Critique of Austrian Economics

From 1930 To 1990

by Victor Aguilar

Abstract

The *Quarterly Journal of Austrian Economics* mission statement (Block, Hoppe & Salerno 1998) claims that "This forum is open... to articles expressing cogent criticisms of Austrian economics that are useful in provoking a rethinking and clarification of critical points of its theory, policy, or method. As was the case during our tenure with the *Review of Austrian Economics*, we will not shy away from controversy, regardless of whose oxen are gored."

The purpose of this paper is to provoke a rethinking of Austrian economics and perhaps to gore a few oxen. I have tried to be cogent.

www.axiomaticeconomics.com

Table of Contents

> [Mises] attracted a number of mainly younger economists who almost formed a church in his honor. They tended to misunderstand his main message and greatly exaggerated those minor parts of his work that were wrong.
>
> Gordon Tullock (1999, p. 229)

> Treating Mises' writings critically and professionally has been difficult in the past. Austrian economists too often and too uncharitably have bristled at any criticism that their mentor, Mises, could have been less than omniscient.
>
> Richard Timberlake (1999, p. 273)

Introduction

The year 1930 was a turning point for everyone, that being the year when so many were financially ruined. The University of London invited Dr. Hayek of Vienna to deliver during the session 1930-31 four lectures which were published (Hayek 1967) under the title *Prices and Production*. Thus, the year became a turning point in economics as well: before 1930 "Austrian" denoted only nationality. After 1930, in the context of economic theory, it denoted a coherent belief system. Specifically, Hayek coined a phrase, "structure of production," and drew a graph to illustrate it, the Hayekian triangle. Half a century later, Garrison would assert that "one of the most distinctive features of Austrian macroeconomic theory is its use of the concept of a 'structure of production'" (1978, p. 169).

This was another difficult time for everybody. (Though not, of course, as difficult as 1930.) Interest in theoretical economics being anticyclical, there were many people turning to the Austrians for answers that mainstream economists seemed unable to provide. The two most popular books of the time were by Sennholz (1979) and Skousen (1977), but neither of these were treatises. The most current Austrian treatise was by Rothbard, written well before the stagflation of the 1970s. Rothbard noted that "one of the unhappy casualties of World War I, it seems, was the old-fashioned treatise on economic principles" (1970, p. vii). The overwhelming response to Friedman's 1980 *Free to Choose* TV series should have dispelled any doubts that there

was a demand for a treatise which "the intelligent layman, with little or no previous acquaintance with economics, could read" (p. vii). Yet almost twenty years had passed since Rothbard's challenge and economists seemed content to concede that they had no alternative treatises.

Friedman was the wrong person to look to for a free-market-oriented treatise, however, since his "assumptions do not matter" methodology (1953) really precluded such an endeavor.[1] Inspired by Rothbard's words, I determined to write a treatise on economic principles. It would be a long time in coming (Aguilar 1999) and, when it did, it was not Austrian. The Austrians had to wait only ten years for a treatise (Skousen 1990). Thus, 1990 was another turning point. They had gotten their long awaited treatise.

This is the story of the evolution of Austrian economics from 1930 to 1990. It is divided into two parts: The legacies of Hayek and Mises.

Part I: The Legacy of Friedrich Hayek

Section I: The Aggregate Production Structure

Skousen reprints Rothbard's "Illustration of the Aggregate Production Structure" with a slight revision, the removal of some extraneous lines (1990, p. 187). See Figure 1. His revision is a good one; it makes the graph look more like the histogram that it is. Skousen then illustrates his own "Idealized Aggregate Production Structure" (1990, p. 195). See Figure 2.

Figure 2 is confusing in that it appears that the vertical axis measures time and the horizontal axis measures consumption. Actually, consumption is the intersection of the graph with the horizontal axis. So what does the horizontal axis measure? This is not made clear until we read that "Time is measured on the vertical line, while *both* price and quantity combined (i.e., total [yearly] revenue) for each stage is measured along the horizontal line" (1990, p. 207). Indeed, thereafter the APS graphs (p. 206 *et passim*) have the vertical and horizontal axes labeled "time" and "revenue," respectively.

---

[1] It is significant that Friedman's "Methodology of Positive Economics" was the first chapter of a book titled *Essays in Positive Economics* (1953) and that his classic statement of economic philosophy (1982) was also a collection of essays. His was a methodology for an essayist, not an economist. Before Friedman the most popular economics writer was Hazlitt and after him it was Krugman. Hazlitt was a journalist and could only be expected to write essays, but that cannot be said of either of his successors. It is to their shame that neither man ever wrote a treatise. For all of his weaknesses, at least Rothbard had the courage to "carve out of economic theory an architectonic... an edifice for beginners to see, for colleagues to adopt or criticize" (1970, p. vii). Only by criticism does science advance. The first step towards winning that race is to enter a horse. Essayists are not in the race because, without common assumptions, debunking one of their papers still leaves the others intact.

Skousen defines A and c explicitly (1990, p. 196). The area, A, represents the gross output of an economy during one year. The rate of interest, r, is assumed to be constant throughout all stages.

$$A = \frac{i(e^{tr} - 1)}{r} \text{ with } r \neq 0 \qquad \text{Eq. 1 (Skousen 1990, p. 196)}$$

Also, c, the total consumption value in any one year, is defined as

$$c = i \cdot e^{tr} \qquad \text{Eq. 2 (Skousen 1990, p. 196)}$$

If one were concerned that Skousen's *Structure of Production* was going to turn into a math book, there was no need. These equations never appear again. For the remainder of his book, Skousen draws the APS as a slightly concave line which abruptly intersects the time axis (1990, p. 206 *et passim*), demonstrating that he never really believed it was exponential and/or he does not know what exponential functions look like.

Section II: Wealth or Income?

Skousen asserts, "Let A be defined as the area of the APS. Thus, A represents the gross output of an economy during the year [GNO]" (1990, p. 195). Clearly, his APS graph describes a *flow* of goods.

What did Hayek, the originator of the structure of production, intend it to represent: a yearly flow of goods or a distribution of wealth? These are, after all, very different things. Hayek (1967, p. 40, italics added) writes:

> The area of the triangle shows the totality of the successive stages through which the several units of original means of production pass before they become ripe for consumption. It *also* shows the total amount of intermediate products which must exist at any moment of time in order to secure a continuous output of consumers' goods.

Also? In the first sentence, the word "pass" implies a flow of goods passing by during a certain amount of time. The second sentence refers to the total amount of goods that exist at a moment in time. It is highly irregular for a graph to mean one thing and *also* something else.

This confusion persists throughout *Prices and Production*. Hayek writes, "When I use the expression producers' goods, I shall be designating all

goods existing at any moment which are not consumers' goods" (1967, p. 37). But then, when moving from triangles to histograms, he writes that he will "make cross sections through our first figure [the triangle] at intervals corresponding to the periods chosen, and to imagine observers being posted at each of these cross cuts who watch and note down the amount of goods flowing by" (1967, p. 43). "All goods existing at any moment" is not the same thing as "the amount of goods flowing by."

Later, Hayek repeatedly refers to the "stock of capital" (1967, p. 137 *et passim*) and writes, "any given demand for consumers' goods can lead to methods of production involving very different demands for producers' goods, and the particular method of production chosen will depend on the proportion of the total wealth not required for immediate consumption" (p. 143). His use of the word "wealth" here clearly refers to a stock of capital.

By 1935 this confusion had been brought to Hayek's attention, but he failed to act decisively. His four-year-old lectures, destined to become his best-known work, had much room for improvement, both in style, to reflect his mastery of the English language, and in substance, to reflect the fire-storm of criticism they had provoked. Instead, in the preface to the revised edition of *Prices and Production* (1967, pp. x-xi), he wrote:

> '[D]emand' for capital goods... does not consist exclusively or even primarily in a demand exercised on any market, but to a perhaps even greater degree in a demand or willingness to continue to hold capital goods for a further period of time. [i.e. stock is more important than supply] On the relationship between this total demand and the monetary demand for capital goods which manifests itself on the markets during any period of time, no general statements can be made.... [i.e. stock and supply are different things, measured in different units, and not directly related] The simplest assumption of this kind that I could make was to assume a fixed relationship between the monetary and the total demand for capital goods so as to make the amount of money spent on capital goods during a unit period of time equal to the value of the stock of capital goods in existence.

Retaining this "simplest assumption" was a big mistake. He should have abandoned consideration of the money spent on capital goods during a unit period of time and focused only on the stock of capital goods in existence.

This confusion persists even today. Garrison writes, "The time dimension that makes an explicit appearance on the horizontal leg of the Hayekian triangle has a double interpretation. First, it can depict goods in process moving through time from the inception to the completion of the production process. Second, it can represent the separate stages of production, all of

which exist in the present, each of which aims at consumption at different points in the future" (2001, p. 47). Then, incredibly, he "resolves" this issue by putting two labels on the horizontal axis of his graph.

The problem is that most economists, not just the Hayekians, seem incapable of distinguishing between a supply, or flow, of goods and a stock of goods. It is easy to find examples in almost any economist's writings where the words "supply" and "stock" are used interchangeably, often in the same sentence. Rothbard has written a long book about economics (1970), yet it is unclear whether his aggregate production structure depicts a supply or stock of goods. Maybe, like Hayek, he means one and *also* the other.

Skousen is at least consistent but, unfortunately, he is consistently wrong. He definitely means the amount of goods flowing by every year.[2] My work is about stock, not supply.

> I assert that the stock of phenomena is more important than the supply because all of the decisions made regarding a phenomenon are based on its stock (how much of it is in existence), and not on how much of it happened to be produced in some arbitrary time period. Phenomena are the same whether they are produced in one time period or another. Most people do not know and none care what the supply of phenomena is, they are concerned with the stock; this week's or month's supply is only a small part of the available stock (Aguilar 1999, pp. xxxvii-xxxviii).

This is one reason why I made no mention of Skousen's aggregate production structure. Mainstream economists have rightly criticized Skousen for double counting. But their GNP/GNO debate is irrelevant to a theory concerned only with stock, not supply, so I did not want to get involved. Now, however, in an effort to reach out to the Hayekians, I propose a new statistic: The Distribution of Wealth over the Capital Structure, DWCS.

A distribution of wealth cannot be criticized for double counting because every item is counted only once. Durable goods are spread out over time according to their depreciation function, weighted by time-preference, so the area under it is the item's current value. Inventory items that do not depreciate are discounted for time-preference on the expected time until they make their contribution to final consumption. Thus, the height of the DWCS graph at each point on the time axis is the present value of all the capital goods that are contributing to consumption at that future date.

---

[2] This seems to be the modern interpretation of Hayek's structure of production. For example, Mulligan writes, "This paper examines the extent to which general productive activity [i.e. a flow of goods], measured by sectoral labor employment, responds to interest rates of various maturities" (2002, p. 24).

Conceptually, the economist's job is easy. He can just mark everything with its present value and the time until it will contribute to consumption. Of course, most of those numbers would be pure guesswork since they concern predictions about the future, but the *concept* is an easy one.

This is in contrast to Skousen's instructions (1990, pp. 184-185), which are conceptually difficult because they require people to remember the date of an item's manufacture and when its costs of production were paid. Economists trained in the subjective theory of value would have trouble seeing the relevance of such information. Admittedly, though, there is little guesswork in collecting it, provided that people have saved their receipts.

Section III: Sideways and Backwards?

The first thing any mathematician will say about the graph of the APS (Figures 1 and 2) is that it is sideways and backwards. From Skousen's equations 1 and 2 it is clear that time, *t*, is the independent variable and independent variables always go on the horizontal axis, not the vertical one.

Hayek (1967, p. 41) writes:

> It is convenient to treat the quantity of intermediate products at any point of this stream as a function of time f(*t*) and accordingly the total quantity of intermediate products in the stream as an integral of this function over a period p equal to the total length of the process of production.

Having written that he would "treat the quantity of intermediate products as a function of time f(*t*)," Hayek too should have known better than to put the independent variable, time, on the vertical axis.[3]

Thus, for the DWCS, time goes on the horizontal axis. But should we put consumption goods to the left and investment goods to the right, or the other way around? In other words, does time run forwards or backwards?

---

[3] Hayek (1967) provides no explanation for why he put time on the vertical axis. His contemporary Strigl, who is a Neo-Ricardian and does not employ Hayekian Triangles, titled a chapter of his book (2000) "The Vertical and Horizontal Connectivity of Prices" and seems to assume (p. 38) that readers already associate "vertical" with the law of costs and "horizontal" with the principle of substitution. Skousen writes, "The direction of economic activity can be illustrated by an assembly line. Another way to look at the transformation of goods through time is as the branches of a tree, which Morishima calls the 'genealogy of production'" (1990, p. 140). Genealogical charts, which have time flowing from top to bottom, date back well before Henry Ford invented the assembly line, which moves horizontally. Skousen's APS should be depicted as a conveyor belt with a queue of products on it that physically get bigger as they approach final assembly, but that is because the APS graph depicts a flow. The DWCS graph depicts a distribution and mathematicians have always drawn distributions the same way, with the independent variable on the horizontal axis and advancing rightward, so there is really no debate about how it should be oriented.

Skousen writes, "Capital goods manufactured prior to the current year are *not* incorporated in the APS even though they may be used in the production of current goods and services" (1990, p. 185). But then he contradicts this view by writing that "the APS can be viewed as a representation of the economy in the past, present, and future" (p. 197). He got it wrong both times. The DWCS includes all wealth currently in existence, which was (of course) all manufactured in the past. But its date of manufacture is irrelevant since its value is determined entirely by considerations of the future. By the subjective theory of value, all goods are valued for their contribution towards *future* consumption, not for their *past* cost of production.

Thus, consumption goods should be on the left side of the graph at time zero. That is why producers' goods are called "higher order goods;" because they get a *higher* position on the time axis. Rothbard has the numbers one through six on his graph printed backwards.[4]

Rothbard's mistake originated with Hayek, who consistently used the terms "earlier stages" and "later stages" backwards. This is ironic since the great contribution of Menger and Böhm-Bawerk, under whom Hayek studied, is the subjective theory of value. Using Menger's "law of imputation," Böhm-Bawerk (1984) led the attack on Marx's labor theory of value and, more generally, on the cost-of-production theory of value. As Skousen says, "Menger had reversed the direction of causation between value and cost. A consumer good is not valued because of the labor and other means of production used. Rather, the means of production are valued because of the prospective value of the consumption goods" (2001, p. 182).

Menger (1981) and Böhm-Bawerk (1959) did not use the terms "earlier stages" and "later stages" but spoke only of higher and lower order goods. When Hayek uses these time-specific terms he is speaking from the perspective of the owner of the final product looking back on his costs of production. He is speaking from Marx's perspective. And that is the perspective that Böhm-Bawerk (1984) went to such pains to refute. In 1941 Hayek (1975, p. 89) dropped these terms and wrote:

> The definition of capital as the produced means of production... is a remnant of the cost of production theories of value.... But, except as a source of knowledge, the actual history of a particular thing... is entirely irrelevant. It has nothing whatever to do with the decisions as to how the thing

[4] Garrison has time on the horizontal axis though he still has it backwards: "The axes have been reversed for convenience of exposition.... The production process begins at point T in Figure 1 and proceeds leftward" (1978, p. 171). Figure 1 (p. 172) has the horizontal axis labeled "← time" with the arrow showing time running backwards. It should be consumption expenditures on the left, arrow pointing to the right.

> shall be used henceforth. Bygones are bygones in the theory of capital no less than elsewhere in economics. And the use of concepts which see the significance of a good in past expenditures on it can only be misleading.

But *Prices and Production* was more widely read than *The Pure Theory of Capital*, so this initial mistake of Hayek's was perpetuated by Rothbard and then by Skousen, even after their master had himself rejected it. The perspective that we want is from right now, at time zero, looking forward into the future. Thus, the DWCS is defined from zero to positive infinity.

Section IV: The Average Period of Production

Böhm-Bawerk (1959, v. 2 p. 86) wrote of an average period of production and was roundly criticized for it:

> Let us suppose, for instance, that the production of a consumption good costs a total of 100 working days. (Let us ignore the cooperating uses of land, just for the sake of simplicity.) Of these, one day was expended ten years ago, further, one day was expended in each of the following years from the ninth to the second. The remaining ninety days were expended in the year immediately preceding completion of the good.... The average recovery of the entire 100 days would then be in accordance with the following formula: $\frac{10+9+8+7+6+5+4+3+2+1}{100} = \frac{55}{100}$

There is no necessity in giving this dead horse another kick. Skousen writes, "It was in part because of this average formulation that Menger referred to Böhm-Bawerk's theory as 'one of the greatest errors ever committed'" (1990, p. 24). He calls this "baffling," though later he writes, "Böhm-Bawerk's controversial solution [to the seemingly infinite period of production] is not only wrong, but it is unnecessary. It has been rightly criticized by economists, even by sympathizers. Rothbard calls the average period of production a 'mythical concept.' Mises states '[it] is an empty concept'" (1990, p. 151). Garrison writes, "[Böhm-Bawerk] obscured the essential subjectivist theme and needlessly exposed [Austrian economists] to criticism from a formalistic point of view. History records the dissatisfaction with these developments on the part of Menger and other members of the Austrian School. Mises rejected the arithmetic approach offered by Böhm-Bawerk and recast the arguments in a subjectivist mold" (1985, p. 163).

Menger's criticism of his wayward student need not baffle us. Böhm-Bawerk made a name for himself in 1884 with his *History and Critique of*

Interest Theories, which was really just shooting fish in a barrel. Five years later his *Positive Theory of Capital* was both good and original. Unfortunately, the good parts (value and price) were not original, being just a restatement of Menger (1981), and the original parts (the average period of production and roundaboutness) were no good. His defensive *Further Essays* did little to strengthen his position.[5,6]

It was with the publication of Böhm-Bawerk's 1889 *Positive Theory of Capital* (1959) that Austrian economists split into two branches. Menger did not find a worthy successor until Mises, two generations later, and together they laid the groundwork for the Axiomatic School founded by this author (1999). Meanwhile, Böhm-Bawerk was laying the groundwork for what would become the Hayekian School. Then the next generation divided both branches again. Mises and Hayek took up Menger's and Böhm-Bawerk's work, respectively. At the same time, Böhm-Bawerk's student Strigl would work along the lines of Ricardo's corn model[7] and Morgenstern would team up with von Neumann to invent game theory.

But the focus on ethnicity obscured these essential distinctions. Keynes and Marshall are both English and Sraffa and Modigliani are both Italian, but nobody thinks to lump their theories together on the basis of race. Why do so with the Austrians?

---

[5] These three volumes are collected under the title *Capital and Interest* (Böhm-Bawerk 1959).

[6] Böhm-Bawerk was a better social philosopher than he was an economist. For instance, he writes, "We may define social capital as an aggregate of products which serve as a means of the acquisition of economic goods by society" (1959, v. 2 p. 32). He specifically excludes the means of subsistence of productive workers as a part of social capital. This focus on definitions may seem pedantic until we read that "There is but one basis for a contrary conclusion. That would be to classify workers, not as members of a civil society for the benefit of which the economy is conducted, but to regard them as objective labor machines. In that case – but only in that case – the workers' maintenance would be in the same class as fodder for beasts of burden and fuel for machines; it would be a means of production; it would be capital" (1959, v. 2 p. 71). Böhm-Bawerk denounces "the tendency among English economists – often and quite justifiably censured – to regard workers as producing machines; that view made their wages a component part of production costs, and counted them a deduction from national wealth instead of a part thereof" (1959, v. 2 pp. 72-73). By "English economists" he means Ricardo and his followers. Ironically, the first post-Menger economist to raise the Neo-Ricardian flag was Böhm-Bawerk's own student Richard Strigl. What Hoppe translates into "rations of the means of subsistence" should have been translated into "corn" to make it more clear to modern readers that Strigl is following Ricardo's corn model (2000, p. 21).

[7] Lest there be any doubt about this, consider Strigl's conception of his task: "The problem was formulated as such: what is the prerequisite for production's taking advantage of the increased returns associated with choosing roundabout methods of production? We found that the existence of a subsistence fund was the prerequisite. While analyzing roundabout methods of production, we found further that there existed various specific provisions of goods whose production, on the one hand, was the result of choosing roundabout methods of production and whose expenditure, on the other hand, was necessary for the continuation of the roundabout process of production, and which had to be continuously reproduced in order to maintain it" (2000, p. 26). More concise is Sraffa's title *Production of Commodities by Means of Commodities* (1960).

Forty-two years after Böhm-Bawerk's attempt, Hayek tried and failed to measure the period of production. He defines "average" as half the time since the application of the original means of production:

> As the average time interval between the application of the original means of production and the completion of the consumers' goods increases, production becomes more capitalistic, and *vice versa*. In the case we are contemplating in which the original means of production are applied at a constant rate throughout the whole process of production, this average time is exactly half as long as the time which elapses between the application of the first unit of original means of production and the completion of the process (1967, p. 42).

Another dead horse. As everyone knows, the average and the midpoint of a distribution are not the same thing. 1930 was indeed a turning point for the Hayekians. Unfortunately however, and largely because of this failure, it was a turn towards oblivion. The following passage (1967, p. 43) is *the* turning point:

> A perfectly continuous process of this sort is somewhat unwieldy for theoretical purposes; moreover such an assumption is not perhaps sufficiently realistic. It would be open to us to deal with the difficulties by the aid of higher mathematics. But I, personally, prefer to make it amenable to a simpler method by dividing the continuous process into distinct periods.

The histograms did not help his exposition. Most of his third lecture (1967) is devoted to saying, basically, that the DWCS remains smooth and continuous even as its parameters change. In the context of a discreet histogram, that is a tough sell. Had he initially defined f(*t*) to be a smooth and continuous function, it would have been easy.[8]

---

[8] Histograms *do* illustrate the proportion of the total movements of goods which is effected by exchange against money. Hayek writes, "If we divide the path traversed by the elements of any good from the first expenditure of original means of production until it gets in the hands of the final consumer into unit periods, and then measure the quantities of goods which pass each of these lines of division during a period of time, we secure a comparatively simple measure of the flow of goods without having recourse to higher mathematics. Thus, we may say that, in the instance we have been considering [in which the whole process of production is completed by a single firm], money has become more efficient in moving goods, in the sense that a given amount of exchanges against money has now become sufficient to make possible the movement of a greater volume of goods than before" (1967, p. 65). For example, early Fords were made almost entirely "in house," that is, steel went in one end of the factory and Model Ts came out the other end. Today there are hundreds of companies each supplying Ford with some part and relying on other companies to supply them with even smaller parts. That there are many such industries so organized explains why the demand for money has increased far beyond what population figures would suggest. But

By substituting a histogram for his continuous function, f(*t*), Hayek was trying to make his simplistic conception of "average" seem more at home. Had he stayed with the continuous function he would have had to explain why it had such an abrupt *t*-intersection and not, as would seem more intuitive, asymptotically approach the time axis. But histograms, being discrete, must have an abrupt beginning and hence a finite range. If one conveniently has an even number of bars each the same width, it seems natural to divide them into two groups with a faint dashed line.

Another forty-seven years later Garrison had a suggestion: "A third though not independent dimension of capital can be envisaged which represents a composite [product] of the two dimensions [time and money].... Much ambiguity can be avoided by using [this] concept of *aggregate* production time rather than *average* production time or *average* period of production" (1978, p. 170). And, indeed, the accompanying figure (p. 174), reprinted here as Figure 3, has the axes labeled $ and APT.

Quite frankly, this does not make any sense. A change of variables just makes the graph look different. It does not attach any meaning to its "average." In any case, Figure 3 should be a parabola in the new coordinate system. Hayek's triangle in the *m*-*t* plane is defined by $t = \frac{c\text{-}m}{r}$. In the *u*-*v* plane, with $u = m$ and $v = tm$ (Garrison's APT dimension), it is $v = \frac{u(c\text{-}u)}{r}$. Here *t* = time, *m* = money, c = consumption expenditures and r = interest.

r = interest? Garrison claims that "the slope of the line [hypotenuse] is the (simple) rate of interest (profit) when the economy is in equilibrium" (1978, p. 173). No, it is not. Compound interest is exponential and interest is *always* compounded – there is no such thing as "simple" interest.[9]

Readers familiar with calculus will recall changing variables to facilitate integration. To integrate in the *u*-*v* plane, however, Garrison needed to mention that the Jacobian of his transformation is $\frac{1}{u}$. But we already knew the formula for the area of a right triangle, so making this integral more tractable could not have motivated the change of variables. Whatever Garrison's motivation was, very little of his paper makes any sense.

---

this has nothing to do with business cycles. For *that* the structure of production must be defined as a distribution of wealth.

[9] Nobody accepts that the rate of interest can be represented by the slope of a straight line. That might have worked for a 1930 lecture, but today anyone with $20 can buy a calculator programmed to do time-value-of-money calculations. They may not understand the math, but they know very well it is not linear.

But there must be *some* temporal measure or the Hayekian's incessant references to "lengthening the period of production" would not mean anything at all. Skousen asserts that the average "is not only wrong, but it is unnecessary" (1990, p. 151). He is half right. It is definitely wrong, but it (or a similar concept) *is* necessary. Thus, having banished Böhm-Bawerk's average from the front door, he is forced to re-admit it through the back door. Skousen's explanation of business cycles depends on credit expansions lengthening the period of production and on the inevitable contraction shortening it. But it is impossible to talk about something being lengthened or shortened unless one knows how to measure it. If Hayekian business cycle theory is to be salvaged, it is necessary (but not sufficient) to attach a measuring rod to the period of production.

What to do? What to do?

First of all, Hayekians should stop using the word "average." Words have meaning and the meaning of this one is the sum of a finite set of numbers divided by the number of elements in the set. Hayek's statistic is actually the midpoint, half the range. But neither average nor range have any meaning in the context of a continuous distribution defined out to infinity.

Skousen and other modern Hayekians have stopped using this word, but not because they stopped using the concept. Basically, when confronted with Böhm-Bawerk's inability to defend his average, Hayekians just substituted the phrase "lengthen the period of production" for the debunked phrase "lengthen the average period of production."[10]

The next step is to attach some meaning to this oft-used phrase. The continuous analog of the average is the mean. So does this imply that Hayekians can stop dancing around their now nameless concept and just slap this new word on it? No. They would have to *prove* that the mean meets the conditions that they have placed on the concept previously known as "average." But what, exactly, are those conditions?

Rothbard writes, "the production structure is lengthened, and the prices of original factors specialized in the higher stages rises. The prices of capital goods change like a lever being pivoted on a fulcrum at its center; the prices of consumers' goods fall most, those of first-order capital goods fall

[10] See for example Cochran, Call & Glahe, "The credit expansion is the familiar Mises-Hayek business cycle theory.... Consumer preferences, augmented by an interest-rate-induced overconsumption, are pulling resources into a *shorter* structure of production, while the credit expansion is attempting to attract resources to support a *longer* production structure. The resource base is ultimately not sufficient to allow completion of both structures simultaneously. This scenario is an updated version of the benchmark case used by Hayek in *Prices and Production* (1967)" (2003, p. 69, italics added). Shorter or longer what? Average?

less; those of highest-order capital goods rise most, and the others less" (1970, p. 855). He does not define "center." But, since he is following Hayek, he probably means the midpoint. Hayek (1967, p. 75) discusses this pivoting action but does not specifically say that it occurs at the midpoint, or anywhere else, because he is using histograms. To describe a function that is pivoting around a moving point requires calculus, not bar charts.

Garrison (2001, p. 47) follows Hayek (1967, p. 39) to the letter by drawing his triangle with five stages: mining, refining, manufacturing, distributing and retailing. Yet he infers a great deal more from the same illustration. He explains "Five gives us just the appropriate degree of flexibility: a structural change that shifts consumable output into the future, for instance, would involve an expansion of the early stages (with the first stage expanding more than the second), a contraction of the late stages (with the fifth stage contracting more than the fourth), and neither expansion nor contraction of the (third) stage that separates the early and late stages" (2001, pp. 46-47). Hence we see that Garrison explicitly places the pivoting action at the midpoint, whereas Hayek demurred.

O'Driscoll and Rizzo write, "A fall in interest rates, generated by monetary expansion, will not increase uniformly the value of all investment projects. The value of investment projects yielding consumption output in the more distant future rises relative to projects with more immediate payoffs. We call these projects and capital goods type 1 and type 2, respectively.... For type 1 goods the stream [of quasi-rents] tends to rise; for type 2 goods the stream tends to fall" (1985, pp. 205-206). The terms "type 1" and "type 2" are then used freely without any effort being made to locate the boundary between them.

Similarly, Skousen writes, "At a certain point somewhere in the middle of the APS, the positive forces... equal the negative forces... and there is no change in output at that central point (C). Above point C, an expansion of higher order production takes place. Below point C, there will be a decline in lower order production" (1990, p. 237). No effort is made to locate exactly where this central point is in the middle of the APS.

None of these economists admit that their central/boundary point is the Hayekians' old nemesis, the average period of production. Clearly, they still do not know how to measure it. Placing their pivot point "somewhere in the middle" is a little vague, to say the least.

But, if it is really true that a change in interest rates causes the DWCS to increase on one side of the boundary and decrease on the other, then the so-

lution is simple: Just differentiate the DWCS with respect to r, set this derivative equal to zero and solve for *t*.

Before we can differentiate the DWCS we must define it mathematically. Skousen's never-used-again equations 1 and 2 are actually the best idea he had. Compound interest grows exponentially, so let us look at the exponential distribution, re^{-rt} for $0 \le t < \infty$. See Figure 4.

Convergence must be our first result. The area out to infinity represents wealth so, clearly, it cannot be infinite. There should be no need for the initial cutoff as in Skousen's Figure 2 or Garrison's Figure 3.

$$\int_0^\infty re^{-rt}dt = 1 < \infty \qquad \text{Eq. 3 Convergence}$$

For continuous distributions, the definition of the mean is similar to the definition of the average except that integrals replace finite summations.

$$\int_0^\infty tre^{-rt}dt = \frac{1}{r} \qquad \text{Eq. 4 Mean}$$

The DWCS is the exponential distribution scaled up by A, the wealth of the nation. That is, the DWCS is the function $f(t) = Are^{-rt}$ for $0 \le t < \infty$.

Is the mean the central/boundary point of Rothbard, Garrison, O'Driscoll, Rizzo and Skousen? Is it the point where the function pivots like a lever on a fulcrum? This is an easy question to answer: Differentiate Are^{-rt} with respect to r, set this derivative equal to zero and solve for *t*. Thus, $\frac{\partial f}{\partial r} = Ae^{-rt} - Atre^{-rt}$. The exponential function is always nonzero so, having set the derivative to zero, we can divide Ae^{-rt} out of both sides to get $1 = tr$. Hence, the central/boundary point is at $t = \frac{1}{r}$, the mean. Q.E.D.[11]

Considering the "roundabout" process that began with Böhm-Bawerk's simplistic average, Hayek's calling the midpoint the average, Garrison's changing variables for no apparent reason and finally Skousen's striking the a-word from his vocabulary, this is a genuinely remarkable result. In spite of using the word "average" in its most colloquial sense, the Hayekians came surprisingly close to the solution to their problem. The continuous analog to the average *does* meet their conditions. They really can slap the word "mean" onto the concept previously known as "average."

[11] Quite Easily Done. Or, as Böhm-Bawerk would say, as plain as a pikestaff.

Thus, while we have not resurrected Böhm-Bawerk's much-maligned average period of production, we have entered a horse of the same color. That is as close as we can get to vindicating Böhm-Bawerk. His ghost can finally rest in peace and stop banging on the pipes at Auburn University. The Hayekians once again have a horse in the business cycle theory race.

Section V: Roundaboutness

Both of Böhm-Bawerk's original contributions (the average period of production and roundaboutness) have been retained a century later and they continue to be weaknesses in the Hayekian position.

The average period of production was the topic of the previous section. What are the weaknesses in roundaboutness? Böhm-Bawerk (1959) was unclear (and perhaps confused himself) about the concept, making it seem that longer processes were more productive *because* they were longer. In fact, processes both short and long can be productive, but the short ones have already been done because people naturally prefer to accomplish their objectives quickly. The reason that increased savings make a people more productive is because it allows them to exploit certain productive processes (the long or "roundabout" ones) from which they had previously been excluded. This was clear at least by 1941 when Hayek wrote:

> Against this it has been rightly argued that the discovery of new, hitherto unknown, ways of producing a thing will be just as likely to shorten the duration of the process as to lengthen it. [Roundaboutness] has nothing to do with technological progress in this sense. On the contrary, it refers to changes under conditions where knowledge is stationary. All that is assumed is that at any moment there are known possible ways of using the available resources which would yield a greater return than those actually adopted, but would not yield this return until a later date, and for this reason are not actually used (1975, p. 72).

Skousen seems to be clear about this, writing that "it should be noted that all technical developments involving shorter processes and higher productivity have already been undertaken by entrepreneurs. Therefore, any new processes being considered must either involve a more lengthy period of production or be more profitable than current processes" (1990, p. 223).

This confusion is not why roundaboutness is a weakness for post-1930 Hayekians. A century ago, Böhm-Bawerk's opacity (1959) had everyone going around about what he meant, but modern Hayekians seem to have this concept pretty well nailed down. The weakness is that roundaboutness (the

specificity of capital goods) is the only nail holding their theory down and they hammer on it relentlessly. Skousen writes:

> The very essence of the market economy is the specificity of capital goods. Suppose, for the sake of argument, that all capital goods were completely non-specific and totally versatile. This would mean that they could be transferred from one project to another at no cost. If this were the case, there would be no structure to the economy and therefore no lags, no structural unemployment of resources or labor – in short, no business cycle. Capital goods are *specific* in nature, although some are more specific in use than others. But the degree to which producer's goods and machinery are nonspecific – that is, usable in more than one stage – is the degree to which the economy will be flexible in adjusting to monetary disequilibrium (1990, p. 155).

Those are strong words. It sounds as if we can refute all of Hayekian business cycle theory with one counter-example, the boom and bust of a non-specific capital good – for instance, the dot.com bubble. Websites are capital because they are not valued directly but only as a means for obtaining the products they advertise. The dot.coms are highly non-specific, facilitating the sale of products at every stage of production. Non-specificity is, in fact, the great virtue of the internet. Television and radio are only useful for consumers' goods; yellow pages are only useful for local businesses; and trade magazines, the traditional forum for advertisers of producers' goods, lack the convenience of surfing the net. When one can obtain anything on the internet that one desires, from machine tools to pornography, I defy Garrison to tell us in which of his five stages (mining, refining, manufacturing, distributing and retailing) the dot.coms belong.[12]

Rothbard is as emphatic as Skousen: "What are the consequences [of a credit expansion]? The new money is loaned to businesses. (To the extent that the new money is loaned to consumers rather than businesses, the cycle

[12] The recent paper by Callahan and Garrison, *Does ABCT Help Explain the Dot-Com Boom and Bust?*, sounds like it might answer our question. Callahan and Garrison write, "conventional macroeconomic aggregates [e.g. the CPI and the PPI] are not the focus of our historical interpretation" (2003, p. 68). Very well. But Hayekian aggregates – the five stages defined by Garrison (2001, Figure 3.5, p. 47) – are never mentioned either. All that Callahan and Garrison really do is quote from Brenner (2002), who is apparently their only authority, and present some data correlating the Federal Funds Rate with the NASDAQ Composite. They write, "We will show Fed funds rates against the NASDAQ Composite index in these tables, since the NASDAQ is the 'tech stock' exchange, and most of the dot-com stocks traded on it" (2003, p. 71). Yes they did. But so did many tech stocks that *can* specifically be placed in one of Hayek's higher stages. Since the people who compile stock indexes have probably never even heard of Hayek, their decision is far from definitive. I continue to ask: Can Garrison tell us in which of his five stages the dot.coms belong?

effects do not occur.) These businesses, now able to acquire money at a lower rate of interest, enter the capital goods' and originary factors' market to bid resources away from the other firms" (1970, p. 855). An easy counter-example is cycle effects occurring when new money is loaned to consumers. In the 1990s, banks would make consumer loans up to 125% of the equity in people's houses. Today, foreclosures are skyrocketing and the streets are lined with "We Buy Ugly Houses" billboards.

So, has all of Hayekian business cycle theory been refuted by these counter-examples? No, for there is still much that it can explain. The tech boom and bust (excluding the dot.coms), for example, played out mostly according to the Hayekian script, since most tech stocks *are* higher order goods. Their theory can provide a *partial* explanation of business cycles.

Section VI: The Natural Rate of Interest

With the average period of production and roundaboutness, the third leg of Hayekian economics is the natural rate of interest. Böhm-Bawerk's theory of interest was muddled and somewhat resembled the productivity theories which he himself had criticized. Instead, the Austrians sought foundations from the Swedish economist Wicksell. However, though he was a better economist than Böhm-Bawerk, his natural rate of interest is really no stronger than the other two legs of Hayekian economics.

The reason that so much controversy surrounds this concept is because nobody has ever seen a natural rate of interest. Economists draw their usual crossed lines (here labeled "savings" and "investment" rather than "supply" and "demand"), but where they cross is pure speculation. It has nothing to do with real-life "Fed watching."

So, if the Fed has so much control over the Federal Funds Rate that they appear to be setting it by decree, what are all those crossed lines for? This author's treatise (1999), is certainly the only economics book that does not contain *any* crossed-line graphs.[13] I do not believe in supply and demand.[14]

---

[13] Mises (1966) does not either, though for a different reason. He believes in supply and demand, but not in the continuity of their graphs. This author does not believe in supply and demand at all.

[14] Block writes, "Supply and demand have been with us for a long time, yet no one is calling for their amendment" (2001, p. 64). I call for their rejection. Block, Hoppe and Salerno write, "scientific progress occurs not by a process of smooth and ever-broadening consensus among different approaches, but via jarring and revolutionary paradigm shifts" (1998, p. iii). However, a year later Hoppe did not find the rejection of supply and demand sufficiently jarring to bother reviewing *Axiomatic Theory of Economics* (Aguilar 1999). Instead, and in spite of their bold mission statement, they continue beating the same horse that threw Hayek in 1936, apparently expecting it to rise from the dead and finish the race with Garrison at the reins.

I believe in the demand distribution, which is a mapping between price and stock. Supply has no place at all in my theory. See (1999, pp. xvii-xviii):

> A large part of the problem with supply and demand is that it is used descriptively, but called predictive. It is easy to predict the past. Economists just observe the quantity produced one month and what it sold for and they put a little × over that spot. Then, by pure conjecture, they draw four tails on their × to fill their graph paper. Supply and demand has never been used predictively, not even to make bad predictions. × marks the spot is a purely descriptive technique. Since they are using the 20-20 vision of hindsight, they can do this for three months in a row and, to nobody's surprise, the sum of the quantities is the quarterly quantity. In the real world, price is constant for years at a time but, for most companies, their weekly and monthly sales figures swing wildly and unpredictably, sometimes by several fold from one month to the next.

The natural rate of interest is worse, since economists do not even know where to put their little ×, much less how to draw the four tails on it. Short term interest rates are set by the Federal Reserve.

Garrison has the interest rate determined by the supply and demand of present goods, labor for wages: "Labor services represent future consumption goods.... The sale of labor services, then, constitutes the demand for present goods and the supply of future goods" (1978, p. 175). The accompanying figure is reprinted here as Figure 5. This implies that production is not the complicated structure it was originally described to be, but is really quite simple: All labor is used at the high end (not spread throughout the structure), is paid for entirely with borrowed money and borrowed money is used for no other purpose (like buying capital) except paying wages.

First an ill-conceived change of variables, then a horizontal axis labeled with time running backwards and now a definition of interest that involves only present goods! Garrison's *Diagrammatical Exposition* (1978) is certainly the low point in Hayekian economics. Twenty-three years later, Garrison would write that "it continues to appear on Austrian economics reading lists" and is "largely compatible with the graphical exposition offered in the present volume" (2001, p. xii). Frankly, that is hard to believe.

If the Hayekians must have a "natural" interest rate, they would have been better off sticking with the classical crossed-line graphs. However, this author declines to define a natural rate of interest.

> The concept of a "natural" rate of interest, which the actual rate of interest (charged by banks) tends toward, is a trap that virtually every established

> school of economics has fallen into.... However the "natural" rate of interest is defined, if it is defined at all, the concept has led to some of the most serious mistakes in economics (1999, pp. 156, 157).

Many people in the business community shun Austrian economists, not so much because they disagree with their theory, but because it comes across as being rather naïve.[15] We saw in the previous section that Hayekian theory depends entirely too much on the specificity of capital goods. In reality, many companies make products or provide services which are used in all of Hayek's five stages – and they experience cyclical behavior too. The dot.coms experienced more extreme cyclical behavior than many of their brethren on NASDAQ who *can* be placed solidly in one of the higher stages of production.

But Austrian economists' most egregious display of naïveté is in regards to their conception of a natural rate of interest. There is no such thing. In any case, credit limits are more important than interest rates and there are many people who cannot get credit at any rate.[16] Interest rates only affect how much money is being transferred. They do not affect who gets it.

Economists define a "small business" as one with fewer than 500 employees. Once companies get close to that size they can borrow money, though not at rates anywhere close to prime. The prime rate does not become meaningful to companies until they are well past the junk bond classification and closer to the Fortune 500 classification. Companies big enough to be listed on the major stock indexes (DOW, S&P 500, etc.) sell most of

---

[15] People in the engineering community shun Austrian economists because their math is so weak. This is too bad because, the skills of engineers being among the highest order of goods, they suffer from volatile employment. Thus, if they were not put off by the Austrian's weak math, they would believe in their theory.

[16] The fact that many people cannot get credit at any rate is obscured by calling certain transactions loans when they are not. When two people sign a contract exchanging present goods for future goods, which one is the creditor and which one the debtor? This may seem obvious, but let us spell it out: The creditor is the one taking the risk, who provides present goods and *trusts* the other to deliver something of greater value in the future. When a poor working person goes hat-in-hand to the auto dealership and asks "Will you give me credit?" he has got the question backwards. He is giving them present goods (his trade-in and/or down payment) in exchange for future goods, the title to the new car five years hence (when it is not new anymore). In the meantime he makes monthly payments to the bank, the insurance company and the dealership for their warranteed repairs. Being allowed physical possession of something that someone else owns is what is called "rent" and that is what these payments are. Until he gets a clear title he has not bought anything. At any time, regardless of payment history, the bank is within their rights to repossess that car and rent it to someone else. The customer *trusts* them not to do this but cannot legally prevent it. The bank takes no risk because the customer pays for insurance and repairs. If he skips out, the car he has been renting is of no value to him because he cannot sell it, register it or insure it without their consent. If he drives it without current plates, the police will quickly send him to jail and the car back to its owner, the bank.

their stock to large investors (mutual funds, insurance companies, etc.) who can borrow money for that purpose. Until companies reach that size, all talk of interest rates is irrelevant to them.[17]

Recently, Stiglitz and Greenwald have raised the same issue. "That some loans are not repaid is central... Thus, a central function of banks is to determine who is likely to default, and in doing so, banks determine the supply of loans" (2003, p. 3). This idea, that bank loans redistribute wealth from one class of people to another, is a fundamental departure from the classical view that banks merely divide the world into those who are willing to borrow at x% but not at x.1%, without any regard to who those people are, their class or their importance to the government.

This author writes:

> I assert that, during boom times, capital is being wasted by every company, from the largest multinational down to the smallest mom-and-pop outfit. This is a harsh assessment of their business practices and the directors of small businesses might complain that I am being unfair to them. Small businesses cannot get credit at any interest rate, even during boom times, and are rarely seen building the grandiose projects that large businesses embark on during a boom. If they are large enough to be publicly traded, however, then some of their stock is held by people or organizations that can borrow from banks. Also, if the rest of the stock market is overvalued, companies will be pressured into reporting unrealistic profits to keep up. Slow, steady growth is unacceptable. Those who do not report extraordinary profits fail. Thus, during boom times, every quarterly report is treated as an emergency[18] and companies consume their capital to meet that emergency. Because of this, the first sign of a bust is when small companies that had previously reported extraordinary profits start to fail and are suddenly discovered to be operating on a shoestring with worn-out and obsolete capital. Unfortunately, this usually goes unnoticed in the glow of the still rising stock indexes, which measure the value of large companies. Companies that are too small to be publicly traded also waste capital. Their owners do not reinvest their profits but let their businesses deteriorate while they buy stocks of larger, publicly traded companies. Thus, boom times are characterized by a transfer of capital from smaller

[17] If it is not clear already, it will be soon: This paper was not intended to help me get on Roger Garrison's good side. Nevertheless, let me take this opportunity to offer him an olive branch. Chapter Six of his recent book (2001) is good and his suggestion of "attempting to explain episodes of boom and bust by contrasting the market's allocation of risk-bearing and policy-induced distortions of risk-related market mechanisms" (p. 110) has merit. This author would emphasis credit limits over interest rates, however, and would point out that "risky" is often just a euphemism for "politically unconnected." Bankers loan money to their friends and call it "risk management" when, in fact, their friends are the least likely to pay it back.

[18] On the subject of companies being pressured into reporting unrealistic profits and on how every quarterly report is treated as an emergency, I refer the reader to Berenson (2003).

> companies to larger ones, and the big ones waste it. Also, while small businesses cannot get credit during a boom, home loans and car loans are easy to obtain, so a lot of capital is converted directly into consumer goods (1999, p. 160-161).

Stiglitz writes, "During the bubble, of course, all kinds of resources get wasted – in amounts that are often hard to fathom, and make government waste look small by comparison" (2003a, pp. 62-63). This may seem like a safe and even an obvious thing for an economist to say, but it is actually a dramatic departure from the mainstream.

First, he admitted that government waste exists. Anyone who has taken a college economics class knows that government expenditures, G, are just added into national income, Y, without any comment on whether they were well-spent or not. Even more remarkable, he mentions problems during the boom. Every textbook in America begins its analysis of the business cycle with an exogenous shock which knocks the economy into recession. Then, they examine what actions the government can take to bring it back to its norm. The idea that there are problems during the boom which pre-exist the exogenous shock is truly revolutionary. Coupled with his admission that bank loans redistribute wealth from one class of people to another, this makes Stiglitz a genuine leader. He is leading the Keynesian's retreat.

Section VII: The Severity and Recalcitrance of Depressions

The Hayekians are known more for their opposition to the Keynesians than for their own theory, so our critique cannot pass over a comparison of the two theories. Are interest rates procyclical [up in good times, down in bad] or anticyclical? In six words this question summarizes the difference between Hayekians and Keynesians. Keynesians believe, and every modern textbook proclaims, that interest rates are procyclical because the government is expected to lower them in its effort to rescue capitalism from its periodic bouts with recession. Hayekians believe that they are anticyclical because low interest rates lengthen the period of production, causing a boom, and then, when the currency is inevitably attacked, the defensive raising of interest rates shortens the period of production, causing a bust.

Basically, Keynesians believe that market forces are unreliable and the government responds to recessions by lowering interest rates. Depressions are endemic to capitalism and it is not their severity and recalcitrance but their absence that requires explanation. Hayekians believe that the government is unreliable and the market responds to unnaturally low interest rates

with an attack on the currency which provokes a recession. But, since interest rates come back down as soon as the threat to the currency is past, the severity and recalcitrance of the slump still requires explanation.

There is some confusion on this interpretation. O'Driscoll and Rizzo write, "The more resources that have already been sunk in the capital-intensive production methods, the greater will be the demand for additional resources that can be used to complete the projects. If a project is nearly complete, then the incremental resources needed to complete it will have a far greater value than would have been the case *ex ante*... [This] capital complementarity effect helps explain the procyclical behavior of interest rates" (1985, p. 209). But on the next page they assert that "investment cycles typically end in a credit crunch, with a comparatively sudden and simultaneous financial 'crisis' for numerous firms." The first statement suggests that interest rates are procyclical while the second statement supports the contention that Hayekians believe that interest rates are anticyclical.

Actually, they have not explained why interest rates are procyclical, or even demonstrated that they are. The only reason that the owners of nearly complete projects would bid up interest rates is because they *anticipate* a credit crunch. They are willing to pay more now to complete their project because they foresee getting cut off entirely. That is to say, they share the Hayekian belief that interest rates are anticyclical. Their actions in response to their Hayekian advisor's forecast of a credit crunch do not make interest rates procyclical, they just ramp them up into the crunch period. O'Driscoll and Rizzo cite Hayek (1937), though he never used the word "procyclical," and wrote specifically about "the rise of the rate of interest towards the end of a boom" (1937, p. 177), which supports this author's interpretation.

Israel Kirzner writes:

> We have before us two quite distinct theoretical disagreements. The first relates to the Keynesian belief that market forces cannot generally be relied upon to promote a powerful tendency toward full-employment of society's resources. The second relates to the Clark-Knight belief that the time-structure can be usefully ignored. Skousen eloquently presented the theoretical case against the Clark-Knight view. But he has not, merely by presenting this case, as yet offered any reasoned case for the rejection of the offending Keynesian thesis (1991, p. 1762).

Kirzner is right in criticizing Skousen. If the Hayekian's explanation of business cycles as the lengthening and shortening of the period of production was a rejection of the Keynesian theses, then how do they explain the

persistence of recessions in the face of low interest rates? How do they explain the fact that we have seen depression/recession conditions long after a spike in interest rates was brought back down to more normal, low rates? The Hayekians can explain some temporary unemployment while the currency was under attack. But, after interest rates came back down, would not the structure of production have just lengthened again and the laid-off workers re-hired? As Skousen himself writes, "[An] aspect of the lower rate of interest is the lengthening of the production process. The reduced cost means that long-term projects that were previously put on the shelf can now be initiated" (1990, p. 287).

Garrison observes, "One key puzzle emerges from the writings of several economists who once embraced the [Hayekian] theory enthusiastically but subsequently rejected it. The key question underlying the recantations is easily stated: Can the intertemporal misallocation of capital that occurs during the boom account for the length and depth of the depression" (1996, p. 14)? Five years later he answered his own question: "the [Hayekian] theory of the business cycle is a theory of the unsustainable boom. It is not a theory of depression *per se*. In particular, it does not account for the severity and possible recalcitrance of the depression that may follow on the heels of the bust" (2001, p. 120).

But Kirzner's proposed solution is inadequate: "In order to reject the Keynesian policy implications it is necessary to appreciate the healthy dynamism of the entrepreneurially-driven market process as having the potential to identify pockets (large or small) of unemployed resources and to move to eliminate them" (1991, p. 1762). Since there *are* enduring pockets of unemployment that are definitely *not* being eliminated by the entrepreneurially-driven market process, Keynesians have an easy retort to Kirzner.

Basically, by 1990 there were three competing business cycle theories:

1) Hayek's Theory is that slumps only occur if, and continue only as long as, interest rates are held high in defense of the currency. This does not explain why slumps have lasted for a decade or longer even though interest rates came back down after only a few years. If the business cycle depends entirely on the lengthening and shortening of the structure of production, would it not have just lengthened again after the crises was over?

2) Keynes' Theory is that slumps occur due to "exogenous shocks" and/or "animal spirits" (i.e. irrational investors) and are thus inherent in the capitalist system and cannot be blamed on the government.[19] But when

[19] Mises (1966, pp. 580-586) has eloquently written about the anarchy of production/animal spirits theory of incompetent businessmen causing trade cycles.

slumps do occur, it is the government's job to rescue capitalism with low interest rates and deficit spending. Even if we accept the dubious claim that investors are irrational people, this does not explain how recessions have so stubbornly resisted aggressive deficit spending and near zero percent interest rates. Nor does it explain why the U.S. government's unprecedented ability to set interest rates and spending levels has not prevented America's long downturn. As Brenner writes, "It cannot be emphasized enough that the revitalization of the US economy from around 1993 took place against a backdrop of economic stagnation in the US and on a world scale lasting at least two decades, beginning in the early 1970s" (2002, p. 7).

3) Kirzner's Theory is that slumps do not exist because entrepreneurs are so healthy and dynamic that, in their quest to root out pockets of unemployment, they can overcome any obstacle, including changes in government spending and interest rates. By ignoring the existence of the Great Depression and the Long Downturn[20], Kirzner is just living the stereotype of the classical economists' blind faith in the market and denials of depression.

Kirzner's theory can be rejected out of hand. As for the Hayekian's interest rate spikes and Keynes' exogenous shocks, both are overrated. Hayekians point to the abrupt monetary contraction in 1930, but they cannot explain why the Great Depression lasted for ten years – fifteen if one counts the war years. Keynesians point to the OPEC shock in the 1970s, but they cannot explain why, thirty years later, we are still in a Long Downturn.

The key to explaining the longevity of recessions is that capital has been *wasted*. Keynes (1953, p. 129) writes:

> Pyramid building, earthquakes, even wars may serve to increase wealth.... If the treasury were to fill old bottles with banknotes, bury them at suitable depths in disused coal mines which are then filled up to the surface with town rubbish, and leave it to private enterprize... to dig the notes up again..., there need be no more unemployment and, with the help of the repercussions, the real income of the community, and its capital wealth also, would probably become a good deal greater than it actually is.

For Americans recalling their pre-Vietnam glory days or for Japanese looking back to the Asian Miracle of the 1970s and '80s, the obvious question is: Where did the wealth go? The answer should be equally obvious: It was wasted. It is at the bottom of a Keynesian coal mine. As I said earlier,

[20] With a nod to Brenner, "Long Downturn" will henceforth be capitalized.

"Boom times are characterized by a transfer of capital from smaller companies to larger ones, and the big ones waste it" (1999, p. 161).[21]

Once this capital has been wasted, it is gone for good. The nation is doomed to recession until they can liquidate their foolish ventures, regardless of whether the central bank is ever pressured into dramatic monetary contraction to defend the currency. The necessary condition for recovery is that the prodigal elements of society are cut off. The government must mercilessly send the crooks to jail and the failures to bankruptcy court.

Section VIII: The Naïveté of Austrian Economists

Much of what Rothbard, Garrison and other Hayekians write sounds more like moralizing than analyzing. Credit expansions *should* collapse so they *do* collapse – inevitably. They are unsustainable! It is this sort of moralizing which makes so many people feel that Austrian economists are naïve. Keen observes: "At least one branch of Austrian economics, associated with Murray Rothbard, has a quite non-evolutionary attitude towards both the existence of the State, and the role of money. The market economy may have evolved, but it seems the State was simply imposed from outside as an alien artefact upon our landscape" (2001, p. 303). O'Driscoll and Rizzo must be frustrated to read this mostly accurate criticism 16 years after they warned Austrians of the same problem (1985, pp. 232-234).

Interest rates are a good example of what Keen means by an "alien artefact." When it became clear that interest could not be wholly endogenous or exogenous, Hayekians had to define two rates, a natural one and the real-life one decreed by the Federal Reserve. It would be more productive if they dropped the natural rate of interest idea and, instead, focused on *how* the Fed decides where to set interest rates. Federal Reserve Board meetings do not take place in a vacuum. Interest rate spikes occur when the central banker's hand is forced. Hayekians need to concentrate more on how and when this happens rather than just declaring that it is inevitable.

Mises, writing not long after the Great Depression, lists three scenarios for interest rate spikes: 1) "a government aiming at deflation [to reestablish

[21] Lachmann writes, "Neo-Ricardian thought appears to be unable to cope with the problem of capital resources which can undergo considerable changes in value while retaining their physical form" (1986, p. 234). Actually, mainstream economists also appear unable to cope with this problem. Any mention of waste automatically gets one shunted off to the growth theorists who happily report back that the physical accumulation of capital is always up, up, up (unless it is getting bombed during wartime) and thus has nothing to do with business cycles. Like the Neo-Ricardians, they are looking at costs of production, not subjective value.

prewar gold parity] floats a loan and destroys the paper money borrowed;" 2) "frightened banks are intent upon increasing the reserves held against their liabilities and therefore restrict the amount of circulation credit;" and 3) "the crises has resulted in the bankruptcy of banks which granted circulation credit and that the annihilation of the fiduciary media issued by these banks reduces the supply of credit on the loan market" (1966, p. 566).

Rothbard discusses an inevitable "distortion-reversion process" but says little about how it actually plays out. Apparently forgetting his master's regression theorem, he declares "the continuance of confidence in the banks is something of a psychological marvel" (1970, p. 867).

Garrison (2001, p. 44) redefines the production possibility frontier, PPF, to be *sustainable* combinations of investment and consumption, but says nothing about what is so unsustainable about a credit expansion. Since he defines consumption on the PPF (which is real) to be the same as consumption on the Hayekian triangle (which is nominal), the unsustainability *cannot* have anything to do with a devaluation of the currency.

So we see that Mises, writing in 1949, was really the last Austrian to make much of an effort to explain or predict interest rate spikes. After that, their discussion of this issue, including Mises' later writings, increasingly took on the tone of a morality play, with the greedy bankers getting their "inevitable" comeuppance.

Another reason why Austrians seem naïve is their relentless call for deregulation, which often ignores fundamental inequities. This author writes:

> Decentralization is not the same thing as deregulation. The term "regulation" is meaningless without reference to the basic framework in which banks operate. A stable system can be governed by the usual laws against criminality that apply to all businesses, while an unstable system requires a vast regulatory bureaucracy and is still plagued with corruption. It is naïve for people who dislike big government to advocate deregulation in the latter case, but it is also wrong to assume that the existence of a central bank is part of the regulations which attempt to prevent corruption. Central banks and regulatory bureaucracies are associated with one another, not because they both oppose an inherent instability in banking, but because the existence of a central bank creates an unstable system that requires constant policing (1999, p. xliii).

In light of the recent scandals, we should point out that there is no invisible hand that prevents dishonest businessmen from cooking their books. For that we need government regulators. And we needed regulations like the Glass-Steagall Act, which prevented conflicts of interest.

But the most absurd example of Austrian economists' naïveté is their demand for a 100% reserve requirement. Do they really want the government to inventory a bank's vaults every morning and again in the afternoon to enforce a rule that makes sense to nobody? Since everyone knows that not a tenth that much gold is actually needed, they would just ship it from bank to bank ahead of the inspectors. Even Skousen considers "the problem of bank evasion and the uncanny ability of banks to escape the 100% rule imposed upon them (1977, p. 47)" to be his plan's major defect.

Free banking is a more workable system since the government does not get involved until someone complains that their attempt to withdraw gold was rebuffed. Provided only that the government's response is merciless – the case is handled by criminal courts and treated the same as any fraud or embezzlement – the system is self-regulating, without any intrusive inspections. The danger is that they will want to show compassion and the bank directors will learn to rely on that. As Machiavelli counsels:

> [A] prince must not worry if he incurs reproach for his cruelty so long as he keeps his subjects united and loyal. By making an example or two he will prove more compassionate than those who, being too compassionate, allow disorders which lead to murder and rapine. These nearly always harm the whole community, whereas executions ordered by a prince only affect individuals (1999, p. 53).

Section IX: Summary of the Critique of Hayek

We have found seven serious problems with Hayekian economics:

1) As discussed in Section II, Hayek was unclear whether his structure of production represents a yearly flow of goods or a distribution of wealth. Mises and Rothbard, like Hayek, seem to mean one and *also* the other. Skousen is at least consistent but, unfortunately, he is consistently wrong. He definitely means the amount of goods flowing by every year. This author's work (1999) is about stock, not supply.

2) As discussed in Section III, Hayek's triangle is printed sideways and backwards. The former problem can be corrected by rotating the graph but the later problem is more fundamental. Hayek is speaking from the perspective of the owner of the final product looking back on his costs of production. He is speaking from Marx's perspective. The perspective that we want is from right now, at time zero, looking forward into the future.

3) As discussed in Section IV, there must be *some* temporal measure or the Hayekian's incessant references to "lengthening the period of produc-

tion" would not mean anything at all. Their theory of business cycles depends on credit expansions lengthening the period of production and on the inevitable contraction shortening it. It is impossible to talk about something being lengthened or shortened unless one knows how to measure it.

4) As discussed in Section V, Hayekian theory depends entirely too much on the specificity of capital goods. In reality, many companies make products or provide services which are used in all of Hayek's five stages – and they experience cyclical behavior too. Rothbard was wrong when he said "To the extent that the new money is loaned to consumers rather than businesses, the cycle effects do not occur" (1970, p. 940 footnote).

5) As discussed in Section VI, Garrison's conception of the natural rate of interest is faulty. The Hayekians are naïve to cling to this mythical concept. There is no such thing as a natural rate of interest. In any case, credit limits are more important than interest rates. The necessity of a bust following boom times is adequately explained by the transfer of capital from smaller companies to larger ones.

6) In Garrison's own words: "the [Hayekian] theory of the business cycle is a theory of the unsustainable boom. It is not a theory of depression *per se*. In particular, it does not account for the severity and possible recalcitrance of the depression that may follow on the heels of the bust" (2001, p. 120). In 1930, Hayek could explain how the depression started. In 1936, he could not explain why it still persisted. See Section VII.

7) Austrian economists seem naïve because their belief in a natural interest rate implies an ethical judgment on what is natural or unnatural, their discussion of the inevitable collapse of a credit expansion is typically presented as a sort of morality play and because they advocate an impractical 100% reserve requirement based solely on ethical considerations. See Section VIII.

Seven strikes and you are out! Hayek's horse fell dead underneath him in 1936. Seventy years later, his followers are still beating that horse saying "Get up! Get up! We have to finish the race!"

The DWCS, presented in Section IV, is a good start towards reforming Hayekian economics. While far from a complete solution to their problems, it at least puts a horse under them again. For a complete solution, they should consult this author's work (Aguilar 1999). But, to understand where I am coming from, we need to first consider the legacy of that other great defender of the free market, Ludwig von Mises.

Part II: The Legacy of Ludwig von Mises

Section X: The Severity and Recalcitrance of Depressions Explained

Of Mises, Hayek, Keynes and Kirzner, only Mises is close to this author's position that the severity and recalcitrance of recessions is explained by the wastage of capital. Hayek describes a rather mechanical shuffling of wealth back and forth between the higher and lower stages of production. Keynes conjures up animal spirits to explain something that he clearly does not understand. And Kirzner is just expressing the blind faith in the market and denials of depression that make the so-called classicals such an easy straw man for Econ. 101 students to slay. But Mises was adamant that his theory was about malinvestment, not overinvestment, and made the *quality* of loans central to his thesis. The principle difference between Mises and Hayek is that Mises focuses almost entirely on malinvestment and capital consumption (i.e. waste) during the boom period. There is nothing in Hayek's triangle about the *quality* of investments, only about the relative *quantity* allocated to the several different stages. Hayek and his followers focus on the lengthening and shortening of the period of production and on talking around the fact that they do not know how to measure it.[22]

Section XI: The Meaninglessness of Price Indexes

In 1930 Hayek predicted "monetary theory will not only reject the explanation in terms of a direct relation between money and the price level, but will even throw overboard the concept of a general price level" (1967, p. 29).

Yet this general price level is still with us. The 5 March 2003 edition of USA Today reports that, in the past year, prices for gasoline were up 29.3%, fuel oil 21.0%, health care 9.2% and tuition 6.3%, which is bad news because these are all fixed costs that working class Americans are committed to paying. But prices for personal computers fell 20.7%, information processing 11.9%, men's clothing 3.9% and autos 2.8%, which is also bad news because information processing and the manufacture, marketing and service of computers, clothing and autos are where most people's jobs are. So what is the response of mainstream economists? They report the arith-

[22] Mises makes only one passing mention of the period of production (1966, p. 556).

metic average of these numbers, 3.3%, and announce that "inflation is under control and there is no sign of deflation."[23]

Considering his strong words against price indexes (1966, pp. 219-223), if Mises has kept up on the affairs of the living with a posthumous subscription to USA Today, he must be rolling in his grave. This author also writes about this excessive tendency towards aggregation: "The assertion of mainstream economists that the average level of prices in an economy is a meaningful statistic has done more damage to their credibility than any other assertion they have made.... Such an average is not just ludicrous but it is definitionally without meaning, for one need only ask in what units the result is expressed and one has found a contradiction" (1999, pp. 144,149).

Opposition to an average price level belongs to the legacy of Mises, though it was Hayek who put the question to the English:

> [I]f we have to recognize that, on the one hand, under a stable price level, relative prices may be changed by monetary influences, and, on the other that relative prices may remain undisturbed only when the price level changes, we have to give up the generally received opinion that if the general price level remains the same, the tendencies towards economic equilibrium are not disturbed by monetary influences, and that disturbing influences from the side of money cannot make themselves felt otherwise than by causing a change of the general price level (1967, p. 28).

Section XII: The Originary Rate of Interest

Mises (1966, p. 524, italics added) writes:

> As the consumers' goods are present goods, while the factors of production are means for the production of future goods, and as present goods are valued higher than future goods of the same kind and quality, the sum thus apportioned, even in the imaginary construction of the evenly rotating economy, falls behind the present price of the consumers' goods concerned. This *difference* is the originary interest.

Difference? Interest is a ratio. In any case, one cannot compare an apportioned sum with a price since they have different units. Skousen estimates that the revenue from the sale of capital goods is 56% greater than that from

[23] Did you hear the one about the three economists who went deer hunting? They spotted a deer standing fully broadside to them. The first economist raised his rifle and fired, just missing the deer's rump. The second economist fired and sent his bullet zinging past the animal's nose. The third economist did not fire but jumped up and down shouting "We got it! We got it!"

consumer goods (1990, p. 191). There is no direct connection between this ratio and the interest rate. If Mises is comparing the average prices of consumers' and producers' goods, does this not conflict with his criticism of price indexes? But even assuming that the PPI and the CPI are meaningful statistics, the same criticism of Garrison (See Section VI) now also applies to Mises. There is a complicated structure of complementary capital goods and labor applied at different points in time. A particular machine lasts a long time and makes partial contributions to the production of a variety of goods. So exactly what prices are being compared? Just as Garrison was ignoring capital, now Mises is ignoring labor.

Keynes (1953, pp. 192-193) also criticized Mises' theory of interest:

> A peculiar theory of the rate of interest has been propounded by Professor von Mises and adopted from him by Professor Hayek... namely, that changes in the rate of interest can be identified with changes in the relative price levels of consumption-goods and capital-goods (Mises 1971, p. 339 *et passim*, particularly p. 363).... By a somewhat drastic simplification the marginal efficiency of capital is taken as measured by the ratio of the supply price of new consumers' goods to the supply price of new producers' goods. This is then identified with the rate of interest.

Here, Keynes is writing in his 1936 *General Theory* about Mises' 1912 *Theory of Money and Credit*, which had been translated into English in 1934. In spite of Mises' vitriolic criticisms of "Lord Keynes," when the ball was back in his court, he did not reply to this criticism in his 1949 *Human Action*. Chapter XIX of *Human Action*, titled "Interest," (Mises 1966, pp. 524-537) is surprisingly short and devoid of any mention of a controversy.

Section XIII: Mises' Regression Theorem

Mises' most notable accomplishment was his regression theorem, which traces the value of money back day by day to the time when it was valued only for its use.[24] This author is mostly in agreement:

[24] It is a sad fact that there are many people with only a superficial knowledge of economics: They have heard of the Austrians and have recently learned that the dollar is not backed up by gold. Frequently dropping Mises' and Hayek's names, they will breathlessly tell one about this "conspiracy," concluding that the currency will collapse at any moment and, hence, we should all buy commodities which, they say, have "intrinsic" value and are thus stable. It is unfortunate that such people associate themselves with the Austrians because, in fact, it was Menger who replaced intrinsic value with subjective value, disentangled use and exchange value and disassociated the origin of money from the decrees of the church or state; it was Mises' regression theorem which explained the "psychological marvel" of how a fiat currency can retain

> Let us say that the value of a unit of commodity money was V_0 when it was still valued primarily for its use value. After the jth day, the change in value is a proportion of the day before's value. Thus, $V_j - V_{j-1} = \varepsilon_j V_{j-1}$ with ε_j the change in value on the jth day relative to its value on the day before. If ε_j were the same every day, the value of commodity money would be growing exponentially with a common ratio of $1+\varepsilon$. ε_j is not the same every day, however, because each day has its own particular effect on the value of commodity money. In the long run, the ε_j's may be considered random as they are not directly related to each other nor are they uniquely a function of V_j. Furthermore, it is assumed that they are taken from an unspecified distribution, but one with a finite mean and a non-zero, finite [variance].[25] Phenomena that change in this way every day conform to the characteristics of proportionate effect (1999, p. 83).

But Mises stopped short of seeing the true significance of his regression theorem. This author's first theorem (1999, p. 102), The Law of Proportionate Effect, asserts that phenomena which conforms to the characteristics of proportionate effect[26] are lognormally distributed. And this is the foundation for the whole of the theory, right up to theorems 12 and 13 (1999, pp. 137-

---

value; and it was Hayek who explained why mining, being the highest of his five stages, is the most volatile.

To counter such sophistry, this author recommends a more widespread distribution of Menger's *Principles* (1981). Ever since Smith's 500-page tome (1976) got itself attached to America's Bicentennial celebration, popular bookstores have stocked multiple editions of it to the exclusion of all other economic treatises. Apparently people buy them to decorate their offices, since almost nobody has read past the pin factory story. Smith's reputation has outlived his contributions while Menger dashes popular misconceptions that are as prevalent today as they were a century ago. If the Mises Institute offered bookstores a cloth-bound edition below cost, they would do more for the cause of sound economics than all their proselytizing.

[25] There is a typographical error in my book on page 83: I wrote "average" but meant "variance."

[26] "That first-unit demand conforms to the characteristics of proportionate effect must be regarded as an axiom. A plausibility argument is provided here. Let $m_j = \phi(m_{j-1})$ with m_j the number of monetary units to which one is indifferent relative to the first unit of a phenomenon on the j'th day of that person's life. We want to show that $\phi(m_{j-1}) = (1+\varepsilon_j)m_{j-1}$. Consider a man who wants to take out a loan at interest. He must think he will have more money in the future than he does now. (More money holdings, not necessarily more wealth.) If he does, the value of individual monetary units will tend to decrease over time relative to other phenomena; that is, ϕ is a positive function when averaged over all phenomena. To determine how much interest he is willing to pay, the man must specify this average ϕ. For him to calculate the interest owed per unit of time as a percentage of the principle is equivalent to specifying $\phi(m_{j-1}) = (1+\varepsilon)m_{j-1}$ with $\varepsilon > 0$ fixed. Fixing ε is a special case of ε_j being a random variable. Here, the probability density function is unity at ε and zero elsewhere. Thus, the axiom that first-unit demand conforms to the characteristics of proportionate effect is a generalization of calculating interest as a percentage of the amount owed" (Aguilar 1999, p. 103).

141), the Law of Price Adjustment, which claims that the price at saturation increases exponentially and the stock remains constant in response to an increase in the importance of a phenomenon relative to money.

Section XIV: Mises' Pseudo-Axiomatic Praxeological Method

Mises' praxeological method was a failure but it can at least be considered a forerunner of this author's axiomatic method. While Mises never provides us with a concise statement of his postulate set, his repeated use of the phrase "action axiom" eventually leads one to believe that it means something like this author's axioms one and two (1999, pp. xxiii-xxiv).[27] And his regression theorem can be considered a special case of this author's third axiom, which asserts that the value of the first unit of anything (not just money) changes each day by a proportion of the previous day's value.

Thus, Mises came remarkably close to the starting point of *Axiomatic Theory of Economics*. Had he been a better mathematician he might have resolved his murky "action axiom" into a clear enumeration of what is known about marginal utility and a statement that value is a total ordering. Also, he might have recognized regression as an axiom applying to everything, not just a theorem applying only to money, though he would have first had to reject originary interest, since this axiom is a generalization of calculating interest as a percentage of the amount owed. Alas, he did not and economists had to wait fifty more years for a well-defined postulate set.

Pre-WWII Hayekians did not use very much math but, then, neither did Keynes or most other economists. After the war, at a time when mainstream economists were trying to emulate physicists, Austrians went math-free on the advice of Ludwig Mises ([1949] 1966). As Skousen has recorded (2001, pp. 290-291), this was largely a result of a sibling rivalry between Ludwig and his brother Richard, a famous probability theorist (1981).

Ironically, Richard Mises' principle rival in probability was Kolmogorov, who gave an axiomatic foundation for the theory of probability (1956). Kolmogorov won; it is he, not Richard Mises, who is now considered the

[27] It means something like it, but they are not identical. For instance, this author agrees with Caplan (1999, p. 825) when he criticizes Rothbard (1970, p. 267) for writing "not only are alternatives ranked ordinally on every man's value scale, but they are ranked *without ties*; i.e., every alternative has a different rank." This author writes, "Since the utility of a given stock is measured by the quantity of money which stands beside it on one's value scale, U(*s*) is a mapping from the stock of a phenomenon one possesses to the money one associates with that stock" (1999, p. 99). Block (1999, p. 26) claims that "only cardinal utility can meaningfully be placed on an axis" while this author places utility thusly (1999, p. 101) while writing "[t]he stability of money does not imply that one's value scale is cardinal; all phenomenon would have to be stable (independent of phenomena's conformance to other definitions) for that to be true" (1999, p. 65).

founder of modern probability theory. This is ironic because Kolmogorov's axiomatic method is actually very similar to Ludwig Mises' praxeological method.[28] The difference, of course, is that Kolmogorov's axioms are productive while Mises' axiom, the proposition that humans act, is really just a platitude. Hoppe writes, "This axiom, the proposition that humans act, fulfills the requirements precisely for a true synthetic a priori proposition. It cannot be denied that this proposition is true, since the denial would have to be categorized as an action – and so the truth of the statement literally cannot be undone" (1995, p. 22). Thus, caught in this catch-22 situation, we must all be Misesians – or be dead. To acknowledge that people act (as opposed to what?) is to accept all of Mises' theory, including originary interest and the works. This is rather like being asked, "Are you taking your antipsychotic medication?" There is no way to answer the question directly without implicitly admitting that one *is* psychotic.

Who ever heard of an axiomatic system with only one axiom? There are only postulate *sets* (e.g. Euclid has five, Kolmogorov has five and this author has three).[29] But Ludwig Mises knew nothing about mathematicians and denounced them all, making no distinction between axiomatists like Kolmogorov and positivists like his brother. Thus having missed a splendid opportunity to team up with his brother's rival,[30] Ludwig Mises' embryonic vision would lie dormant for half a century before the axiomatic method would find its champion in economics.

Meanwhile, Debreu (1959) made a half-hearted attempt to give an axiomatic foundation for the theory of economics. Unfortunately, by using

---

[28] This author writes, "In general, no more can be known about a specific situation than is known about all situations, that is, no more than what can be deduced from universal axioms" (1999, p. 89). Ludwig Mises would probably agree. If modern Misesians could get over their math phobia, they might also notice the similarity between the axiomatic and the praxeological methodologies. Hans-Hermann Hoppe wrote a book extolling Mises' praxeological methodology and even went so far as to claim that "Mises improves the Kantian philosophy" (1995, p. 17). Four years later I showed him *Axiomatic Theory of Economics* (Aguilar 1999), which has a chapter on epistemology, including a section titled "The possibility of synthetic *a priori* knowledge." His response was to flip through it and, immediately upon spotting some math equations, hand it right back to me. Murray Rothbard had the same response in 1993. Misesians complain that mainstream economists ignore them. But, by refusing to look at the work of a mathematician, they can hardly claim to have taken the high ground. If people want to be accepted, they must first learn to accept others. Skousen observes that "Today Böhm-Bawerk's *Karl Marx and the Close of His System* is published by Marxists" (2001, p. 188). If only the Misesians could be so open-minded towards mathematicians!

[29] Moise includes an introduction to the three geometries (1990, pp. 139-159) and a summary of the postulational method (1990, pp. 455-461) which are accessible to the general reader.

[30] "The Meaning of Probability" (1966, p.106) is a stunning display of shooting oneself in the foot.

grossly unrealistic assumptions, Debreu only succeeded in giving the axiomatic method a bad name.[31] Keen writes:

> It is almost superfluous to describe the core assumptions of Debreu's model as unrealistic: a single point in time at which all production and exchange for all time is determined; a set of commodities – including those which will be produced in the distant future – which is known to all consumers; producers who know all the inputs that will ever be needed to produce their commodities; even a vision of "uncertainty" in which the possible states of the future are already known, so that certainty and uncertainty are formally identical. Yet even with these breathtaking dismissals of essential elements of the real world, Debreu's model was rapidly shown to need additional restrictive assumptions (2001, p. 173).

O'Driscoll and Rizzo (1985) have also argued against the "perfect information" assumption, as has Stiglitz (2003b, p. 25):

> In effect, the Arrow-Debreu model has identified the single set of assumptions under which markets were (Pareto) efficient. There had to be perfect information, or, more accurately, information (beliefs) could not be endogenous, they could not change either as a result of the actions of any individual or firm, including investments in information.

In sharp contrast to Debreu's presentation of his assumptions, this author's axioms are printed in plain language right up front before any theorems are deduced from them. There is no need for the prefatory phrase "In effect..." which Stiglitz found necessary because Debreu had been so opaque about his assumptions.

My assumptions are three:

1) One's value scale is totally (linearly) ordered:
   i) Transitive; $p \leq q$ and $q \leq r$ imply $p \leq r$
   ii) Reflexive; $p \leq p$
   iii) Anti-Symmetric; $p \leq q$ and $q \leq p$ imply $p = q$
   iv) Total; $p \leq q$ or $q \leq p$
2) Marginal (diminishing) utility, u(s), is such that:
   i) It is independent of first-unit demand.

[31] Times without number people have looked at the title of my book (1999), rolled their eyes and immediately chastised me for my "blackboard economics." Obviously, they had mistaken me for Debreu.

ii) It is negative monotonic; that is, u'(s) < 0.

iii) The integral of u(s) from zero to infinity is finite.

3) First-unit demand conforms to proportionate effect:

i) Value changes each day by a proportion (called $1+\varepsilon_j$, with j denoting the day), of the previous day's value.

ii) In the long run, the ε_j's may be considered random as they are not directly related to each other nor are they uniquely a function of value.

iii) The ε_j's are taken from an unspecified distribution with a finite mean and a non-zero, finite variance (1999, pp. xxiii-xxiv).

Kolmogorov also prints his axioms in plain language right up front before any theorems are deduced from them:

> Let E be a collection of elements which we shall call *elementary events*, and $\mathfrak{I}$ a set of subsets of E; the elements of the set $\mathfrak{I}$ will be called *random events*.
>
> **I.** *$\mathfrak{I}$ is a field of sets.*
>
> **II.** *$\mathfrak{I}$ contains the set E.*
>
> **III.** *To each set A in $\mathfrak{I}$ is assigned a non-negative real number* P(*A*). *This number* P(*A*) *is called the probability of event A.*
>
> **IV.** P(*E*) *equals* 1.
>
> **V.** *If A and B have no elements in common,* P(*A*+*B*) = P(*A*) + P(*B*)
>
> A system of sets, $\mathfrak{I}$, together with a definite assignment of numbers P(*A*), satisfying Axioms I-V, is called a *field of probability* (1956, p. 2).

Here, Kolmogorov does not introduce any new terminology ("field" is a well-known math word) but is comfortable with the standard language of mathematicians. Debreu, however, is not comfortable with the standard language of economists but instead introduces his many assumptions by way of a long and idiosyncratic vocabulary list. Thus, by the time we have learned Debreu-speak, we have lost track of all our new assumptions about these familiar-sounding words. We have entered the land of "blackboard economics" without having ever passed a signpost with a concise five-point list of axioms like Kolmogorov provides.

But debunking mainstream economics is beyond the scope of this paper – we are discussing Austrian Economics from 1930 to 1990.

Part III: Conclusion

Austrian economists (by nationality – they were not a school until Hayek's famous lectures) were already weak by 1930. Menger was good. His 1871 *Principles of Economics* (1981) is one of the most important economics book ever written. But, with the publication of Böhm-Bawerk's 1889 *Positive Theory of Capital* (1959), Austrian economists split into two branches. Menger did not find a worthy successor until Mises and together they laid the groundwork for the Axiomatic School founded by this author (1999). Meanwhile, Böhm-Bawerk was laying the groundwork for what would become the Hayekian School. This branch has grown progressively weaker all the way up to 1990. We found only problems with it while the legacy of Mises contains *some* good ideas.

Hayek lost his debate with Keynes because he saw that "it would be open to us to deal with the difficulties by the aid of higher mathematics" (1967, p. 43) but chose the easy way out instead. When confronted with his confusion between stock and supply, he chose to retain "the simplest assumption of this kind that [one] could make" (1967, p. xi) and, within a year, his followers had abandoned him to embrace Keynes' *General Theory*. Since then, the Austrian's only attempt at a diagrammatical exposition (Garrison 1978) did nothing to improve their reputation. And Skousen can hardly claim to be a better mathematician either. His book (1990) would benefit tremendously if all the hand-drawn APS graphs were replaced with computer-generated printouts of the DWCS, Are^{-rt}, with its mean, 1/r, marked. The values of the parameters A and r should also be clearly labeled so we can see exactly what he thinks changed as a result of the government policies described in the text. All too often it is not clear to the reader (or probably to Skousen himself) if only r changed or if A was also affected.

Sechrest writes, "Graphical analysis can produce definite benefits. It forces one to identify the variables and parameters involved in whatever relationship one is examining" (2001, p. 83). No, it does not. Mathematical analysis does. If an author draws one Hayekian triangle and then another – or even if he superimposes them – how are we to know if the areas underneath them are supposed to be the same or different? Only if he *tells* us what the areas are. And that means math, not graphs. Graphs illustrate mathematical functions; they are not a substitute for them.[32]

---

[32] If A is independent of r, then the Production Possibility Frontier, PPF, is a straight line from (0,A) to (A,0). Skousen (1991, pp. 20-27) claims that all investment and no consumption is unrealistic, while Garrison (2001, pp. 40-45) draws the PPF as a slightly convex line from (0,A) to (A,0), but without specifying

Garrison writes, "The choice of a linear construction [for the APS] over an exponential one maintains a simplicity of exposition without significant loss in any other relevant regard" (2001, p. 46). This author disagrees. Math is easier when one does it right. If we define the APS to be Are^{rt}, then the output of consumer goods is C = f(0) = Ar. The output of investment goods, I, is Gross National Output, A, minus C, that is, I = A(1-r). Consider the Production Possibility Frontier, PPF, with C on one axis and I on the other. Clearly, r = 0 implies that C = 0 and I = A; r =1 implies that C = A and I = 0. So, as the interest rate advances from zero to 100%, we move along the PPF from a situation of all investment and no consumption to the other extreme of all consumption and no investment.

Now let us define the APS as a traditional Hayekian triangle with consumption, C, one leg of the triangle; time since the beginning, B, the other leg of the triangle; gross output, A, the area under the triangle; investment, I, gross output minus consumption, A - C; and the interest rate, r, the slope of the hypotenuse, C/B. Clearly, r = 0 implies that C = 0 and I = A. But what must the interest rate be for C = A and I = 0? One hundred percent? Or some other percentage? I know the answer but, since Garrison has made such an issue of telling us that the choice of a linear construction over an exponential one maintains a simplicity of exposition, I want to see him derive the maximum interest rate for us.

Keen observes "The one barrier which stands in the way of today's neoclassical economist transmuting into tomorrow's Austrian is the Austrian insistence that there is little, if any, role for mathematics in economic analysis" (2001, pp. 304-305). He is right. This issue *must* be addressed if the Austrians are to survive.

The introduction of the DWCS and the mean period of production has greatly strengthened the Hayekian position. If they follow through with these ideas they can have a viable theory. In return, I ask that they stop describing their theory as deductive and based on the platitudinous action axiom. The use of words like "deduction" and "axiom" is inappropriate for people who have not provided a clear and concise statement of their postulate set. Kolmogorov had it easy – mathematicians were already familiar with axiomatic systems like geometry, so the only question put to him was whether his particular postulate set was an adequate foundation for the

---

A(r) such that it decreases as it approaches either extreme. If Skousen wishes to resurrect his 1991 argument, he must make A an explicit function of r and challenge Garrison to justify the shape of his PPF. In the following two paragraphs, since neither man has specified any function A(r), I will assume that A is independent of r and the PPF is a straight line from (0,A) to (A,0).

theory of probability. But with Debreu's breathtaking dismissal of the real world on one hand and Hoppe's catch-22 on the other, most of my time is spent banishing misconceptions about what "axiomatic" means.[33] The first step is a clean split between the Misesians and the Hayekians.

To adopt this division, the economists known as "Austrians" (e.g. Garrison and Skousen) must take the less ethnic name of "Hayekians." Keynesians do not call themselves "English" and Sraffians do not call themselves "Italian," so why do Hayekians call themselves "Austrian?" Skousen has recorded (2001, p. 434) that Anna Schwartz refused to contribute to *Feminist Economics* and, for the same reason, I have grave doubts about identifying economists by their ethnicity. The four leading Austrian-born economists of this century, Mises, Hayek, Strigl and Morgenstern, are associated with four different schools of thought. There is no more an "Austrian" economics than there is a Feminist or a Black economics.

It would be more accurate to consider Menger and Mises forerunners of this author's Axiomatic School while making Hayek the founder (and Böhm-Bawerk the forerunner) of the Hayekian School. Menger, Mises and this author are the only truly subjectivist economists.[34] Böhm-Bawerk's average period of production demonstrates that he was still mired in the labor theory of value. Hayek's backwards triangle and his use of the terms "earlier stages" and "later stages" is no better. Skousen gives plenty of lip-service to subjectivism but is belied by his instructions for compiling the APS (1990, pp. 184-185), which depend on remembering the date of an item's manufacture and when its costs of production were paid. Making everybody

---

[33] The Random House College Dictionary offers three definitions: "axiom, *n*, 1. a self-evident truth. 2. a universally accepted principle or rule. 3. *Logic, Math*, a proposition that is assumed without proof for the sake of studying the consequences that follow from it." This author (1999, p. ix) employs definition #3. The problem with #1 is that, lacking a "burning bush" experience, nothing ever appears sufficiently self-evident. The problem with #2 is the same one encountered when ordering pizza: Everybody will go hungry if they must wait for universal agreement on which toppings they want.

[34] Mises writes eloquently: "Neither acting man himself nor economic theory needs a measure of the time expended in the past for the production of goods available today. They would have no use for such data even if they knew them. Acting man is faced with the problem of how to take best advantage of the available [stock] of goods. He makes his choices in employing each part of this [stock] in such a way as to satisfy the most urgent of the not yet satisfied wants. For the achievement of this task he must know the length of the waiting time which separates him from the attainment of the various goals among which he has to choose. As has been pointed out and must be emphasized again, there is no need for him to look backward to the history of the various capital goods available. Acting man counts waiting time and the period of production always from today on. In the same way in which there is no need to know whether more of less labor and material factors of production have been expended in the production of the products available now, there is no need to know whether their production has absorbed more or less time. Things are valued exclusively from the point of view of the services they can render for the satisfaction of future wants. The actual sacrifices made and the time absorbed in their production are beside the point. These things belong in the dead past" (1966, p. 494).

save their receipts is not that much different than Böhm-Bawerk's trying to remember the one hundred working days that were expended in the production of a consumption good.

Thus, for this reason and because Mises' praxeological method and his regression theorem somewhat inspired this author's postulate set, I insist on claiming Mises as my forerunner and on asking the economists now called "Austrians" (e.g. Garrison and Skousen) to call themselves Hayekians.

Salerno writes:

> By 1978, the headlong retreat from Mises and the praxeological paradigm had begun in earnest.... Rothbard clearly recognized that the rapid spread of the Lachmannian strand of nihilism and the calculated apotheosizing of the methodologically tolerant Hayek and shunting aside of the allegedly "dogmatic" Mises, which was fostered by the new institutional arrangements, was leading to decay and retrogression.... Lew Rockwell gave us the hard-core institute; Murray Rothbard gave us the hard-core journal. With these institutional means at our disposal we have achieved our goal of putting the modern Austrian revival back on track (2002, p. 121-125).

This is a remarkable thing for the editor of the QJAE to say only a year after devoting an entire issue (Fall 2001) to apotheosizing the methodologically tolerant Garrison and shunting aside Mises' dogmatic insistence that economics be deduced from a few general axioms. Garrison writes, "Lachmann's ideas about expectations and the market process served as an inspiration for many of my own arguments... the reader will not fail to notice Hayek's influence in virtually ever chapter – and in virtually every graph – of this book" (2001, p. xiv).[35] He refrains from speculating, with Rothbard, on whether this might lead to decay and retrogression.

Salerno writes that Rothbard "seized upon [QJAE] as the main instrument for reclaiming Austrian economics from those who had stripped it of its essential Misesian content in search of acceptance by mainstream economists" (2002, p. 124). I too would like to see the essential vision, though not necessarily the content, of Mises reclaimed. However, I believe that the only way to vindicate Mises' vision of economics as a deductive science is the discovery of an axiomatic system that actually works. Like mine.[36]

---

[35] One cannot fail to notice the absence of Mises' influence; check the index for "deduction," "axiom," etc..

[36] Moise, in a section titled "A Historical Comedy," has written "Saccheri was dissatisfied with the situation of the parallel postulate; he believed that this statement ought to be proved as a theorem... he undertook to 'vindicate Euclid of every blemish' by showing that the parallel postulate was a consequence of the other postulates of synthetic geometry.... The irony is that if Saccheri's enterprise had succeeded in the way he thought it had, no modern mathematician would have regarded his book as a vindication of Euc-

A word to the wise: There is no such thing as acceptance, only submission. What QJAE contributors need is not to look more like mainstream economists, but a bigger stick to beat them with. If it was not clear in the seventies, it is now: Austrian economics is inadequate. But it is inadequate because the axioms were chosen badly, not because economics cannot be deduced from a few general axioms. While Mises does not deserve the ostracism that he gets in the mainstream journals, neither is he worthy of the adulation that he gets from QJAE contributors. Leadership of an "outsider" organization should go to one who does not value followers who worship him so much as enemies who fear him.

---

lid.... In the nineteenth century, two fundamental questions were settled. First, it was shown that the postulates of synthetic geometry, including the parallel postulate, were consistent.... It was shown further that the parallel postulate is independent of the others. This was done, in the only way it could be done, by the discovery of 'geometries' in which all the synthetic postulates except the parallel postulate were satisfied. These two developments were the real vindication of Euclid from a modern viewpoint" (1990, pp. 158-159).

There is a somewhat parallel comedy in economics with Mises as Euclid, Rothbard as Saccheri and this author as Lobachevsky. Mises initiated the idea that economics should be deductive but, by 1982, "a lot of younger Austrians... had given up basic Misesian praxeology, that is: that Austrian theory is deduced from a few general axioms" (Salerno, 2002, p. 124). Rothbard vowed to vindicate Mises of every blemish and, towards that end, he (and Hoppe) treated me like a pariah when I showed them my book (1999). Why? Because I had my own postulate set, not Mises' "action axiom." Yet it is I, not Rothbard, who vindicated Mises, in the only way that it could be done, by the discovery of a postulate set that actually works.

But Mises was no Euclid. Of Moise's two questions, the first one failed for Mises because his "action axiom" is just a platitude. Thus, only his *vision* of economics as a deductive science is vindicated.

Appendix: QJAE Referee Comments

I submitted this paper to the QJAE in March of 2004. Seven months later I received the following referee comments. The envelope was postmarked 20 October 2004 though the letter inside had been back-dated to 16 April 2004.

Referee Comments:
"Critique of Austrian Economics From 1930 To 1990"

> I can in no way recommend publication of this paper. Although purporting to be a critique of the Austrian tradition since 1930, and while citing a number of prominent Austrian economists, the paper reveals tremendous ignorance of the Austrian tradition the author is supposed to be criticizing. The notion that there was no Austrian tradition before Hayek published *Prices and Production*, and that the big split within the tradition occurs along Menger-Mises vs. Böhm-Bawerk/Hayek lines reveals that the author knows not of what he is speaking.
>
> The author grossly errs in equating the Austrian tradition itself with capital theory, thus ignoring the core of Austrian economics: praxeological price theory. The author further spends an inordinate amount of time parsing details regarding which direction capital structure triangles lie and which way arrows on diagrams point. Although these may be important regarding pedagogy, they hardly define who gets the theory right and who gets it wrong.
>
> Finally, while making relatively grandiose claims as to the success of his own axiomatic system as opposed to Mises', the author merely asserts that his axioms are right and that Mises' are wrong. A critique must be more than a tissue of assertions. It must reasonably demonstrate the problems of the object of the criticism. In order to provide such a critique, it is customary to know a reasonable amount of the object in question and to provide sound reasons for the critique. The author of this paper does neither. The writing is also way below the standard for acceptance in the *Quarterly Journal of Austrian Economics*. The paper is at times rambling, at others incoherent, at others unscholarly both in its form and content.
>
> For all of these reasons, this paper does not merit publication in the QJAE (correspondence from Judith Thommesen, Managing Editor).

The QJAE does not publish papers about capital theory? How much things have changed since Fall 2001 when they devoted an entire issue to apotheosizing the author of a book titled *The Macroeconomics of Capital Structure*! Rather than subject this poor lady to more of my rambling and incoherent writing, I will defend my "gross error" by quoting from the dust-jacket of her master's 2001 book. "Roger W. Garrison claims that modern

Austrian macroeconomics, which builds on the early writings of F. A. Hayek, can be comprehended as an effort to reinstate the capital-theory core that allows for a real coupling of short- and long-run perspectives.... This volume [*Time and Money: The Macroeconomics of Capital Structure*] puts forth a pursuasive argument that the troubles that characterize modern capital-intensive economies, particularly the episodes of boom and bust, may best be analyzed with the aid of a capital-based macroeconomics."[37]

Thommesen's criticism of me for focusing on capital theory and ignoring praxeological price theory is related to her refusal to recognize the "big split" between Menger, Mises and myself, all of whom focused on praxeological[38] price theory and Böhm-Bawerk, Hayek, Skousen and Garrison, all of whom focused on capital theory. Admittedly, Rothbard wrote on both topics, proving that they are not mutually exclusive, but he was prolific and wrote on many topics. Now I too have written on both topics: My 1999 *Axiomatic Theory of Economics* was about price theory while this paper reaches out to the capital theorists, who dominate modern Austrianism.

Section III is 700 words long, which does not seem inordinant.[39] The fact that it concludes with my calling Hayek a Marxist should have provoked a stronger response than whining about the time I spent "parsing details" on boring pedantry. The direction of the capital structure, either looking forward into the future to see value in the consumption of the final products or backward into the past to see value in the costs of production, is the difference between being a Mengerian or a Marxist. That distinction *does* define who gets the theory right and who gets it wrong.

I wrote a 270-page book about my axiomatic system and proved many theorems based on those axioms. That is not a "tissue of assertions." I am under no obligation to repeat all of that material here. I should be able to assume that any referee of this paper has already read my 1999 work.

It is obvious that, when the need to back-date some referee comments came up in October 2004, Thommesen panicked. Unwilling to involve anyone else, she wrote them herself. The reason they are so weak is that she is an administrator, not an economist. I need a more worthy opponent.

---

[37] Lest anyone doubt that Garrison is the master of the QJAE, consider Mark Thornton's justification for their Fall 2001 issue. "While it is quite unusual to devote an entire issue of a journal to the appraisal of a single book [Garrison's *Time and Money*], in this case it is warranted.... [T]he book is an important contribution to Austrian economics as well as the comparative study of macroeconomic schools of thought" (2001, pp 3-4). But Thornton, their Book Review Editor, has refused to review my 1999 *Axiomatic Theory of Economics*, so someone else may have to do the comparative study. Perhaps the school master himself?

[38] "Praxeological" is not a dictionary word. Roughly, it means "axiomatic," which is the word I use.

[39] This appendix is 800 words, which is probably starting to seem very long indeed for Thommesen.

REFERENCES

Aguilar, Victor. 1999. ***Axiomatic Theory of Economics***. Hauppauge, NY: Nova Science Publishers, Inc.

Berenson, Alex. ***The Number: How the Drive For Quarterly Earnings Corrupted Wall Street and Corporate America***. New York, NY: Random House

Block, Hoppe and Salerno. 1998. Editorial. ***Quarterly Journal of Austrian Economics***. 1 (1): iii-iv

Block, Walter. 1999. "Austrian Theorizing: Recalling the Foundations." ***Quarterly Journal of Austrian Economics***. 2 (4): 21-39

——. 2001. "Yes, We Have No Chaff: A Reply to Wagner's 'Austrian Cycle Theory: Saving the Wheat While Discarding the Chaff.'" ***Quarterly Journal of Austrian Economics***. 4 (1): 63-73

Böhm-Bawerk, Eugen von. [1921] 1959. ***Capital and Interest***. 3 vols. George D. Huncke and Hans F. Sennholz, trans. South Holland, IL: Libertarian Press

——. [1898] 1984. ***Karl Marx and the Close of His System***. New York, NY: Augustus M. Kelley

Brenner, Robert. 2002. ***The Boom and the Bubble***. New York, NY: Verso

Callahan & Garrison. 2003. "Does Austrian Business Cycle Theory Help Explain the Dot-Com Boom and Bust?" ***Quarterly Journal of Austrian Economics***. 6 (2): 67-98

Caplan, Bryan. 1999. "The Austrian Search for Realistic Foundations." ***Southern Economic Journal***. 65 (4): 823-838

Cochran, Call & Glahe. 2003. "Austrian Business Cycle Theory: Variations on a Theme." ***Quarterly Journal of Austrian Economics***. 6 (1): 67-73

Debreu, Gerard. 1959. ***Theory of Value: An Axiomatic Analysis of Economic Equilibrium***. New York, NY: John Wiley & Sons, Inc.

Friedman, Milton. 1953. "The Methodology of Positive Economics." in ***Essays in Positive Economics***. Chicago, IL: University of Chicago Press.

——. [1962] 1982. ***Capitalism and Freedom***. Chicago, IL: University of Chicago Press

Garrison, Roger. 1978. "Austrian Macroeconomics: A Diagrammatical Exposition." in ***New Directions in Austrian Economics***, edited by Louis Spadero. Kansas City, KS: Sheed, Andrews and McMeel

——. 1985. "A Subjectivist Theory of a Capital-using Economy" in ***The Economics of Time and Ignorance***. New York, NY: Basil Blackwell Ltd.

——. 1996. "The Austrian Theory in Perspective" in ***The Austrian Theory of the Trade Cycle***, compiled by Richard Ebeling. Auburn, AL: Ludwig von Mises Institute

——. 2001. ***Time and Money: The Macroeconomics of Capital Structure***. New York, NY: Routledge

Hayek, Friedrich A. November 1937. "Investment that Raises the Demand for Capital." ***Review of Economic Statistics***. 19: 174-177

——. [1935] 1967. ***Prices and Production***. New York, NY: Augustus M. Kelly, Publishers

——. [1941] 1975. ***The Pure Theory of Capital***. Chicago, IL: University of Chicago Press

Hoppe, Hans-Hermann. 1995. ***Economic Science and the Austrian Method***. Auburn, AL: Ludwig von Mises Institute

Keen, Steve. 2001. ***Debunking Economics***. Annandale, NSW Australia: Pluto Press

Keynes, John M. [1936] 1953. ***The General Theory of Employment, Interest and Money***. New York, NY: Harcourt Brace Jovanovich, Publishers

Kirzner, Isreal M. December 1991. "Review of ***Structure of Production*** by Mark Skousen" ***Journal of Economic Literature***. XXIX: 1761-1762

Kolmogorov, A. N. [1933] 1956. ***Foundations of the Theory of Probability***. Nathan Morrison trans. New York, NY: Chelsea Publishing Company

Lachmann, Ludwig M. 1986. "Austrian Economics Under Fire: The Hayek-Sraffa Duel in Retrospect." in ***Austrian Economics***, edited by Wolfgang Grassl and Barry Smith. London, England: Croom Helm

Machiavelli, Niccolò. [1513] 1999. ***The Prince***. George Bull trans. New York, NY: Penguin Books

Menger, Carl. [1871] 1981. ***Principles of Economics***. Dingwall and Hoselitz trans. New York, NY: New York University Press

Mises, Ludwig von. [1949] 1966. ***Human Action: A Treatise on Economics***. Chicago. IL: Contemporary Books, Inc.

——. [1912] 1971. ***The Theory of Money and Credit***. H. E. Batson trans. Irvington-on-Hudson, NY: The Foundation of Economic Education, Inc.

Mises, Richard von. [1928] 1981. ***Probability, Statistics and Truth***. Hilda Geiringer trans. New York, NY: Dover Publications, Inc.

Moise, Edwin E. 1990. ***Elementary Geometry from an Advanced Standpoint***. New York, NY: Addison-Wesley Publishing Company

Mulligan, Robert F. 2002. "A Hayekian Analysis of the Term Structure of Production." ***Quarterly Journal of Austrian Economics***. 5 (2): 17-33

O'Driscoll & Rizzo. 1985. ***The Economics of Time and Ignorance***. New York, NY: Basil Blackwell Ltd.

Rothbard, Murray N. [1962] 1970. ***Man, Economy and State***. Los Angeles, CA: Nash Publishing

Salerno, Joseph T. 2002. "The Rebirth of Austrian Economics – In Light of Austrian Economics." ***Quarterly Journal of Austrian Economics***. 5 (4): 111-128

Sechrest, Larry J. 2001. "Capital, Credit, and the Medium Run" ***Quarterly Journal of Austrian Economics***. 4 (3): 63-77

Sennholz, Hans F. 1979. ***Age of Inflation***. Belmont, MA: Western Islands

Skousen, Mark. 1977. ***Economics of a Pure Gold Standard***. Irvington-on-Hudson, MA: The Foundation for Economic Education, Inc.

——. 1990. ***Structure of Production***. New York. NY: New York University Press

——. 1991. ***Economics On Trial***. New York, NY: Irwin Professional Publishing

——. 2001. ***The Making of Modern Economics***. Armonk, NY: M. E. Sharpe

Smith, Adam. [1776] 1976. ***An Inquiry into the Nature and Causes of the Wealth of Nations***. Chicago, IL: The University of Chicago Press

Sraffa, Piero. 1960. ***Production of Commodities by Means of Commodities***. London, England: Cambridge University Press

Stiglirz & Greenwald. 2003. ***Towards a New Paradigm in Monetary Economics***. Cambridge, England: Cambridge University Press

Stiglitz, Joseph. 2003a. ***The Roaring Nineties***. New York, NY: W. W. Norton and Co.

——. 2003b. "Information and the Change in the Paradigm in Economics." ***The American Economist***. 47 (2): 6-26

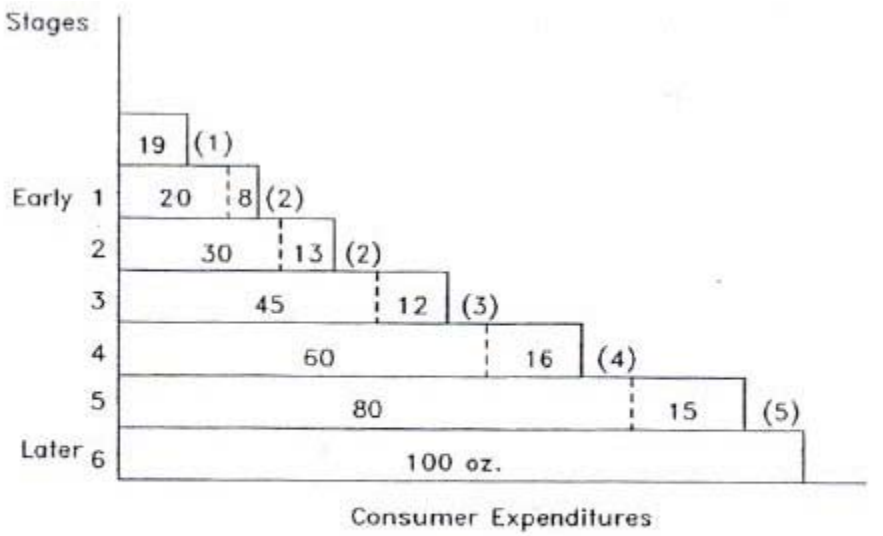
Strigl, Richard von. [1934] 2000. ***Capital and Production***. Dr. & Mrs. Hoppe trans. Auburn, AL: Ludwig von Mises Institute

Thornton, Mark. 2001. Editorial. ***Quarterly Journal of Austrian Economics***. 4 (3): 3-4

Timberlake, Richard. 1999. "Ludwig von Mises and Price Indexes." ***Cato Journal***. 19 (2): 273-277

Tullock, Gordon. 1999. "Mises and the Dialog of Science." ***Cato Journal***. 19 (2): 229-246

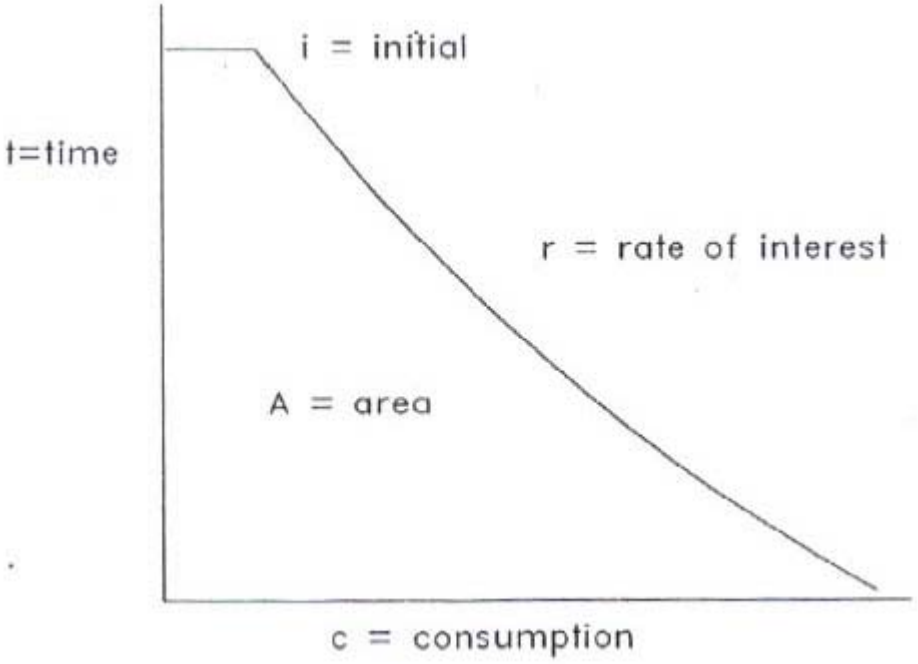
Figure 1. Rothbard's Aggregate Production Structure



Note: In Rothbard's illustration, the production process takes up to six years (six stages). Total gross income is 418 oz. Total gross savings / investment is 318 oz. Net (new) savings / investment is 0. Total consumption is 100 oz. Net income to factors are: 83 oz. to land and labor (19 + 8 + 13 + 12 + 16 + 15 = 83 oz.), 17 to capital owners (1 + 2 + 2 + 3 + 4 + 5 = 17 oz.).

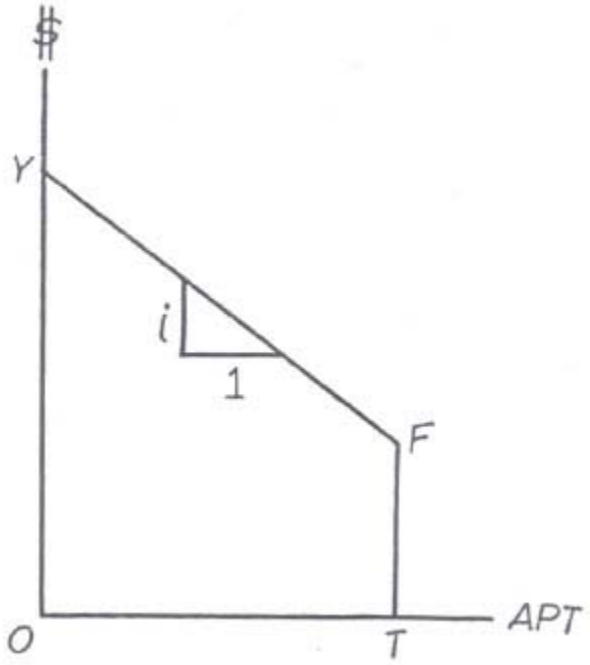
Source: Skousen 1990, p. 187 (*Original source:* Rothbard 1970, p. 314)

Figure 2. Skousen's Aggregate Production Structure



Source: Skousen 1990, p. 195

Figure 3. Garrison's Aggregate Production Structure



Source: Garrison 1978, p. 174

Figure 4. The Exponential Distribution, re^{-rt}

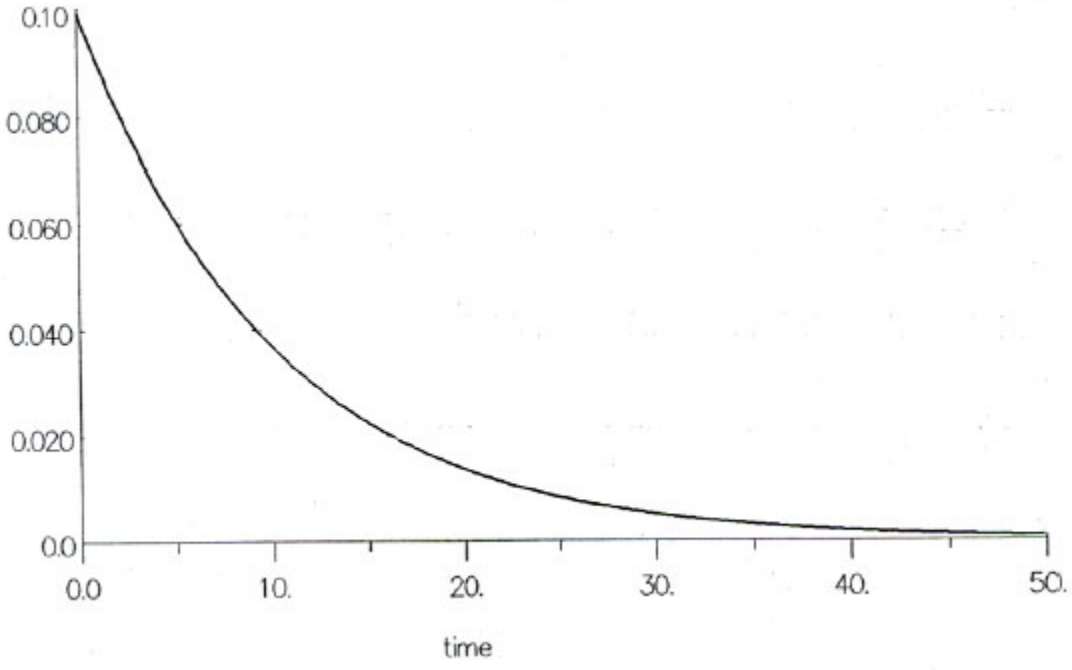
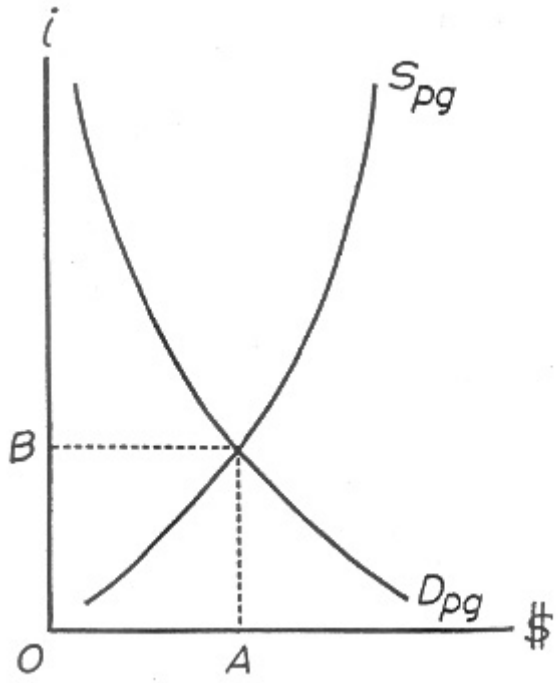


Figure 5. Garrison's Supply and Demand for Present Goods



Source: Garrison 1978, p. 176