

A Rejoinder to Mr. Murphy

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I would like to thank Robert Murphy for taking up the challenge to write a rebuttal to my 2004 paper, *Critique of Austrian Economics from 1930 to 1990*. As I state on the home page of this website, “critiques and rebuttals are how science advances.” I firmly believe this and, after only three years of searching, I have found someone in the Austrian camp who also believes it.

For those who are not familiar with Robert P. Murphy, he has a regular online column (www.mises.org/articles.aspx?author=Murphy) and has written a study guide (2006) for Murray Rothbard’s treatise (1970), *Man, Economy and State*, both of which are available from the Mises Institute.

Murphy writes, “Most Austrians are familiar with Victor Aguilar’s *Critique of Austrian Economics From 1930 to 1990*. He has long since thrown down the gauntlet, by publicly offering to pay \$1000 for the best response to his critique... I decided that I would be an appropriate person to write just such a reply.” Because of Murphy’s following among young Austrians, particularly those studying *Man, Economy and State*, which is the standard approach to Austrian theory, I also feel that he is an appropriate person to rebut my *Critique* and I have paid him \$1000 to do so.

Hayek’s and Rothbard’s Production Theory of Value

Having famously accused Hayek of taking the perspective of the owner of the final product looking back on his costs of production, that is, of taking Marx’s perspective, let us begin by examining Murphy’s defense of Hayek’s alleged Marxist leanings. Murphy’s response to my claim that the Hayekian triangle is sideways and backwards is classic bait and switch. I raise two objections to the Hayekian triangle:

“Hayek’s triangle is printed sideways and backwards. The former problem can be corrected by rotating the graph but the latter 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” (Aguilar, p. 27).

The first objection, that Hayek defied the convention of mathematicians by putting the independent variable on the vertical axis, is not, as I point out in this quote, the fundamental problem. That is an expository issue. The fundamental problem is that the Austrians are speaking from the perspective of the owner of the final product looking back on his costs of production. Murphy baits us with the promise of defending against this fundamental objection and then switches to addressing the expository objection.

Then, while Murphy is busy extolling the virtues of sideways graphs, he does not notice that he himself is hopelessly mired in the Marxist perspective. Murphy writes, “the consumer’s good is always the 1st order, regardless of how far back we push the analysis, even if we go back to axes carved by prehistoric men” (Murphy, p. 6). *How far back we push the analysis???* That sounds like we are speaking from the perspective of the owner of the final product looking *back* on his costs of production. Think about it: When did copper axes exist? Past, present or future? Obviously, they existed in the past. So why does Murphy, who claims to believe in the subjective theory of value, care about them?

What sort of analysis is Murphy doing that requires knowing the cost of copper axes in millennia past? For that matter, what sort of analysis is he doing that requires knowing the cost of a load of lumber I purchased from Home Depot last week? Maybe it was wisely bought or maybe it was a stupid purchase, but Home Depot is not going to take it back, so what is done is done. Those boards are valued now, according to the subjective theory of value, only for the value attached to the consumer goods they can be made into, discounted for time preference. If my architectural dreams come to naught and I wind up feeding the boards into my stove, then they are valued for no more than I would value a

load of firewood. It does not matter how much I paid for them or how much labor was expended at the sawmill cutting them into the proper dimensions.

I insist, “The perspective that we want is from right now, at time zero, looking forward into the future. Thus, the DWCS [Distribution of Wealth over the Capital Structure] is defined from zero to positive infinity... 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” (Aguilar, p. 8, 7).

Murphy writes, “Second [after baiting us with the promise of defending Hayek from the charge of Marxism and then switching to defend sideways graphs], Rothbard does *not* have ‘the numbers one through six on his graph printed backwards’ (Aguilar, p. 7). Those numbers aren’t representing units of time, but rather the stages of production. Following Menger, the lowest order (consumer good) stage is the 1st order, the next highest stage is the 2nd order, and so forth” (Murphy, p. 5). Okay, *if* (and this is a big “if”) we accept the Marxist perspective that value is determined by past costs of production, *then* it makes sense for Rothbard to enumerate them as follows. Hopefully everybody saved their receipts, as per Skousen’s instruction (1990, pp. 184-185), since it may be difficult to explain to them why those yellowing slips of paper are relevant today.

- 1) The cost to the retailer to buy the product from the distributor in January 2007 and rent a storefront and hire sales people until March 2007.
- 2) The cost to the distributor to buy the product from the manufacturer in 2006, rent warehouse space to store it and hire truckers to deliver it.
- 3) The cost to the manufacturer to buy materials, rent equipment and hire workmen in 2005 when the product was manufactured.
- 4-98) . . .
- 99) The cost to the caveman to purchase the “axes carved by prehistoric men” (Murphy, p. 6) which initiated the whole project.

But, the point is, I do *not* accept this Marxist perspective. My objective is not to quibble with Rothbard over how the costs of production should be labeled (either counting stages or indicating the times, in years gone past, when those costs were incurred) but to *reject* the whole concept of seeing significance in past costs of production. I believe (and apparently I am the only one who does) in the subjective theory of value. “By the subjective theory of value, all goods are valued for their contribution towards *future* consumption, not for their *past* cost of production” (Aguilar, p. 7).

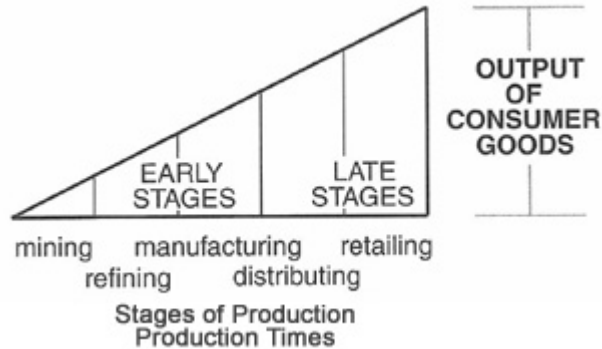
Combining Hayek and Murphy, we get an obvious absurdity: Hayek defines the “average period of production” as half the time since the application of the original means of production:

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).

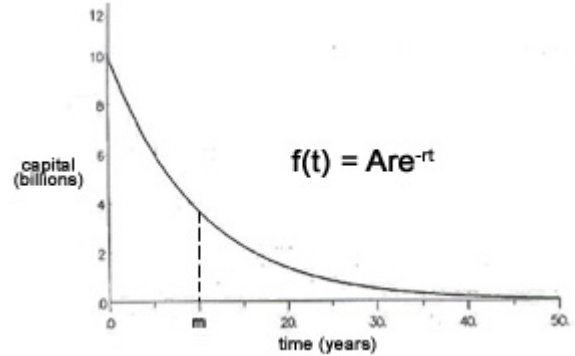
But Murphy defines the “original means of production” as “axes carved by prehistoric men” (Murphy, p. 6). Therefore, since prehistoric men lived 10,000 years ago, the oft-cited (in Austrian literature) average period of production is 5000 years? For *every* consumer good? Ridiculous!

Comparison of Garrison's and Aguilar's Capital Structure

Roger Garrison's Aggregate Production Structure a.k.a. Hayekian Triangle



Victor Aguilar's Distribution of Wealth over the Capital Structure



"The time dimension that makes an explicit appearance on the horizontal line 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"

$A = \$100B$ (the wealth of the nation)
 $r = 10.0\%$ (the real interest rate)
 $m = 10$ years (the mean of the DWCS)

If the real interest rate drops below 10.0%, there is an increase in the value of capital dedicated to consumption more than ten years in the future and a decrease in the value of capital dedicated to consumption less than ten years in the future.

(Garrison, 2001, p. 47)

Roger Garrison's Obfuscatory "Double Interpretation"

As poorly as this misunderstanding (whether to look to future consumption or past costs of production for the source of value) reflects on Murphy, this is not the principle source of his confusion. Murphy believes, incredibly, that supply and stock are the same thing, which leads him to contend that the only disagreement that I have with Garrison is over the use of an exponential or a linear construction. Actually, as early as 1990, Skousen was using an exponential function for his Aggregate Production Structure, APS, though not very well. "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" (Aguilar, p. 3).

In fact, the principle question that divides Garrison and myself is not the form of the graph (though that is important too), but what it represents: The Aggregate Production Structure, APS, represents income and the Distribution of Wealth over the Capital Structure, DWCS, represents wealth. This distinction has profound implications. In particular, attaching the APS to the Production Possibilities Frontier, PPF, as Garrison advocates (2001), puts a maximum limit on the interest rate.

Are supply and stock (or, more generally, income and wealth) the same thing? Murphy writes, “At the most basic level, there is nothing at all irregular about a graph meaning one thing ‘and *also* something else.’ For example, a physicist could graph the vertical displacement of an object against time, and say that the graph meant height *and also* the potential energy stored in the object” (Murphy, p. 2).

The obvious retort is that height and potential energy are linearly related, that is, one can be obtained from the other by an equation of the form $y = mx + b$. Potential energy is mass times the acceleration due to gravity times height. For instance, if an elevator cab with a mass of 920 kilos is raised to the top floor of a skyscraper 412 meters above the ground, it will have 3.7 MJ of potential energy, $(920 \text{ kg})(9.8 \text{ m/s}^2)(412 \text{ m})$. If the cable breaks, it will crash through the lobby with 3.7 MJ of kinetic energy. The potential energy of the elevator cab, in joules, is 9016 times its height, in meters.

A graph can mean height and *also* potential energy for the same reason that one can put Fahrenheit and Celsius side-by-side on the same thermometer. They are linearly related to each other: $F = 1.8C + 32$. Similarly, the displacements of American and *also* Japanese engines can appear on the same chart in spite of the fact that American manufacturers cite cubic inches while Japanese manufacturers cite liters. A liter is 61 cubic inches. They both measure the same thing, volume.

But are stock and supply linearly related? No. Supply is the derivative (change in) stock. The stock of houses in town is determined by driving up and down the streets and counting them. The supply of houses is determined by calling county records and asking

them how many building permits have been filed recently. The units for the former are houses, e.g. “There are 5472 houses in town.” The units for the latter are houses per year, e.g. “Twenty-eight new houses were built last year.” In physics, this is the difference between position and velocity. If I am driving on the freeway, my position is five miles west of Phoenix and my velocity is 80 mph, eastbound. Not only do these two statistics have different units, but they are completely different things.

Every function has a unique derivative, but not a unique antiderivative. For instance, if $f(x) = x^2 + 5$, then its derivative is $f'(x) = 2x$. But $2x$ has many possible antiderivatives, $x^2 + C$, with C an arbitrary number. C could equal five, but it could also equal four or 327.28 or any other number. That is why antiderivatives are called indefinite integrals – because, without further information, we do not have any definite knowledge of what C is. Murphy is wrong when he claims that there is a one-to-one relation between stock and supply in the same way that there is a one-to-one relation between height and potential energy.¹

Garrison was obfuscating when he wrote, “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). He knew very well that his triangle represented supply or he would not have attached it to the Production Possibilities Frontier, PPF, which illustrates how a nation’s budget is partitioned. The term “production” is defined as how much of something is produced in one year, e.g. “Twenty-eight new houses were built (produced) last year.” The term never refers to how much of a thing exists at the moment.

¹ Murphy quotes Rothbard, “net saving means a change in the level of gross saving over the previous period of time” (Murphy, p. 4). Does anybody else think that this is what the word “net” means? Obviously, Rothbard did not understand the difference between a function and its derivative any more than Murphy does.

Murphy is no better. He gives an example of what is basically my DWCS (Murphy, p. 3) with wealth measured in wine bottles, both the 1987 vintage that are ready to consume now and the nouveau ones that that will not be ready for consumption until 2027, with the former being of more value than the latter because the latter are discounted for time-preference. As I describe, “Inventory items that do not depreciate are discounted for time-preference on the expected time until they make their contribution to final consumption” (Aguilar, p. 5). But then, after having illustrated my DWCS, Murphy easily slips into defending Skousen’s conception of the APS and Garrison’s plan to attach it to the PPF, apparently not noticing that he is now discussing something completely different from what he illustrated.

Here is a hint for the confused student: When your Austrian professor draws a triangle on the chalkboard (or an exponential function if you have one of the more enlightened professors who knows what exponents are), ask him, “What does the area under that graph represent?” If he answers, “the wealth of the nation,” then his graph is of the DWCS, even if he has got it backwards, with the tail on the left. If he answers “gross national output” or some other phrase² denoting national income, then his graph is of the APS. Now hold him to it! If he says his graph represents wealth and then, later, draws a PPF graph off to the right and connects the two figures with dashed lines, remind him that production is not wealth, it is income.³

“Skousen is at least consistent but, unfortunately, he is consistently wrong. He definitely means the amount of goods flowing by every year. This seems to be the modern interpretation of Hayek’s structure of production” (Aguilar, p. 5). It is because of his intellectual honesty that I chose Skousen’s 1990 *Structure of Production* to be canonical.

² The letter O in Skousen’s GNO can be either “output” or “outlays,” which he considers synonymous.

³ Murphy writes, “I [Murphy] used [Skousen’s] *Economics on Trial* when lambasting GDP figures in intro classes” (Murphy, p. 1). Since Skousen’s alternative to the GDP is gross national output (1991, pp. 38-46), not the wealth of the nation, it is clear that Murphy, along with Garrison, are using Skousen’s APS and consider the area under it to be GNO – income, not wealth. Murphy’s attempt to distance himself from Skousen is, as far as I can tell, just infighting between the Mises Institute and the Foundation for Economic Education. Besides attaching the APS to the PPF and abandoning Skousen’s abortive attempt to understand the exponential function, I see no evidence that Garrison has advanced or altered in any way the theory set forth in Skousen’s “magnum opus,” *Structure of Production*.

Garrison (2001) was also consistently wrong, particularly when he attached the Hayekian triangle to the PPF and thus inadvertently allowed the 100% limit on the marginal propensity to consume to put an upper limit on interest rates. But, with his talk of “double interpretations,” he is too slippery to be considered canonical.

Roger Garrison’s Innovation: A Maximum Interest Rate

Why is having a maximum rate of interest a problem? Because, clearly, there are people willing to pay very high interest rates and other people, like pawn brokers and payday loan companies, willing to charge such rates. Even if the existence of such transactions does not seem important to Roger Garrison in his ivory tower at Auburn University, the necessity of a having a maximum interest rate, combined with his insistence on using simple rather than compound interest, produces nonsensical results. It was to force him to carry his analysis through to its logical conclusion that I challenged Garrison, “I want to see him derive the maximum interest rate for us” (Aguilar, p. 38).

Murphy defends simple interest, “The absolute *most* Aguilar could fairly have said, is that using simple interest is so unrealistic as to render Garrison’s diagram unsuitable for its intended purpose. Other than that, Garrison’s claim is perfectly true” (Murphy, p. 8). This is like saying, except for the fact that someone on the other team caught the ball, the quarterback’s pass was a fine throw. Is Garrison an “innumerate boob?” Let’s find out!

Garrison insists on using simple interest but will not follow through on this choice to its logical conclusions. If he really wants us to identify the interest rate with the slope of the Hayekian triangle’s hypotenuse, then he should do the math and see what interest rates are associated with different marginal propensities to consume. Getting Garrison to actually do the math instead of just vaguely drawing lines on his chalkboard was the point of my challenge to him:

“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” (Aguilar, p. 37-38). I had hoped that Garrison would respond but, after three years, it is clear that I am going to have to do the math for him.

Let us draw the Hayekian triangle with the vertical leg labeled C for consumption, the horizontal leg labeled B and gross national output labeled A, for the area inside the triangle. We will here label the marginal propensity to consume with the letter m, not the more common mpc.⁴ $A = CB/2$ and $C = mA$, so $A = mAB/2$ and thus $B = 2/m$. Since Garrison defines r, the interest rate, equal to C/B , we have $r = mC/2$ and thus $r = m^2A/2$. Q.E.D.⁵

As I observed, “Clearly, $r = 0$ implies that $C = 0$ and $I = A$ ” (Aguilar, p. 38). A marginal propensity to consume of zero is associated with an interest rate of zero. The equation above bears this out as $m^2A/2$ is zero if m is zero. Now let us try it for some more realistic values of m in the neighborhood of 90%, which is what most textbooks estimate the marginal propensity to consume to be:

<u>Marginal Propensity to Consume</u>	<u>Real Interest Rate</u>
100%	0.500 A
95	0.451 A
90	0.405 A
85	0.361 A
80	0.320 A

⁴ “Without an introduction to the notation, most people who pick up an economics text think MPC (actually $C'(Y)$, the derivative of consumption with respect to national income) means M (money) times P (prices) times C (consumption), all of which appear elsewhere in the same equation. Spelling words with variable names is one of the surest signs of someone without mathematical maturity” (1999, p. 39).

⁵ Quite Easily Done. Or, as Böhm-Bawerk would say, as plain as a pikestaff.

This does not make any sense at all. *The interest rate is a proportion of gross national output???* These two statistics do not even have the same units! Gross national output is a term coined by Skousen to refer to his definition of national income (the statistic that mainstream economists denounced for double counting), which is measured in dollars per year. Skousen's instructions for compiling it (1990, pp. 184-185) require people to save their receipts, which I denounced (Aguilar, p. 6) as being contrary to the subjective theory of value. But, ignoring these controversies for the moment, let us suppose that we have followed Skousen's instructions and found the GNO to be \$100 billion dollars a year. Then what, exactly, is the maximum interest rate? What is the interest rate associated with a 90% propensity to consume?

The point of my challenge to Garrison three years ago was to get him to admit that his choice of a linear construction over an exponential one produces nonsensical results, in this case, that the maximum interest rate is half the gross national output. Skousen's conception of the APS as an exponential function is somewhat better (the maximum interest rate is 100%) but, in my opinion, the fact that use of the APS imposes *any* limit on interest rates is a fatal flaw, regardless of what that limit is.

Robert Murphy's Tactic of Blaming the Messenger

Note that, when I use the acronym APS, I am referring to the Aggregate Production Structure, a term coined by Skousen. Section I of my paper (Aguilar) is titled "The Aggregate Production Structure" and figures 1, 2 and 3 reprint Rothbard's (1970, p. 314), Skousen's (1990, p. 195) and Garrison's (1978, p. 174) conceptions of it. The originator of the term, Skousen, toys with the idea of it being exponential (1990, p. 195), though he does not seem to really know what exponential functions are. Rothbard depicts it as a histogram (1970, p. 314) while Hayek (1967, p. 39) and Garrison (2001, p. 47) depict it as a triangle. Basically, the term "Aggregate Production Structure" is a generalization of the Hayekian triangle to include exponential and histogram depictions as well as triangular ones. But the one thing that all of these men agree on, in spite of some

obfuscation about double interpretations by Hayek (1967, p. 40) and Garrison (2001, p. 47), is that the term APS denotes income, not wealth.

When I use the acronym DWCS, I am referring to my own suggested construction, which is about wealth (that is what the W stands for), not income. Murphy writes, “I [Murphy] point out the grave defect that Aguilar’s suggested construction breaks down if the (real?) interest rate exceeds 100%” (Murphy, p. 16), and then he quotes a passage from my *Critique* while omitting the introductory phrase, “If we define the APS to be Are^{rt} , then...” (Aguilar, p. 38). If he had quoted the entire passage it would have been clear that I was contrasting the maximum interest rate obtained by using a linear or an exponential function *for the APS*. I was examining Skousen’s conception of the APS as being exponential.

Why does Murphy think that there is no negative sign in the exponent of Are^{rt} (Aguilar, p. 38)? That is because the APS has the tail on the left, going back into the past – all the way “back to axes carved by prehistoric men” (Murphy, p. 6). When I defined the Distribution of Wealth over the Capital Structure I wrote, “The DWCS is the exponential distribution scaled up by A, the wealth of the nation. That is, the DWCS is the function $f(t) = Ae^{-rt}$ for $0 \leq t < \infty$ ” (Aguilar, p. 14). Notice the negative sign? The DWCS has its tail extending to the right because it sees value in future consumption.⁶ Murphy is wrong when he refers to the APS as “Aguilar’s suggested construction.” The term Aggregate Production Structure, APS, and, specifically, the use of an exponential function for it, Are^{rt} without a negative sign, is Skousen’s suggested construction.

My suggested construction, the DWCS, does not limit interest. The interest rate can be any finite, positive number. It is the inverse of the mean and, since I have defined the

⁶ “The definition of 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 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” (Hayek, 1975, p. 89). If only Hayek’s 1941 *Pure Theory of Capital* had been more widely read than his 1935 *Prices and Production*, with its backwards triangles, Murphy would not now, sixty years later, be seeing significance in past expenditures all the way “back to axes carved by prehistoric men” (Murphy, p. 6).

domain of the DWCS to be from zero to positive infinity and proven that it converges (Aguilar, p. 14), how could the inverse of its mean not also be defined for any finite, positive number?⁷ In the context of the APS, attaching it to the PPF requires that there be a maximum interest rate associated with 100% consumption. This is because, once one has decided to forgo saving any of one's income, nothing changes if one becomes even *more* devoted to immediate consumption.⁸ The DWCS *cannot* be attached to the PPF because the former is about wealth and the latter is about income, which, contra Murphy, are not the same thing.

Ludwig Mises' Ordinary Interest and Praxeological Method

Murphy writes, "Since (I take it) the purpose of this contest is to defend the (theoretical) honor of the editors of the *Quarterly Journal of Austrian Economics*, it is far more appropriate for me to focus on Aguilar's criticism of Hayek and (especially) Garrison and Mises [rather than Skousen]" (Murphy, p. 1). Yet, in my *Critique*, I raise four objections to Garrison's *Time and Money*. Murphy ignored the first two, he responded to the third one with a false analogy to physics and he responded to the fourth one by mislabeling Skousen's theory as mine and then criticizing me for Skousen's mistake.

As for defending Mises, Murphy concedes both of my major objections. Regarding Mises' theory of ordinary interest, Murphy writes, "Aguilar basically asks how one can derive the ordinary *rate* of interest from the vast array of prices in an actual structure of production. I too raised a similar objection in my dissertation (2003)" (Murphy, p. 14).

⁷ Only God, who is immortal, can have a real interest rate of 0%. Setting $r = 0$ would imply that every event, no matter how far in the future, is of equal importance. For us mortals, the interest rate and its inverse, the mean, can be any finite, positive number. In other words, the DWCS is defined to be exponential and, since the function $f(t) = Ae^{-rt}$ is not exponential if one sets $r = 0$ or $r = \infty$, r cannot take these values.

⁸ The marginal propensity to consume is currently (Feb 2007) at 101% for the United States, a record high. So 100% is not an *absolute* limit, but it can be just slightly exceeded, and then only by a country whose currency is accepted around the world by people who do not (immediately) need to convert their savings into their own currency. The Japanese, for example, sell us millions of cars a year and are willing to accept, in exchange, dollar-denominated savings accounts even though dollars cannot be used for making purchases in their homeland.

Regarding Mises' pseudo-axiomatic praxeological method, Murphy concedes, "I certainly agree that Mises never *formally* lays out his praxeological system the way he says it should be done; a pithy summary would be to question whether Mises' method agreed with his methodology. It is also humorous when Aguilar asks, 'Who ever heard of an axiomatic system with only one axiom?' (Aguilar, p. 34)" (Murphy, p. 14).

The four (unanswered) objections that I have to Garrison's theory are as follows:

- 1) Mainstream economists use the term "Production Possibilities Frontier" to mean that it is impossible to cross this boundary, not just that bad things happen when one does. If Garrison will admit that depressions are caused by *malinvestment*, not *overinvestment*, then he can avoid discussing unsustainable events that take place outside the PPF. I observe that "Hayek describes a rather mechanical shuffling of wealth back and forth between the higher and lower stages of production" (Aguilar, p. 29). Garrison must concede that this is all that his theory does too.⁹ Nobody is going to accept that the economy can be outside the PPF, even if Garrison denounces such ventures as "unsustainable."
- 2) In Section VIII, which Murphy declined to respond to, I write, "Garrison (2001, p. 44) redefines the Production Possibilities 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

⁹ Murphy asks, "How can a website be 'wasted'? Why wouldn't it just be relocated to a more appropriate use" (Murphy, p. 13)? Well, there were costs associated with producing this website. Murphy was paid \$1000 for his rebuttal and the designers who created the layout did not donate their time. I myself spent a whole Sunday afternoon writing *Critique of Austrian Economics*. If I were to come to my senses and realize that what the economics community really wants is another sycophantic ode to Rothbard, it would be hard to describe the expenditures on this site as anything other than "wasted." Murphy writes, "[I]f all capital goods were perfectly non-specific, then there couldn't possibly be a boom-bust cycle.... The dot.com bubble in no way contradicts this" (Murphy, pp. 11-12). Murphy does not understand the difference between websites and search engines. When I wrote, "The dot.coms are highly nonspecific, facilitating the sale of products at every stage of production" (Aguilar, p. 16), I was referring to search engines. For instance, www.badscience.com gets a lot of hits from people looking for Philip Plait's www.badastronomy.com, but badscience.com is just a bunch of miscellaneous links to commercial websites. Their clients, who probably have no knowledge of the deception involved in generating the traffic they are paying for, advertise products at every stage of production. Badscience.com is a survivor of the dot.com crash, and one that Plait probably wishes had failed along with the others. I continue to ask: Can Garrison tell us in which of his five stages badscience.com belongs?

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” (Aguilar, p. 26). It is a conundrum. If Garrison raises the specter of inflation to explain unsustainability, he cannot explain his identification of real and nominal interest rates, but if he assumes stable prices, he cannot explain unsustainability. Garrison must concede that his theory is only applicable in times of stable prices and, hence, the interest rate is real throughout his graph. This is basically the same concession that I demanded for mistake #1.

- 3) Garrison was obfuscating when he wrote, “The time dimension that makes an explicit appearance on the horizontal leg of the Hayekian triangle has a double interpretation” (2001, p. 47). Skousen definitely means the amount of goods flowing by every year and, in spite of his obfuscation, this is also what Garrison means. This choice is a problem for Garrison because it implies that there must be a maximum interest rate. Garrison wanted to reach out to mainstream economists by attaching his triangle to their PPF but, unfortunately, this committed him to using income rather than wealth, which pinned him down on the wrong side of his double interpretation.
- 4) Garrison insists on using simple interest but will not follow through on this choice to its logical conclusions. As we have seen, the choice of a linear construction over an exponential one produces nonsensical results, in this case, that the maximum interest rate is half the gross national output. Garrison must concede that, if he does not want people to think he is an innumerate boob, he is going to have to use compound interest.¹⁰ This is basically the same concession that I demanded for mistake #3, since adopting the DWCS implies both agreeing to study wealth rather than income and also compound interest rather than simple interest.

¹⁰ In Appendix A of my book (1999, pp. 213-224) I raise the possibility that the time-value of money is not exponential. I had certainly hoped that it was, since my third axiom is equivalent to this assumption, but I was surprised to discover that $1/t^2$ also works. I speculate that the inhabitants of another planet might organize their economy in this way and feel that it perfectly natural to calculate interest by taking the square root of the amount owed, inverting, subtracting a constant, squaring and inverting again. While this may seem awkward to us, it is not inconsistent and I cannot criticize such an alternative set of axioms any more than Euclideans can criticize Lobachevsky’s axioms.

Robert Murphy's Criticisms of the Form of the DWCS

I said earlier that “the principle question that divides Garrison and myself is not the form of the graph (though that is important too), but what it represents: The Aggregate Production Structure, APS, represents income and the Distribution of Wealth over the Capital Structure, DWCS, represents wealth.” However, having addressed this basic issue, let us now turn to Murphy’s criticisms of the form of the DWCS, particularly its smoothness, its being defined out to infinity and the meaning of its mean (no pun intended).

Some of Murphy’s criticisms of the DWCS could be leveled against any distribution. For instance, he asks, “what if we wish to depict an economy that does *not* have the smoothness inherent in this function?... It seems that once we want the DWCS to more accurately represent an actual capital structure, we would be forced to abandon the elegant mathematical construction and end up drawing a histogram” (Murphy, p. 16). Actually, as anyone who has worked with confidence intervals knows, if one has at least thirty samples, there are really no problems with using the normal distribution which, like the exponential distribution that we are using, is smooth and continuous. There are a lot more than thirty people in America and they each own thousands of distinct capital-goods items, so I think we are safe to define the DWCS to be smooth and continuous.¹¹

Also, Murphy notes that the DWCS is defined out to infinity yet, in reality, people do not look much more than a few decades into the future, if that. Murphy writes, “Aguilar might respond that this is a harmless simplification, since the height of his graph goes to zero as we go out to infinity on the time axis” (Murphy, pp. 15-16), but Murphy clearly does not think it harmless himself. Actually, all continuous distributions have a tail that

¹¹ Readers who wish to learn more about the exponential function can find a chapter on it in any introductory statistics textbook. As a probability density function, it describes the probability of having to wait t time-units for the first change in a Poisson process. For instance, the number of customers to enter a retail store in an hour has a Poisson distribution and the time, in minutes, before the next customer arrives has an exponential distribution, assuming that customers are rare enough that there is a negligible chance of getting two at a time. In industry, the number of defects to appear in the stream of manufactured products rolling off an assembly line is described as a Poisson process, again assuming that there is a negligible chance of a single item having more than one defect.

trails off into infinity. For instance, the normal distribution (a.k.a. the bell-shaped curve) is defined from $-\infty$ to $+\infty$, but there is only a 0.04% chance of observing phenomena more than three and a half standard deviations from the mean. Just because nobody has ever seen such unusual phenomena does not mean it is wrong to grant them a smidgen of probability. Anyway, regarding the DWCS, people do sometimes look to eternity - the designers of the Great Pyramid certainly did.

Murphy writes, “Although [Aguilar] may be right that the Hayekian approach is bankrupt, even so Aguilar’s suggested fix doesn’t fit the bill. Again, Hayek is trying to describe the entire capital structure that must be maintained if one is to yield a constant stream of consumption goods. This capital structure *cannot* be defined from the initial time to ‘infinity,’ for the simple reason that people can’t wait forever to eat (or drive cars or watch TV)” (Murphy, p. 9).

I agree: The Hayekian approach is bankrupt. However, the capital structure *can* be defined from the initial time to infinity. As I said when I defined the DWCS, “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” (Aguilar, p. 5). Note that, when I say “initial time,” I mean “right now, at time zero” (Aguilar, p. 8). It is possible that Murphy is looking “back to axes carved by prehistoric men” (Murphy, p. 6) when he says “initial time.” *That* analysis is of no value to us. We should be looking forward to future consumption, not back to caveman days.

Murphy did not read my paper very thoroughly. *Of course* people cannot wait forever to eat. That is why I weight the value of goods that will be consumed in the future by time preference. Mine would not be much of a theory if it could be dismissed simply by

pointing out that people value a hamburger today more than they value a hamburger next week.

It is possible that Murphy is unaware of functions like $1/t$ which asymptotically approach the time axis, similar to the way Ae^{-rt} does, but do not converge, that is, the area under $1/t$ out to infinity is infinite. I write, “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” (Aguilar, p. 14). Why does Murphy think I had to prove convergence, and do it first before proving any other results? It was to meet exactly the sort of criticism that he is leveling against me here.

Like “convergence,” “average” is another difficult word for the Austrians. Murphy writes, “I have heard plenty of people use *average* as a general term, which could include the mean, median, and mode under its umbrella.” Yes, plenty of people, but not mathematicians. “In any event,” Murphy continues, “Aguilar thinks that what the Hayekians *really* mean to say is ‘the midpoint, half the range.’” (Murphy, p. 8). Actually, that is not what Hayekians mean, it is what Hayek himself meant (1967, p. 42). Forty-two years earlier Böhm-Bawerk had his own definition (1959, v. 2 p. 86) and forty-seven years later, Garrison had a suggestion (1978, p. 170). The objective of this passage is not to identify what the Hayekians *really* mean, but to point out that they do not actually know what they mean when they use this ambiguous word.

Murphy writes, “[Böhm-Bawerk’s] notorious concept of the average period of production was designed to quantitatively assess how long a unit of factor inputs was ‘tied up’ in the pipeline. Whatever Aguilar’s other objections, he can’t condemn Hayek for relying on something that is finite in scope. The original factors are necessarily tied up for only a finite time” (Murphy, p. 9). Are they? What about those copper axes that Murphy was so concerned about in the previous section? How long have they been tied up? Again, not to belabor the point, but Murphy’s constant tendency to look back into the past to the original factors of production betrays his Marxist leanings.

Conclusion

To get an intuitive feel for what the mean of the DWCS represents, ask yourself, "How much of my wealth is in my house, which is intended to provide shelter for twenty years; how much is in my car, which is intended to provide transportation for five years; and how much is in peaches or fashionable clothes for my girlfriend, which will be valuable for about a week before becoming overripe or going out of style?" If you are a businessman, such as a farmer, ask yourself, "How much of my wealth is in my farm, which is intended to grow crops for another twenty years until the aquifer dries up; how much is in my tractor, which is intended to till the soil for another five years until it breaks down; and how much is in the crops in the field, which will be harvested next month?"

Also note that these time periods are the means of the useful lives of these items. When I say that a house provides shelter for twenty years, I do not mean that it provides one big burst of shelter twenty years hence, nor that it provides shelter until the twenty year mark and then falls to kindling; I mean that it contributes a continuous stream of shelter out to infinity but, due to deterioration, less and less as described by exponential decay, with a mean of twenty years. The fact that some functions defined out to infinity (such as the exponential function) have a finite mean while others (such as the inverse function) do not have a finite mean confuses many people, but this is just basic calculus and I will refer the reader to any introductory calculus text for an explanation.

For wealthy people, the mean of their personal DWCS is around twenty years, that is, most of their wealth is in long-term projects. Their interest rate is about 5%, slightly less than what they get on certificates of deposit. For middle-class people, the mean of their DWCS is around five years, that is, most of their wealth is in their car. Their interest rate is about 20%, slightly more than what they pay on their credit cards. For people living in hardscrabble conditions, their horizon does not extend beyond a month and their yearly interest rate is about 1500%. This is slightly more than what they pay at the pawn shop when hocking their possessions. Murphy writes, "Surely there are differences between the capital structure of current America and Bangladesh, that cannot be attributed merely to different A and r " (Murphy, p. 16). I would

respond that, no, Banglas are just like Americans, only poorer. If Murphy thinks there is some other difference, I would like to hear what it is.

Murphy concludes, "Aguilar next goes on to demonstrate the superior precision of his own approach, and in particular his ability to determine precisely where the 'fulcrum' point is when interest rates change. In contrast, the Austrians know that there must be some intermediate stage that is unaffected by the change, yet they can't really say which one. On this point I am in total agreement with Aguilar" (Murphy, p. 9).

Good. I like to hear that people totally agree with me. I was quite proud of locating the pivot point for the Austrians. After a hundred years, it is about time someone found it. And, on that positive note, let's quit. As much fun as it is to pick Murphy's rebuttal apart, I think I have made my point. Murphy has utterly failed to refute any part of my *Critique of Austrian Economics*. I need a more worthy opponent. Perhaps Roger Garrison would like to take a shot at it? A thousand dollars says he cannot write a better rebuttal than Murphy did!

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