in conclusion:

There is truth ... both in the subjective and objective theory of interest. That the rate of interest is equal to the subjective rates of preference is indicated by the tangency of the plane (or line) to the desirability surfaces (or curves); that it is equal to the rate of return on sacrifice is indicated by its tangency to the surface (or curve) of effective range of choice. These two equalities are not incompatible, as has too often been assumed. Interest is determined partly by objective or technical factors which supply the range of opportunity (boundary surfaces or curves); partly by subjective factors which determine individually the choice (the desirability curves) (Fisher 1907, 411).

Fisher claims that the geometrical diagram provides the best intuitive understanding “of the manner in which the objective or ‘technical’ conditions ... cooperate with the subjective conditions which influence the rate of interest,” but that the mathematics provide the best understanding of “the determinateness of the problem, owing to the equality between the number of equations and the number of unknowns” (Fisher 1907, 415).

Fisher's combination of impatience and opportunity determining the rate of interest is much the same as Böhm-Bawerk's interaction of the three causes of interest. The interest rate is determined by a balance of the forces of opportunity (that lead to increased roundaboutness) and impatience (that leads to increased present consumption). Fisher (1907, 126) describes the trade-off this way: “Spending

increases immediate income but robs the future, whereas investing provides for the future to the detriment of the present.” Böhm-Bawerk (1959, v.2, 323) has same trade-off: “The constant presence of the *agio* in favor of present goods works like a self-acting brake on the proclivity to lengthen the period of production.”<sup>10</sup>

While there are extensive similarities between Fisher’s and Böhm-Bawerk’s theories, two important differences become the subject of controversy; the independence of Böhm-Bawerk's third cause of interest, and the adequacy of simultaneous equation models in explaining the rate of interest.

## **5 CONTROVERSY OVER BÖHM-BAWERK’S 3<sup>RD</sup> CAUSE**

Fisher devotes an entire chapter of *The Rate of Interest* to Böhm-Bawerk. While accepting most of Böhm-Bawerk's interest theory, Fisher criticizes Böhm-Bawerk's claim of the independence of the third cause of interest – the increased productivity of more roundabout or time-using methods of production – and rebuts Böhm-Bawerk’s claim that the third cause “is entirely apart from and in addition to” (Fisher 1907, 58-59) the first two causes of interest.

Fisher's attacks Böhm-Bawerk's numerical examples by eliminating the effects of the first two causes to demonstrate that the third cause alone will not yield a positive rate of interest. Fisher also demonstrates that, in contrast, the first two causes alone are sufficient to yield a positive interest rate.<sup>11</sup>

Fisher then goes on to attack Böhm-Bawerk's peculiar argument for the independence of the third cause; that if the first two causes are absent, they will be forced back into existence by the productivity of roundabout production processes.

In other words, the “technical superiority of present goods” produces interest by restoring the “other two circumstances.” But this is tantamount to the admission that “technical superiority” actually depends for its force on these “other two circumstances” and is not “independent.”

The essential fact is that its presence does not produce interest when the other two are absent (Fisher 1907, 72).

Fisher is correct that Böhm-Bawerk fails to demonstrate that the third cause alone is logically sufficient to produce a positive rate of interest. Curiously, Fisher proceeds to exaggerate this criticism and deny *any* role for objective forces of production in the determination of the interest rate.

It is from the preference for the early over the late fruition of *any* productive process that the so-called "technical superiority of present over future goods" derives all its force. The imagined "third circumstance" producing a superiority in present goods is only the first two circumstances in disguise (Fisher 1907, 70-1).

Elsewhere, Fisher (1907, 72) claims that "the 'technical superiority' of present goods is a "delusion" and that "to abstract both the underestimate of the future and underprovision for the present is to abstract the *whole* basis for interest and not a part merely" (Fisher 1907, 65). These exaggerated claims seem to make no sense for a man whose own theory of interest incorporates the influence of both subjective impatience and objective investment opportunities.

Böhm-Bawerk (1912b, 165) responds to Fisher with a dense, 32 page essay, admitting that his peculiar example, in which the third cause calls the first two causes into existence, "is not conclusive for an independent influence of the third reason." But he adamantly defends a reduced claim that the third cause *influences* the rate of interest.

We can by no means infer ... that my third reason is no "independent cause" of the value advantage of present goods. We cannot ... omit it from a complete enumeration of all causes ... But Fisher drew these very inferences. At the utmost we could arrive at the indispensability of the first two reasons, by no means at the lack of influence of the third reason (Böhm-Bawerk 1912b, 171).

Böhm-Bawerk was not alone in reacting to Fisher's exaggerations. Seager's (1912, 849) "decisive objection" to Fisher's theory is its incompleteness in omitting "influences within the process of production" which determine the interest rate. Brown (1913, 633) criticizes Fisher's impatience theory because it "refuses to admit productivity as an independent direct cause of interest."<sup>12</sup>

Tobin (1985, 33) claims "that Fisher's many critics apparently did not understand the 190[7] version [of his theory]. They typically concentrated on the 'impatience' side of Fisher's theory of intertemporal

allocation and missed the ‘opportunities’ side.’” Tobin seems to think that the critics alone were at fault, when, as we have seen, Fisher contributed significantly to their “misunderstandings.”

In *The Theory of Interest*, Fisher acknowledges Böhm-Bawerk's and others' criticisms of his position, but provides little response: “Although Böhm-Bawerk devoted many pages in the third edition of his book and the Supplements (*Exkurse*) to answering my criticisms, I can find nothing in his answers which affects the main argument” about the lack of independence of Böhm-Bawerk's third cause of interest (Fisher 1930a, 483).

### **Is There Value in the Controversy over Böhm-Bawerk’s Third Cause?**

The interesting question is why Fisher so exaggerates his claims for the importance of impatience as *the* determinant of the rate of interest? Value theory provides an answer. During the 1896 - 1907 period when Fisher developed his theory of interest, serious debate continued about the superiority of the classical cost-of-production value theory versus the neoclassical subjective utility theory of value. Fisher's theories were entirely neoclassical, and he argued constantly for the new subjective theory of value. For his interest theory, this meant stressing its fundamentally subjective nature.

While Böhm-Bawerk, as an Austrian, shared the subjective utility theory of value, his theories contained residual classical, cost-of-production elements. Böhm-Bawerk's utility theory of value is generally forward-looking. Goods acquire value from the utility they provide to consumers, not from a backward look at their cost of production. Similarly, the Austrian theory of imputation, to which Böhm-Bawerk subscribes, imputes value to capital goods from the discounted stream of *future* earnings. In marked contrast, Böhm-Bawerk's concept of the period of production is a backward-looking measure of capital, based on the *past* labour involved in the production of the capital good. The period of production measures the temporal sequence of production, from inputs to outputs. Furthermore, Böhm-Bawerk retains a classical emphasis on labour as the most important factor of production, and uses the classical wages fund concept in his subsistence fund model of interest determination.

Böhm-Bawerk's contemporaries noticed this contrast between his neoclassical value theory and his classical analysis of capital and production. Fetter (1902, 175) accuses Böhm-Bawerk of having a 20th

century theory of value but an 18th century cost-of-production theory of capital. Böhm-Bawerk's fundamental concept of capital was as produced means of production – concrete, heterogeneous, intermediate goods used to produce output. The productivity of roundabout production was the result of time – production processes incorporating intermediate capital goods. While Fisher adopts much of Böhm-Bawerk's theory of interest, he explicitly rejects Böhm-Bawerk's theory of capital and production (Fisher 1897b, 523).

In place of Böhm-Bawerk's analysis of the productivity of time and production, Fisher emphasizes the productivity of nature and exchange. Instead of explaining the productivity of roundabout production processes, Fisher *accepts as given the productivity of nature*. Fisher (1906, 104) follows John Rae's claim that "nature provides many opportunities in which man may, at slight present cost, secure a great future return." By assuming the existence of a range of rates of return on different investment projects, Fisher can ignore issues of production. The interest rate is determined by the interaction of natural productivity with subjective time preference. "Man is continually hunting ... for bargains with Nature; but he deals at nature's bargain counter only up to a definite point – a point decided upon by him and not by Nature" (Fisher 1907, 37).<sup>13</sup>

Investment for Fisher is not Böhm-Bawerk's time-sequence of production but rather an exchange with nature at her "bargain counter."<sup>14</sup> Fisher's focus on the exchange of naturally produced goods is reinforced by his constant examples capital goods as orchards and land. Fruit-output is produced by nature, and the capital-good, land, is given. Since land has no production process, its value can only be the discounted value of future earnings. This choice eliminates all cost of production issues including Wicksell effect complications from changes in production.<sup>15</sup>

Fisher's downplaying of Böhm-Bawerk's third cause and exaggeration of the subjective, impatience cause of interest can be seen as part of a trend to jettison classical conceptions of production in favour of an emphasis on subjective exchange. Böhm-Bawerk's third cause, as Stigler (1941, 195) notes, "has obvious classical origins," including a wages fund flavour, an emphasis on labour as the most important factor of production, and a class-based conception of the differing time preferences of

capitalists and workers.<sup>16</sup> It also echoes Adam Smith's view of capital as advances, where an increase in the capital stock, by increasing the division of labour, increases productivity.

Fisher casts aside these classical elements and emphasizes instead individual subjective factors and exchange processes. He develops his theory of interest first in a pure exchange model ("First Approximation") where subjective factors alone are sufficient to yield a positive rate of interest. The investment opportunities Fisher adds in his "Second Approximation" are *assumed rather than derived*, so that Fisher cuts "away Böhm-Bawerk's analysis of production and the role of capital in it" (Hennings 1990, 258). Fisher's investment takes the form of consumer exchange with goods produced by Nature.

The controversy over the independence of Böhm-Bawerk's third cause is not simply about logic and definitions of necessary and sufficient conditions. Fisher's exaggerated emphasis on the subjective causes of interest and his exaggerated attempts to downplay the role of objective conditions of production are symptomatic of ongoing value-theory debates that provide the fuel for the intensity of the controversy.

## **6 CONTROVERSY OVER SIMULTANEOUS EQUATIONS**

Böhm-Bawerk's (1912b) critique of Fisher's (1907) *The Rate of Interest* initiated the second controversy. Böhm-Bawerk attacks Fisher's simultaneous equations model of interest rate determination, accusing Fisher of circular reasoning. This accusation prompted the criticisms of Stigler, Kuenne and others that Böhm-Bawerk lacked mathematical sophistication and simply failed to understand the concept of simultaneous determination. The controversy centres around Fisher's (1907) descriptions of the adjustment to equilibrium in his "First and Second Approximation" models.

In the "First Approximation," future income is fixed and there are no production/investment decisions. The aggregation of all individuals' time preferences, expressed in the demand and supply of loanable funds, determines the equilibrium rate of interest. If an individual's current rate of time preference deviates from the market rate, he will adjust his income stream until his actualized rate of time preference equals the market rate. For example, if Irving's rate of time preference is above the market rate, he can increase his total utility by exchanging future income for additional present income. As the

shape of his income-stream shifts to the present, his actualized rate of time preference falls until it reaches the market rate. An individual whose current rate of time preference is less than the market rate will lend present income up to the point where her actualized rate of time preference rises to the market rate.

Fisher (1907, 130-1) describes the simultaneity in interest rate determination this way:

What determines the rate of interest? Thus far we have regarded the individual only, and ... he conforms his rate of preference to the rate of interest. For him the rate of interest is a relatively fixed fact, since his own time-preference and resulting action can affect it only infinitesimally. .... [F]or him individually the rate of interest is the cause, and the rate of preference the effect. For society as a whole, however, the order of cause and effect is reversed. .... [W]hile for the individual the rate of interest determines the rate of preference, for society the rates of preferences of the individuals determine the rate of interest. The rate of interest is simply the rate of preference, upon which the whole community may concur in order that the market of loans may be exactly cleared.

In describing the simultaneous nature of his "Second Approximation," where time preferences and investment opportunities (technologies) now determine the rate of interest for society as a whole, Fisher (1907, 147) raises the concern about circular reasoning.

[I]t may appear that we are reasoning in a circle: the rate of interest depends on individual rates of preference; the rates of preference depend on the time-shapes of individual income streams; and the choice of these time-shapes depend ... on the rate of interest itself... Yet this series is not the vicious circle it seems, for the last step is not the inverse of the first.

Picking up on Fisher's own concern, Böhm-Bawerk (1912b, 189) first accuses Fisher of "arguing in a vicious circle." If individuals adjust the time shape of their income streams and their rate of time preference to the given rate of interest, then how can time preference *determine* the interest rate?

Although the interest rate is unequivocally determined at a certain state of options where the market is "cleared" we must still explain the cause and effect relationship. .... Fisher himself falls prey to [a vicious circle] when he does not explain the interest rate as a resultant from the

originary preference rates of individuals, but rather from preference rates that are adjusted to the interest rate. This in fact means to explain the establishment of the interest rate from the established interest rate, or the resultant from the resultant (Böhm-Bawerk 1912b, 191).

The answer to Böhm-Bawerk's question, although Fisher never says so explicitly, is that preference *functions* determine the market rate of interest, while the interest rate determines the *actual point* chosen on each individual's time preference function. Böhm-Bawerk does not realize that Fisher is providing a theoretical explanation that is not circular – preference functions, resource endowments, and investment opportunities jointly determine the interest rate. Böhm-Bawerk's accusations fall flat because of his failure to distinguish between a function and a specific value of that function. In fairness to Böhm-Bawerk, Fisher confusingly uses the same term, "rate of preference," for *both* preference functions and actualized values of the functions.

Böhm-Bawerk also objects to Fisher's emphasis on mathematical determination. Fisher's main defense to the circular reasoning charge he himself raised is that his solution to the problem of interest is mathematically determinate: "there are as many determining conditions as there are unknown quantities" (Fisher 1907, 148).

In a mathematical appendix to the "First Approximation," Fisher (1907, 374-394) presents a simultaneous equations model and demonstrates its determinateness in terms of numbers of equations and unknowns. Böhm-Bawerk (1912b, 190) assesses Fisher's mathematical demonstration of the determination of the interest rate as "correct" and "cogent." But for Böhm-Bawerk, it is not enough.

[Fisher's demonstration] would be rather nice if mathematical and causal "solutions" of problems were the same ... But *to find* a certain quantity that matches other given assumptions and *to explain* this quantity are two entirely different things. .... Certainly a single interest rate corresponds to the state of options that "clears" the market; the problem is solved mathematically. But this mathematical determination fails to inform us on the sequence of causality between the facts. Therefore causal interpretation must accompany mathematical determination (Böhm-Bawerk 1912b, 191-2).

This is the key passage<sup>17</sup> leading Stigler and Kuenne to conclude that Böhm-Bawerk misunderstood the nature of simultaneous determination.

### **Is There Value in the Controversy over Simultaneous Equations?**

Did Böhm-Bawerk misunderstand the nature of simultaneous determination?

First, as we have seen, Böhm-Bawerk uses simultaneous determination in his own subsistence fund model of interest determination. Even Kuenne (1971, 35), who claims that Böhm-Bawerk did not “understand the idea of simultaneity of variation,” acknowledges that Böhm-Bawerk's own subsistence fund model involved the interdependence of general equilibrium. Kuenne gives Böhm-Bawerk “credit for an analytical sally of the most impressive ambition” namely, “an attempt to formulate a general equilibrium model inclusive of the economy's capital and interest variation.”

Second, during this era similar controversy about causality and simultaneous determination occurred between Walras and Pareto. Walras (1954, 145) attached causal interpretations to his interdependent variables in statements like “if it is certain that *rarete* and value in exchange are two concomitant and proportional phenomena, it is equally certain that *rarete* is the cause of value in exchange.” Walras, using value-theory words, also refers to *rarete* as the “underlying price determinant.” Pareto ([1909] 1971, 179-80) dismissed summarily Walras's interpretations and sharply contrasted simple causation with mutual determination by simultaneous equations. “[A]ny economist who looks for *the cause* of value shows thereby that he has understood nothing about the synthetic phenomenon of economic equilibrium. .... [T]he mutual dependence of economic phenomena ... makes the use of mathematics indispensable ...; ordinary logic can serve well enough for studying the relations of cause and effect, but soon becomes impotent [for] relations of mutual dependence.”

Most commentators would hesitate to charge Walras with failing to understand simultaneous equations. I am contending that the quest for causal explanation is motivated, not by mathematical incompetence, but by a concern for value theory explanations.

The marginal revolution occurred during Böhm-Bawerk's lifetime (1851 - 1914) together with value-theory battles between the subjective marginal utility theory and the objective cost of production

theory. The subjective marginal utility theory of value did not conquer the profession overnight. The earliest beachheads were in areas of demand and exchange, where classical theory was weakest. Only later, with second and third generation marginalists like Böhm-Bawerk, J.B. Clark, Knut Wicksell and others did the new theories conquer areas of production and capital. Böhm-Bawerk argued for the new subjective theory in extensive debates over the origin and cause of value with Harvard's Macvane in the pages of the *Quarterly Journal of Economics* and the *Annals of the American Academy of Political and Social Sciences*.<sup>18</sup> Another debate with Edgeworth in the *Economic Journal* centred around an article by Böhm-Bawerk entitled "The Ultimate Standard/[Determinant] of Value."<sup>19</sup> Pareto ([1909] 1971, 180) recognized such debates in judging Walras's errors in claiming one-way causal explanations as "excusable ... at the time when we are passing from inexact theories to new and better theories; but they should be inexcusable now that these theories have been developed." Fisher's exaggerations of subjective elements of his interest theory at the expense of objective elements are also, I would argue, a function of the atmosphere of value theory debates.

The lines of debate are not clearly drawn as neoclassical versus classical value theories. Böhm-Bawerk, Edgeworth and Fisher all accept a marginal utility theory of value, but differences persisted within the neoclassical camp. Böhm-Bawerk's capital theory retained strong classical aspects, and was part of the Austrian school, which generally emphasized subjective aspects of the new theory to a greater extent than others. All of these factors enter into the explanation of the Böhm-Bawerk-Fisher controversy over simultaneous equations.

Böhm-Bawerk's criticism of Fisher's simultaneous determination was not motivated by mathematical incompetence. What Böhm-Bawerk was looking for in Fisher, and did not find, was a value theory explanation to underlie Fisher's price theory. Böhm-Bawerk's quest was for a value theory explanation *in addition to* Fisher's price theory explanation. For Böhm-Bawerk, value and price theories were complements, not substitutes but. He accepts and understands the mathematical determination of equilibrium, but wants more: "causal interpretation must *accompany* mathematical determination" (Böhm-Bawerk 1912b, 192, emphasis added).<sup>20</sup>

Böhm-Bawerk's desire for additional “causal interpretation” is for a one-way value theory explanation from cause to effect. A value theory explanation must have two components for Böhm-Bawerk. First, it must trace the origin of interest back to the *originary* factors of production, labour and land. Second, it must ground the convergence to equilibrium in the forces of the subjective preferences of individuals. Böhm-Bawerk articulates his vision of an adequate explanation using a revealing metaphor of a streaming river to explain the distribution of income, particularly the flow of interest to capitalist. The flow of interest (and flows of wages and rent) are the outpouring from the end of a river. To explain the flows he offers three explanations of interest – as a problem of production, of distribution, and of value.

Productivity theories explain the flows of interest, wages and rent as originating in the productive powers of three factors of production – capital, labour, and land.

the same value that flowed out of each source will at the mouth of the river pour into the income of those persons who own the property at the source. It is not so much *one* stream as *three* streams ... the whole explanation [is] at the source, in the production of goods (Böhm-Bawerk 1959, v.1, 349).

Marx's exploitation theory, according to Böhm-Bawerk, views interest as purely a problem of distribution. While the only source of the river is labour, some of labour's product is unfairly diverted by capitalists at the mouth of the river. The explanation of interest is at the mouth of the river, as a problem of (unfair) distribution.

Böhm-Bawerk's own explanation of interest is as a problem of value. There are two sources to the river – land and labour. The stream of goods they produce is transformed midway by the relationship between subjective wants and the quantity of means available to satisfy those wants. This midstream valuation determines the flows of wages, interest and rent that emerge at the mouth of the river.<sup>21</sup>

Böhm-Bawerk's comparison of these explanation summarizes his evaluation:

Whoever treats the interest problem as a production problem exclusively, breaks off his explanation before he has reached the crucial point; he who treats it as a distribution problem and nothing more, does not begin his explanation until that point has been passed. Only the searcher

who undertakes to shed light upon the remarkable rise and fall in the exchange values of goods, the extent of which constitutes the 'surplus value,' can hope to have gathered from them a genuinely scientific explanation of interest. The problem of interest is, in the last analysis, a *problem of value* (Böhm-Bawerk 1959, v.1, 351).

Böhm-Bawerk's (1959, v.2, 381) quest was “to trace the phenomenon of interest back to the beginnings which are among the simplest natural and psychological fundamentals of our economic system, and then to proceed onward through the phenomena of value.” His value "stream" meets his criteria of tracing the origin of interest back to the *originary* factors of production, and grounding the convergence to equilibrium in the general equilibrium forces associated with the theory of value – the subjective preferences of individuals. In addition, the value theory forces must be operationalized in the relevant markets to show *how* the determination of prices, especially in the labour market, account for a positive rate of interest.

These criteria reveal why Böhm-Bawerk considers Fisher's theory of interest to be inadequate. First, Fisher's theory is only a partial equilibrium theory. Not only are prices given, there is no analysis of factor markets, factor substitution or production. Without this analysis, Fisher does not trace his interest explanation back to the labour market. Although Fisher provides stories of convergence to equilibrium, they occur only in the loan market. This is why there are no statements in Fisher of standard neoclassical relationships like the wage is equal to the discounted marginal product of labour or rent is equal to the discounted marginal product of land (Lutz 1967, 100). The key (for Böhm-Bawerk) analysis of the labour market and production decisions is missing.

Second, Fisher focuses on a price theory explanation. Böhm-Bawerk separated the explanation of interest into two questions – the value theory question as to *why* interest exists and the price theory question of *how* the rate of interest is determined. Fisher claims that an answer to the second question implicitly answers the first question as well. This claim marks the beginning of the subsuming of value theory explanations under price theory explanations of the rate of interest.<sup>22</sup>

Fisher was willing to bypass value theory concerns because, as part of the emerging neoclassical mainstream, he believed that value theory issues were relatively settled. According to Dorfman (1959, v.5, 464), by Fisher's time “the dominant neo-classicists ... felt that value theory was largely a settled issue.” Marshall and Clark had produced a satisfactory synthesis of the classical and utility doctrines so that “fundamental exploration” was “simply not necessary.” Although Fisher's exaggerations of the subjective aspects of his interest theory are a reflection of past value theory battles, his explicit neglect of value theory reflects the relative comfort of an economist whose value theory has carried the day.

Fisher's switch from value-theory combatant to victor is also consistent with his switch in terminology from the "marginal rate of return on sacrifice" (1907) to "marginal rate of return over cost" (1930a). In 1907, while still battling for the subjective theory of value, Fisher emphasized the subjective. By 1930, the place of that value-theory was secure and he could better afford to give equal emphasis to the role of objective cost in interest rate determination.

Although accepting the utility theory of value, Böhm-Bawerk is an Austrian whose views are not entirely mainstream. For him, there are still important value theory issues to be argued. For economists like Fisher, who believe that fundamental value theory propositions have been agreed upon, Böhm-Bawerk's arguments probably appeared as tilting at imaginary windmills.

In a classic article on the Austrian school, Kauder (1957, 413-14) identifies a distinctive Austrian concern for value theory explanations – explanations capturing the “essence” or the “reality underlying a phenomenon.” He contrasts this concern with “contemporary economists” who “do not reach for the everlasting reality behind the floating observations. They work with the appearances of every day life which are reduced by abstraction and isolation to a simplified model.” In other words, most economists are content with price theory models and see no need for underlying value theory.

In evaluating the relative importance of the two key controversies with Fisher, Böhm-Bawerk is unequivocal that the methodological value theory controversy has priority.

it is a trifle whether the "third reason" outwardly is independent of must be grouped under the main heading "first reason." It is of utmost importance, however, for the future development of

economic thought and the problem of interest whether the *causal relationship* between the facts surrounding the interest phenomenon proceeds the way my opponents believe it to proceed, or the way I am inclined to believe (Böhm-Bawerk 1912b, 193).

Fisher's response is equally unequivocal. He rejects Böhm-Bawerk's concern for causal value theory explanation in favour of the concept of equilibrium in a simultaneous equations price theory model.

Böhm-Bawerk claims that merely to *find out* the factors operative in a given problem is not the same thing as to *explain* those factors. He thinks that my theory of interest would be adequate only if the mathematical solution of the problem by means of simultaneous equations, and what he calls the "causal" solution were the same, or at least somewhat similar. .... The causal solution cannot be so simply conceived as to make one factor solely *cause* and *another* solely effect. The advance of all science has required the abandonment of such simplified conceptions of causal relationship for the more realistic conception of equilibrium. Here, all factors are considered as variables. Any disturbance in one factor reacts on all the others, and the variations in these other factors react upon the factor of original disturbance. The mathematical solution of the problem of interest by means of simultaneous equations recognizes the mutual interdependence of all the factors in the interest problem and, at the same time, yields a determinate solution for the problem (Fisher 1930a, 484 Fn 39).

For Fisher, equilibrium is enough.

## 7 CONCLUSIONS

The distinction between value theory and price theory is the key to understanding the controversies between Böhm-Bawerk and Fisher. Value theory provides underlying price-independent determinants of price and one-way chains from cause to effect. Price theory explains the equilibrium prices resulting from the mutual interdependence of variables in a simultaneous equations model. If the

goal of economics is rigorous price theory alone, the controversies seem unimportant and uninteresting. From a price-theory perspective, Böhm-Bawerk is wrong in claiming the independent effect of the third cause of interest, and his insistence on explanation beyond a consistent simultaneous equations model seems wrongheaded or, at best, confounding.

Historically, economists focus on price theory alone during periods when they consider the major value theory battles to have been settled. The Böhm-Bawerk/Fisher controversies occurred during a period when value theory battles were still ongoing. Böhm-Bawerk and Fisher were only the second generation after the marginal revolution, and their controversies were part of the contentious extension of the subjective marginal utility theory of value to new areas of production and distribution. A value theory perspective casts light on the deep theoretical and methodological issues underlying the controversies.

The controversy over the independence of Böhm-Bawerk's third cause of interest was not merely about mistakes in logic and the definition of necessary and sufficient conditions. It was about Fisher's exaggerated emphasis on the subjective causes of interest and his attempts to downplay the role of objective conditions of production. Böhm-Bawerk's theory, although largely neoclassical, contained remnants of classical, objective production elements that Fisher rejected in favour of the ascendant neoclassical emphasis on subjective impatience and a conception of production as exchange with nature.

The simultaneous equations controversy had less to do with Böhm-Bawerk's alleged misunderstanding of mathematics and more to do with fundamental differences between Böhm-Bawerk and Fisher on the need for value theory. For Fisher, who believed the essential value theory issues had been settled, the equilibrium outcomes of price theory were enough. For Böhm-Bawerk, who was still struggling with value theory differences between the classical, Austrian, and other neoclassical approaches, insisted on an accompanying value theory explanation to underlie and complement the price theory model. He sought a one-way value theory explanation from cause to effect that traced the origin of interest back to the *originary* factors of production, labour and land, and grounded the convergence to equilibrium in the forces of the subjective utility-maximizing choices of individuals.

As an Austrian “outsider,” Böhm-Bawerk stood apart from the mainstream in his controversies with Fisher, Edgeworth and others.. As an outsider, important value theory issues were at stake, and his arguments can only be fully understood from a value-theory perspective. The interdependence of equilibrium models did not address his concerns. In contrast, insiders like Fisher believed that value theory issues had been settled and therefore conducted the debate in price theory terms. Equilibrium explanations were enough. From a price theory perspective, the criticisms of the outsiders appear as tilting at windmills or misunderstandings of equilibrium methodology. To understand the criticisms at the heart of these controversies – the “troubled spirits” that recur – a value-theory perspective is essential.

## ENDNOTES

<sup>1</sup> Fetter also made major contributions to the general capital theory literature of this era, including separate debates with Irving Fisher, Charles Tuttle and H.J. Davenport. See Fetter (1977).

<sup>2</sup> For Meek (1974, p. 248), value theory involves “the postulation of some kind of (relatively) independent ‘determining constant’ from which one proceeds to the final conclusion by means of a simple one-directional *catena* of causes.” For Heilbroner (1983, 255), “Value theory is the name we attach to the search for processes or structures that impart orderly configurations to the empirical world, akin to the arcs created in iron filings under the influence of a magnet.” See also Dobb (1940).

<sup>3</sup> The operationalization of Böhm-Bawerk's value theory “in the mechanism of the exchange economy can be shown only by a corresponding theory of price. Böhm-Bawerk therefore turns to price theory, developing the implications of the law of value for the behavior of buyers and sellers” (Schumpeter 1951 [1914], 171).

<sup>4</sup> Böhm-Bawerk (1959, v.2, 273, 283) describes the three causes as: 1) “*difference[s] in the ... provision for wants as between the present and future,*” 2) “*the undervaluation of future goods and advantages by reason of perspective,*” and 3) “*present goods are for technological reasons preferable means to the satisfaction of wants and for that reason they are a warrant of higher marginal utility than are future goods.*”

<sup>5</sup> Böhm-Bawerk (1959, v.2, 269) believed that “Psychologists would appear to be more competent than we economists are” to explain this second cause of interest.

<sup>6</sup> In attempting to measure the degree of roundaboutness, Böhm-Bawerk develops the flawed concept of the period of production, a focus of other controversies. Because Fisher has no objections to the period of production, it does not enter into their controversies.

<sup>7</sup> Böhm-Bawerk (1959, v.2, 361) describes his “endeavour to discover the concrete determinants of the interest rate and to study the manner in which it functions. That method involves varying the factual presupposition, one after the other, of our schematic example and then observing what effect each change has on the determination of the interest rate.” Notice the price-theory emphasis on the “concrete determinants” of the market rate of interest and the comparative statics analysis within an interdependent set of market relationships.

<sup>8</sup> Here is Böhm-Bawerk's (1959, v.2, p.323) own account the interaction of the three reasons in the labour/subsistence market: “The constant presence of the *agio* in favor of present goods works like a self-acting brake on the proclivity to lengthen the period of production. Without functioning as a complete preventative, it does serve to *make prolongation more difficult*; .... And so in the end, under the influence of the *agio* the total subsistence fund is automatically distributed to the individual branches of production in such quotas that each one adopts the production period most favorable to the total provision ...

<sup>9</sup> Böhm-Bawerk, C.W. Mixer and Fisher carried on a separate debate as to whether John Rae anticipated Böhm-Bawerk's theory of interest. Mixer's 1897 article claims that Rae's earlier theory of interest was seminal. Böhm-Bawerk (1900) disputes Mixer's claims. Mixer (1902) replies, as does Fisher (1905) in a review of Böhm-Bawerk (1900). Mixer's 1905 reprint of reprint of John Rae's (1834) *The Sociological Theory of Capital*, together with editorial comments, appears in 1905. [Fisher's correspondence shows his role in championing Rae and Mixer and helping to persuade publishers to accept Mixer's 1905 book.]

<sup>10</sup> The similarities between Böhm-Bawerk and Fisher are even more apparent in this passage from Fisher (1930b, 2-3): “the productivity theorists have assumed time-preference as a part of the eternal order; while the ‘time-necessity’ theorists have taken productivity of nature for granted as a necessary condition of existence. Whether productivity is used to mean the natural increase of plant and animal life or the product brought into being by any labour applied to any material agent, ... there can be no value product and hence no comparative valuation of goods in the present with like goods in the future, except in the minds of men. In other words, the mere physical productivity of nature alone is utterly without power to create any value whatsoever... Hence, a surplus value in the form of interest is not and can not be produced merely by the inherent productive powers of Nature. Similarly, the necessities of men to consume consumption goods in the near present rather than in the remote future can not alone create interest.”

<sup>11</sup> Fisher (1907, 70) concludes “that if we eliminate the ‘other two circumstances’ (relative underestimate of, and overprovision for, the future), we eliminate entirely the superiority of present over future goods, and the supposed third circumstance of ‘technical superiority’ therefore turns out to be non-existent” (1907, 70).

<sup>12</sup> Ironically, Brown (1912, 649-50) asserts the validity of the more balanced view of the determination of interest that Fisher espouses in his own 1907 appendices. “[I]mpatience is not the fundamental cause of modern interest nor even a cause through which all other causes must operate, but ... it is one of two coordinate cause,” the second being the technical superiority of roundabout production.

<sup>13</sup> Elsewhere, Fisher (1930a, 192) says “Nature’s productivity has a strong tendency to keep up the rate of interest. Nature offers man many opportunities for future abundance at trifling present cost.”

<sup>14</sup> This concept of production as exchange with nature persists in later Fisherian versions of neoclassical theory. Hirshleifer (1970, 12) describes production as “transformations of commodity-combinations effected through dealing with Nature rather than through exchange with other economic agents. .... Or to put it another way, production is ‘exchange’ with Nature, while exchange proper represents redistribution of the commodities already made available with the help of Nature.” According to Arrow and Starrett (1973, 133), early neoclassicals “put stress on the notion of exchange as expressing the essence of the economic system; production to some extent appeared merely as an indirect way of exchanging initial holdings.”

<sup>15</sup> Seager (1912, 844) first pointed out Fisher’s emphasis on capital as land instead of as produced means of production. When produced capital goods exist, “the relation between the value of capital and the value of its product is not one of simple dependence from value of products to value of capital, as Fisher represents, but one of mutual dependence,” where cost of production affects the price of capital goods.

<sup>16</sup> See Cohen (2008, 164-167) on Böhm-Bawerk’s differing time preference characterizations of labourers and capitalists.

<sup>17</sup> The passage also includes the statement that “Mathematical determination is neutral with regard to the question of causality. It has nothing to do with it.” Böhm-Bawerk goes on to say “‘Unequivocal determination’ of a problem thus by no means comprises a causal solution. By no means does it protect us from vicious circle explanations. As a matter of fact, we can continue to move in circles with problems that have been determined mathematically. It seems to me that Fisher committed this very error” (Böhm-Bawerk 1912b, 191).

<sup>18</sup> See Böhm-Bawerk (1890, 1894), Macvane (1890, 1892, 1893a, 1893b) and Wieser (1892).

<sup>19</sup> "Standard" is the translation from the German *Massstab*, but the publisher claims that the "title could ... well have read, 'The Ultimate Determinant of Value.'" (Bohm-Bawerk [1894] 1962, 310).

<sup>20</sup> Hennings (1997, 78n) agrees: "Böhm was well aware of the phenomenon of interdependence: he only insisted that it be explained in terms of causality."

<sup>21</sup> The three flows or branches of wages, interest and rent that emerge at the mouth of the river "are neither identical with, nor proportionate in their volume to the two ... springs that formed the headwaters. It is not the relative volume of the spring at the source which determines how great the volume of the spring shall be at the outlet, but rather how great a proportion of the united stream has been pushed into the channel of each branch through the operation of the laws of value" (Böhm-Bawerk 1959, v.1, 350).

<sup>22</sup> "It is, therefore, not necessary in beginning our study of interest to distinguish, as many writers do, between the principles which lead to the *existence* of interest and those which regulate the *rate* of interest. By the existence of interest these writers mean that the rate is greater than zero. It seems preferable to reverse the order of the two problems and seek first to find the principles which fix the terms on which present and future goods exchange, without restricting ourselves in advance to the thesis that, always and necessarily, present goods command a premium over future goods. .... After these general principles have been established a special study will then be in order to discover why the rate of interest is, in actual experience, almost never zero or negative." (Fisher 1930a, 67-8)

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