Multiple Interest Rates and
Austrian Business Cycle Theory

Robert P. Murphy[*]

I. INTRODUCTION

In its canonical form (e.g. Mises 1998 and Rothbard 2004), Austrian business cycle theory (ABCT) has focused on the distortions in the structure of production introduced by lowering "the" market rate of interest below "the" natural rate. To be sure, Mises and his followers are aware that in the real world, there are a multiplicity of interest rates, depending on the length of the loan and the perceived risk of default. Even so, it remains that the standard exposition of ABCT (e.g. Garrison 2001) still relies on the contrast between "the" market rate vs. "the" natural rate of interest.

The present paper explores the implications of these real-world facts—namely, the different rates of interest based on the term structure and risk spreads—on the traditional ABCT. I argue that the original Misesian insights still hold valid, and that the economist armed with ABCT has much to contribute to contemporary debates. However, I also conclude that the canonical ABCT *does* need to be updated, in light of a crippling objection raised early on by Pierro Sraffa (1932a, 1932b).

Specifically, I will argue that the Austrians need to develop an equilibrium construct that is more robust than the Misesian "evenly rotating economy" (ERE), or what in mainstream terminology would be described as a *steady-state* equilibrium. Rather than couching their business cycle theory in terms of the ERE, Austrians should use a more general notion of *dynamic* equilibrium. In this construct, the fundamentals of consumer preferences, resources supplies, and technology can change over time, but these changes are perfectly anticipated and thus entrepreneurs earn no pure profits. If they insist on

[*] Adjunct Scholar, Ludwig von Mises Institute. Contact: rpm@ConsultingByRPM.com.

defining "the" natural rate of interest with reference to the ERE, Austrians will have very little to contribute to modern discussions of financial markets. But by relaxing their equilibrium construct to allow for changing conditions, the Austrians can retain the essence of the Mises-Hayek business cycle theory, and use their superior capital theory to enlighten mainstream financial economists.

This paper is organized as follows: Section II revisits the Sraffa-Hayek debate to underscore the serious limitations of the notion of "the" natural rate of interest. In Section III, I propose a more general construct of equilibrium—a *dynamic* equilibrium—which is entirely consistent with Hayek's own pioneering work (1937) on intertemporal plan coordination. I show how Hayek could have answered Sraffa, by walking through an example of a bank-induced misallocation of resources even in an economy with no single natural rate of interest.

Section IV explores the yield curve and its mysterious predictive power. I point out that the ERE is of little help on this important topic—because the yield curve is necessarily flat in the ERE—and then use ABCT to light the way for mainstream economists.

In Section V, I bring up yet another problem with the Misesian equilibrium construct: By using the ERE to distinguish entrepreneurial profit from the pure interest return, Misesians have difficulty explaining something so simple as the higher "equilibrium" yield on a corporate bond versus a Treasury bond of the same maturity. Inasmuch as risk spreads apparently convey information about the real world, Austrians working in the Misesian tradition should further refine their equilibrium construct (and their treatment of pure interest versus pure profit) in order to account for such elementary facts of the bond market. In particular, the Austrian needs refined tools to analyze financial markets in order to grapple with such controversial topics as maturity mismatching. Finally, I conclude in Section VI.

II. THE SRAFFA-HAYEK DEBATE: MULTIPLE NATURAL RATES

Friedrich Hayek's *Prices and Production* (1931) was an elaboration and extension of the Misesian theory of the trade cycle, of which Piero Sraffa published a scathing review (1932a) in the *Economic Journal*. Hayek responded (1932), and then Sraffa offered a final rejoinder (1932b). The Sraffa-Hayek debate involved several points of fundamental disagreement, but for our purposes we need to concentrate only on one: the possibility of multiple "natural rates" of interest on different commodities.

Following Mises, Hayek had argued in *Prices and Production* that the unsustainable boom period is caused when the banks charge a money rate of interest lower than the "natural rate" of interest. Against this explanation, Sraffa made the simple observation that *there is no such thing* as "the" natural rate of interest in any economy outside of (what we would now call) a steady-state equilibrium. Consequently, Hayek's proposal that banks set the money rate of interest equal to "the" natural rate of interest was apparently nonsensical.

To set the context, we should first review two quotations from Sraffa's initial review:

> Dr. Hayek's theory of the relation of money to the rate of interest is mainly given by way of criticism and development of the theory of Wicksell. He [Hayek] states his own position as far as it agrees with Wicksell's as follows:—"In a money economy, the actual or money rate of interest may differ from the equilibrium or natural rate, because the demand for and the supply of capital do not meet in their natural form but in the form of money, the quantity of which available for capital purposes may be arbitrarily changed by the banks."
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> An essential confusion, which appears clearly from this statement, is the belief that the divergence of rates is a characteristic of a money economy: and the confusion is implied in the very terminology adopted, which identifies the "actual" with the "money" rate, and the "equilibrium" with the "natural" rate. *If money did not exist, and loans were made in terms of all sorts of commodities, there would be a single rate which satisfies the conditions of equilibrium, but there might be at any one moment as many "natural" rates of interest as there are commodities, though they would not be "equilibrium" rates.* (Sraffa 1932a, p. 49, italics added)

A few pages later, Sraffa spells out the implications of this insight for Hayek's policy recommendation:

> [I]n times of expansion of production, due to additions to savings, there is no such thing as an equilibrium (or unique natural) rate of interest, so that the money rate can neither be equal to, nor lower than it….[T]here is a "natural" rate of interest which, if adopted as bank-rate, will stabilise a price-level (i.e. the price of a composite commodity): it is an average of the "natural" rates of the commodities entering into the price-level, weighted in the same way as they are in the price-level itself. What can be objected to [in this Wicksellian approach] is that such a price-level is not unique, and for *any* composite commodity arbitrarily selected there is a corresponding rate that will equalise the purchasing power, in terms of that composite commodity, of the money saved and of the additional money borrowed for investment. (Sraffa 1932a, p. 51, italics original)

An Example

At this point, it may help to work through a concrete example that illustrates Sraffa's claims (which may confuse the modern reader because of Sraffa's anachronistic use of the term *equilibrium*). We will examine a hypothetical barter economy in which there are only two types of goods, apples and oranges. Suppose that in the first period, apples and oranges trade at par, but in the following period a frost is expected to reduce the supply of oranges (relative to the supply of apples at that time). In such a scenario, the values in Table 1 are entirely plausible exchange ratios (where a "claim to a future apple"[1] refers to an airtight claim *today*, guaranteeing an apple to be delivered next period):

1 present apple	:	1 present orange
1 present apple	:	2 claims to future apples

[1] We have avoided the obvious term *future apple* because it might confuse readers who are familiar with futures markets. In the actual financial markets, a *futures* contract and a *forward* contract both entitle the owner to delivery of goods at a future date, but he must hand over money for them *at that time* (at the futures price or forward price, respectively). In contrast, in the text above, we are envisioning a scenario where the investor in period 1 *pays for* the claim which guarantees him delivery (with no further strings attached) of an apple or orange in period 2. To relate this to actual financial markets, the investor in period 1 is buying a European call option with a strike price of zero that expires in period 2.

1 present apple	:	½ claim to future orange
1 present orange	:	½ claim to future orange
1 present orange	:	2 claims to future apples
1 claim to future apple	:	¼ claim to future orange

Table 1—Arbitrage-Free Real Exchange Ratios
(calculated in first period)

Note that we are assuming perfect foresight: Although the relative supply of apples and oranges changes from the first to second period, this change is entirely *anticipated*. Consequently, the values in Table 1 allow for no arbitrage profits.[2]

Now, in such a barter economy as depicted in Table 1, what is "the" natural rate of interest? There is no such thing. The own-rate of interest on apples is 100 percent (one present apple in period 1 exchanges for two apples in period 2). But the own-rate of interest on oranges is –50 percent (because one present orange only trades for ½ future oranges). Consequently, if we were to introduce a money commodity and a central bank, and someone such as Hayek recommended that the bank set the money rate of interest equal to "the" natural rate, we would be unable to follow his advice.

As Sraffa pointed out, we can certainly obtain a unique "real" rate of interest once we specify a basket of commodities, the price of which will serve as a measure of the "price level." For example, if we assume that the relevant basket consists of one apple and one orange, then the real or natural rate of interest in our hypothetical economy is –20 percent. To see this, consider an investor in the first period who possesses 100 apples and 100 oranges (i.e. 100 "baskets" of commodities). Our investor can enter the market for

[2] For example, someone starting with one present apple can't engage in a series of trades in order to end up (in the same initial period) with *more* than one apple. If he swapped (a) his present apple for a present orange, (b) then the present orange for two claims to future apples, (c) then the claims to two future apples for ½ of a claim to a future orange, and (d) finally the ½ claim to a future orange for a present apple, then the investor would be right back where he started. In general, this might not be the case; arbitrageurs would buy and sell until the spot and future-claim prices eliminated all such opportunities for pure profits. (We are of course abstracting away from the fact that in reality, all trades take some time, and there is truly no such thing as a riskless profit.)

future fruit by selling these present goods in exchange for 80 apples and 80 oranges (i.e. 80 baskets) to be delivered in the following year.[3]

However, our choice of the commodity basket was completely arbitrary; perhaps only a few consumers in this economy actually eat oranges, and hence they should not be weighted on a par with apples. But once we change the construction of the index basket, the computed real rate of interest will also change. If, for example, the basket consists of *two* apples and one orange, then the resulting real rate of interest is exactly zero. Finally, if the basket consists of *three* apples and one orange, the real rate of interest is +14 percent.

As this simple example demonstrates, when the natural or own-rates of interest differ on individual commodities, there is no way to isolate a unique natural rate of interest for the economy as a whole. By specifying a basket of commodities to serve as a price index, one can certainly obtain a unique number, but the construction of such a basket is largely arbitrary and has no intrinsic relation to issues in capital or interest theory.

Hayek's Response

Ironically, Hayek seemed perfectly aware of these issues. Indeed, because his terminology is more familiar to modern ears, Hayek's own summary is much more comprehensible:

> Mr. Sraffa denies that the possibility of a divergence between the equilibrium rate of interest and the actual rate of interest is a peculiar characteristic of a money economy. And he thinks that "if money did not exist, and loans were made in terms of all sorts of commodities, there would be a single rate which satisfies the conditions of equilibrium, but there might, at any moment, be as many 'natural' rates of interest as there are commodities, though they would not be 'equilibrium' rates" (p. 49). I think it would be truer to say that, in this situation, there would be *no single rate* which, applied to all

[3] Specifically, the investor can (a) sell all 100 oranges in period 1 for 50 oranges to be delivered in period 2, (b) sell 60 of his apples in period 1 in exchange for 30 (additional) oranges to be delivered in period 2, and finally (c) he can sell his remaining 40 apples in period 1 in exchange for 80 apples to be delivered in period 2.

> commodities, would satisfy the conditions of equilibrium rates, but there might, at any moment, be as many "natural" rates of interest as there are commodities, *all* of which would be *equilibrium rates*…There can, for example, be very little doubt that the "natural" rate of interest on a loan of strawberries from July to January will even be negative, while for loans of most other commodities over the same period it will be positive. (Hayek 1932, p. 245, italics original)

It is obvious from his general remarks, as well as his example of strawberries, that Hayek is perfectly aware of the possibilities illustrated in our hypothetical economy in Table 1. It is also noteworthy that Hayek has no problem with the notion that at least for some goods, a marginal present unit could be less valuable than a marginal future unit. In other words, Hayek appears to reject the strategy of classifying "strawberries in January" as a different good from "strawberries in July," as many modern Misesians would do (e.g. Block 1978), when faced with a case of present goods trading for fewer units of future goods.

As we mentioned above, Hayek's description probably sounds more accurate to modern readers than Sraffa's, because the two economists ascribed different meanings to the word *equilibrium*. For Hayek, a system of intertemporal prices is in equilibrium whenever the individuals involved have no reason to alter their behavior (and hence cause prices to change). This usage is consistent with the more modern view of equilibrium price systems being free from arbitrage opportunities, and it is also compatible with Hayek's famous vision (1937) of intertemporal plan coordination.

In contrast, Sraffa's use of *equilibrium* reflects a classical concern with the long run, and anticipates his own later work (Sraffa 1960) which has been aptly described as "neo-Ricardian." In the following passage, we can clearly see that Sraffa does not adhere to modern usage:

> In equilibrium the spot and forward price coincide, for cotton as for any other commodity; and all the "natural" or commodity rates are equal to one another, and to the

> money rate.[4] But if, for any reason, the supply and the demand for a commodity are not in equilibrium (i.e. its market price exceeds or falls short of its cost of production), its spot and forward prices diverge, and the "natural" rate of interest on that commodity diverges from the "natural" rates on other commodities. (Sraffa 1932a, p. 50)

Here we see that Sraffa conceives of market prices in the fashion of the classical economists. Yes, a sudden surge in demand can drive up the actual price of cotton above its "costs of production," but then the higher profits will lead to more cotton production, which would push the cotton price back down. So long as consumer preferences, resource constraints, and technology were held fixed, actual market prices would tend towards the levels prescribed by the cost theory of value.[5] Ironically, the neo-Ricardian vision of an economy in "equilibrium" is very similar to the Misesian ERE.

So long as an economy is in (what we would now call) a steady state, where the relative prices in each period remain identical, then both Hayek *and* Sraffa would classify it as "in equilibrium." However, a dynamic economy—one in which relative prices change over time, such as the hypothetical economy in Table 1—would definitely *not* be in equilibrium for Sraffa. (After all, its internal elements are not "stable" as time passes.) But for Hayek, as well as modern general equilibrium and finance theorists, such an economy would still be in equilibrium, so long as every individual had correctly anticipated the relevant changes. In this case, no individual has any reason to alter his or her plans, and hence these *plans* are stable over time, even though relative (spot) prices might evolve with the passage of time.

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[4] When someone buys (or "goes long") a forward contract, he promises to buy a certain quantity of the underlying commodity or financial asset at a future date, for a specified *forward price* that he pays *at the time of delivery*. Sraffa is saying that in a long-run, steady-state equilibrium (where all the spot prices remain the same, day after day), the spot and forward prices are the same for any commodity. For example, if the spot price of wheat is $10 per bushel, then someone who locks himself into buying 100 bushels of wheat in twelve months' time will also lock himself into paying (at that time) $10 per bushel. This may sound strange to the student of mathematical finance, where a standard relation holds that the forward price of an asset is equal to the current spot price multiplied by the percentage growth in value of a risk-free bond over the length of the contract. (In other words, Sraffa's condition seems to assign a forward price that is too low.) However, the modern mathematical "rule" for forward pricing relies on an arbitrageur's ability to "short" an indefinite amount of the underlying asset, something that obviously can't be done with physical commodities.

[5] For a modern statement of classical price theory, see Carson (2004). For my critique of Carson's defense of Ricardo, see Murphy (2006).

For our purposes in this paper, Sraffa's idiosyncratic terminology is unimportant, as long as it does not obscure his critique of Hayek. Yet it was necessary for us to first clarify the exact meaning of *equilibrium* for Hayek, before proceeding to his attempted solution to Sraffa's critique.

Hayek's Solution to Sraffa's Objection

We have already seen the potential problem that a dynamic economy poses for the standard Austrian explanation of the trade cycle: How can Hayek (or Mises) claim that the boom-bust cycle is caused by a money rate of interest lower than the natural rate, if—outside the ERE—there are (in principle) as many natural rates as there are commodities?

Hayek himself seemed unconcerned. After making the clarification (caused by Sraffa's terminology) we have quoted above, Hayek goes on to argue:

> [T]he only essential point at issue here is whether the fact that any of the "natural" rates, in terms of a single commodity, may be out of equilibrium in consequence of a disparity between the supply of and demand for this particular commodity can have effects which are anything like those of a divergence between the actual money rate and the equilibrium rate which is due to an increase in the quantity of money. I certainly believe that it is possible in this case to change "artificially" the rate of interest in a sense in which this… cannot be said of any commodity. (Hayek 1932, p. 246)

Hayek then discusses Sraffa's example, not quoted in the present paper, of farmers who arbitrarily increase the supply of wheat (which Sraffa hoped to show would be analogous to Hayek's fear of the bankers arbitrarily increasing the supply of credit to producers). Although Sraffa thought the two cases were equivalent, Hayek claims that the wheat farmer case would *not* have effects similar to those caused by the bankers' actions:

> Let us take Mr. Sraffa's case in which the farmers "arbitrarily changed" the quantity of wheat produced—which I understand…to mean that they…so increased the supply of wheat that its price fell below its cost of production and, as a consequence of its temporary abundance, loans of wheat were made at a much lower rate of interest than

> loans of other commodities. But would that fall in the rate of interest on wheat-loans cause anyone to start round-about processes of production for which the available subsistence fund is not sufficient? There is no reason whatever to assume this. In so far as people live on wheat, they will actually be provided with food for a longer period… (Hayek 1932, p. 246)

Finally, in order to see exactly what happens when the bankers artificially lower the money rate of interest, Hayek comes up with the best analogy he can for the case of barter:

> The [situation] would, however, be different if the actual supply of wheat were not changed, but if, under the mistaken impression that the supply of wheat would greatly increase, wheat dealers sold *short* greater quantities of future wheat than they will actually be able to supply. This is the only case I can think of where, in a barter economy, anything corresponding to the deviation of the money rate from the equilibrium rate could possibly occur. And if we assume that, in the community where this happens, wheat is the most important consumption good, then the consequences might be similar to those which occur when the money rate is below the equilibrium rate. (Sraffa 1932, pp. 246-247, italics original)

In this tantalizing passage, Hayek puts his finger on the crucial point: When the commercial banks flood the loan market with artificial credits, this causes producers to *erroneously begin projects that are physically unsustainable*. Specifically, the producers lengthen production processes as if the savings of real goods had increased (when in fact they have not). Thus, when Hayek laments that the banks cause a divergence of the money from the equilibrium rate of interest, he is referring to the fact that the false interest rate disrupts the intertemporal coordination between producers and consumers. Sraffa clearly missed the entire essence of ABCT, because—as Hayek pointed out—Sraffa's suggested barter example would actually *increase* the subsistence fund; it was (by stipulation) a mistake, but only because consumers would have preferred that some *other* goods had been produced rather than the increment in wheat output. In other words, Sraffa's example of an erroneous (and unprofitable) increase in wheat production would *not* count as a "malinvestment" in the Misesian sense.

Unfortunately, Hayek carries this train of thought no further, and doesn't drive home the essence of the ABCT. In his rejoinder, Sraffa understandably feels his victory is complete:

> Dr. Hayek's ideal maxim for monetary policy, like that of Wicksell, was that the banks should adopt the "natural" rate as their "money" rate for loans: the only obstacle which he saw was the difficulty of ascertaining in practice the level of the "natural" rate (p. 108 of the book). I pointed out that only under conditions of equilibrium [i.e. in a steady state —RPM] would there be a single rate; and that when saving was in progress there would at any one moment be many "natural" rates, possibly as many as there are commodities; so that it would be not merely difficult in practice, but altogether inconceivable, that the money rate should be equal to "the" natural rate. And whilst Wicksell might fall back… upon an average of the "natural" rates weighted in the same way as the index number of prices which he chose to stabilise, this way of escape was not open to Dr. Hayek, for he had emphatically repudiated the use of averages. Dr. Hayek now acknowledges the multiplicity of the "natural" rates, but he has nothing more to say on this specific point than that they "all would be equilibrium rates." The only meaning (if it be a meaning) I can attach to this is that his maxim of policy now requires that the money rate should be equal to all these divergent natural rates. (Sraffa 1932b, pp. 250-251)

Of course, one might object to the claim that Hayek "has nothing more to say on this specific point," but Sraffa's bafflement is quite understandable. In his brief remarks, Hayek certainly did not fully reconcile his analysis of the trade cycle with the possibility of multiple own-rates of interest. Moreover, Hayek never did so later in his career. His *Pure Theory of Capital* (1975 [1941]) explicitly avoided monetary complications, and he never returned to the matter.

Unfortunately, Hayek's successors have made no progress on this issue, and in fact, have muddled the discussion. As I will show in the case of Ludwig Lachmann—the most prolific Austrian writer on the Sraffa-Hayek dispute over own-rates of interest—modern Austrians not only have failed to resolve the problem raised by Sraffa, but in fact no longer even recognize it.

Retrogression: The Case of Lachmann

Austrian expositions of their trade cycle theory never incorporated the points raised during the Sraffa-Hayek debate. Despite several editions, Mises' *magnum opus* (1998 [1949]) continued to talk of "the" originary rate of interest, corresponding to the uniform premium placed on present versus future goods. The other definitive Austrian treatise, Murray Rothbard's (2004 [1962]) *Man, Economy, and State*, also treats the possibility of different commodity rates of interest as a disequilibrium phenomenon that would be eliminated through entrepreneurship.

To my knowledge, the only Austrian to specifically elaborate on Hayekian cycle theory vis-à-vis Sraffa's challenge is Ludwig Lachmann. After summarizing the views of Sraffa and Hayek (much as we have done in this paper), Lachmann writes:

> It is not difficult [to] close this particular breach in the Austrian rampart. In a barter economy with free competition commodity arbitrage would tend to establish an overall equilibrium rate of interest. Otherwise, if the wheat rate were the highest and the barley rate the lowest of interest rates, it would become profitable to borrow in barley and lend in wheat. Inter-market arbitrage will tend to establish an overall equilibrium in the loan market such that, in terms of a third commodity serving as *numéraire*, say steel, it is no more profitable to lend in wheat than in barley. This does not mean that actual own-rates must all be equal, but that their disparities are exactly offset by disparities between forward prices. The case is exactly parallel to the way in which international arbitrage produces equilibrium in the international money market, where differences in local interest rates are offset by disparities in forward rates. In overall equilibrium it must be as impossible to make gains by 'switching' commodities as currencies. (Lachmann 1986, p. 238)

Lachmann's argument is correct as far it goes. In equilibrium, where there are no arbitrage opportunities in the price structure, the rate of return (adjusted for risk) must be the same in all investments (such as forward contracts in wheat and barley) whether the standard of value is dollars, steel, or any other designated *numéraire*. However, there is no reason for these rates to *equal each other*: The "interest rate" in terms of steel may be different from the "interest rate" measured in terms of iron or gold. Above we saw that the different weighting of the commodity basket (used to gauge the price level) could affect the calculated real rate of interest. In the same way, if we designate the commodity basket as "one unit of gold" we will compute one rate of interest (i.e. the own-rate on units of gold), whereas if we designate the basket as "one unit of iron" we may compute a different rate of interest (i.e. the own-rate on units of iron). We can see this most clearly by adding a third commodity, steel, to our hypothetical economy from above. Table 2 then depicts a selection of plausible prices for this barter economy:

PRICES POSTED IN PERIOD 1			PRICES POSTED IN PERIOD 2		
1 spot apple	:	1 spot orange	1 spot apple	:	¼ spot oranges
1 spot apple	:	2 claims to future apples	1 spot apple	:	2 spot steel
1 spot orange	:	½ claim to future orange	1 spot orange	:	8 spot steel
1 spot steel	:	1 spot apple		:	
1 spot steel	:	4 claims to future steel		:	

Table 2—(Abridged) Equilibrium Exchange Ratios With Three Commodities

The hypothetical exchange ratios of Table 2 satisfy Lachmann's criteria. If we specify steel as our *numéraire*, then the rate of return is 300 percent (the own-rate of interest on steel). For example, an investor who starts out with 1 apple in period 1, can trade it on the future-claim market for 2 apples in period 2. The value of his initial investment is 1 unit of steel (since all commodities trade at par on the spot market in the first period), while the value of his investment in period 2 is 4 units of steel (since he can trade his 2 delivered apples in period 2 for 4 units of steel). Thus, our investor turned a good with a market value of 1 unit of steel in period 1, into holdings worth 4 units of steel in period 2, for a return of 300 percent. Similar reasoning shows that the rate of return is 300 percent (measured in units of steel) if our investor had chosen oranges instead.

But these considerations don't prove that "the" natural rate of interest in our barter economy is 300 percent. If we choose apples instead of steel as our *numéraire*, then the measured rate of return in all three commodities will be 100 percent. For example, an investor starting with 1 orange in period 1 can trade it on the future-claim market for ½ orange in period 2. The market value of his initial investment is 1 apple, while the period 2 market value of his ½ orange is 2 apples, indicating a rate of return of 100 percent.

As this example illustrates, Lachmann's demonstration—that once we pick a *numéraire*, entrepreneurship will tend to ensure that the rate of return must be equal no matter the commodity in which we invest—does not establish what Lachmann thinks it does. The rate of return (in intertemporal equilibrium) on all commodities must indeed be equal once we define a *numéraire*, but there is no reason to suppose that those rates will be equal *regardless* of the *numéraire*. As such, there is still no way to examine a barter economy, even one in intertemporal equilibrium, and point to "the" real rate of interest. Indeed, we can take Lachmann's own example of the international money market and use it to prove Sraffa's point: What is "the" rate of interest in the world economy? Perhaps the rate of interest measured in U.S. dollars is 4 percent, while the rate of interest measured in Japanese yen is 3 percent. So what is the natural or real, underlying rate? Only by arbitrarily specifying a commodity basket can we give an answer. Lachmann's arguments, though correct, do not help the Austrians on this point.

III. A DYNAMIC EQUILIBRIUM CONSTRUCT

Regarding the possibility of multiple "natural" rates of interest in a barter economy, the chief stumbling block for the Austrians has been their use of the ERE as the benchmark equilibrium construct. Particularly for those Austrians who endorse Mises' pure time preference theory of interest (Mises 1998, Chapters XVIII and XIX), "the" natural or real interest rate is equated with "the" premium placed on present versus future goods.

Although Misesians acknowledge the fact that the real, or natural, or originary, rates of return could be different among different commodities in the real world, they typically ascribe these differences to uncertainty and entrepreneurial profit or loss. As with Lachmann's argument in the previous section, modern Misesians typically believe that competition would whittle away price discrepancies such that the rates of return would be equalized in all branches. For example Rothbard writes:

> Not only will the rate of interest be equal in each stage of any given product, but the *same* rate of interest will prevail in *all* stages of *all* products in the ERE. In the real world of uncertainty, the *tendency* of entrepreneurial actions is always in the direction of establishing a uniform rate of interest throughout all time markets in the economy. The reason for the uniformity is clear. If stage three of good *X* earns 8 percent and stage one of good *Y* earns 2 percent, capitalists will tend to cease investing in the latter and shift to greater investments in the former. The price spreads change accordingly, in response to the changing demands and supplies, and the interest rates become uniform. (Rothbard 1998, p. 372)

As with Lachmann's argument, Rothbard's too is correct as far as it goes. However, it is safe to say that most Rothbardians think that these observations prove more than they really do. As our discussion in the previous section established, in general it is *not* true that one can analyze a barter economy and point to "the" natural rate of interest, or "the" uniform premium placed on present versus future goods. Even after arbitrageurs have whittled away all pure profit opportunities, so that there is no advantage in rearranging investments, it is possible that the premium on one commodity may be different from another.

To reiterate, this is possible because *relative spot prices may evolve over time*. By using the ERE as their no-profit benchmark, Misesians typically do not bother imagining a world in which prices, quantities of output, and other data change, albeit in a perfectly predictable manner. Even the alternative Misesian constructions (1998, pp. 245-246) of the *plain state of rest* and the *final state of rest*—which are distinct from the evenly rotating economy—do not describe a dynamic equilibrium.

This is not mere pedantry. There are plenty of situations that a mainstream economist can handle with his price tools and equilibrium constructs, that an Austrian (relying on the

ERE) cannot.[6] For example, the price of gasoline typically rises in the summer months because of increased demand. In the real world, of course, the *exact* change in price is only discovered once it actually happens, but people in the oil and refining business have a pretty good idea that the baseline itself will rise. For a different example, retailers know that the quantities of their sales will be much higher in the period between Thanksgiving and Christmas. For an even more obvious example, the owners of ski resorts know that their revenues will rise and fall with the change in seasons.

To be sure, economists such as Mises and Rothbard would have no trouble dealing with such familiar examples in their analyses, if relevant. But the point is that strictly speaking, *they have no formal equilibrium construct to deploy* in such scenarios. Because the underlying data of the market change in the above examples, they do not qualify as either the ERE or a final state of rest. And although each would experience successions of plain states of rest, this has nothing to do with the equilibrating tendency of the market; we cannot use the plain state of rest as a "target" to which the actual market would move in such scenarios.

In case the reader thinks cases of seasonal demand are trivial, and do not justify the use of a new equilibrium construct, consider the more complicated scenario of a nonrenewable resource. For example, suppose all of the oil in the world is concentrated into a giant pool, conveniently located on the surface of the earth. Further suppose that the marginal extraction costs are zero, so that the owner of the oil is only concerned with drawing down his asset in a way that maximizes his present discounted stream of revenues.

We can imagine an anti-capitalist environmentalist being horrified at the thought of allowing the decentralized price mechanism govern the rate of consumption of this dwindling resource. (Let us put aside concerns about global warming, and assume that the environmentalist is only concerned about the ability of future generations to use the

[6] Hülsmann (2000) also rejects the ERE as an unsuitable construct for Austrians who normally pride themselves on realistic constructions, and offers a replacement. In a related project, Hülsmann (1998) attempts to recast Austrian business cycle theory in accordance with a general theory of error. Of all current Austrians, Hülsmann's work probably bears the closest affinity to the efforts in this paper, though our proposed solutions are not the same.

oil.) Because there is a fixed and finite number of barrels, every barrel consumed *today* translates into one fewer barrel available for all of mankind for the rest of eternity.

On the other hand, such sobering thoughts shouldn't lead the oil owner to restrict output altogether, because then nobody would *ever* get to enjoy the resource. What then would be the "socially optimal" rate of consumption, and how would it compare to the path chosen in a free market?

Unfortunately, the standard Austrian tools would be inapplicable in this scenario. Because the stock of oil would diminish each period, even if we hold everything else (including consumer preferences) fixed, we would expect the relative price of oil to increase over time. Moreover, the absolute quantity of oil consumed would also need to change, at least at some point—either the oil would literally run out one day, *or* the owner would draw it down at a constantly decreasing rate. In either case, the number of barrels brought to market couldn't be the same, day in and day out, forever. Therefore, we clearly cannot use the ERE to describe the "equilibrium" path of spot oil prices over time.

The Rothbardian economist could of course defend the ethical legitimacy of private property rights, and could also argue that any government intervention in the oil market would hurt at least one person and therefore not constitute a Pareto improvement. Even so, the awkward fact remains that Rothbardian price theory can't easily handle such a simple case as our hypothetical pool of oil.

In contrast, mainstream (free market) economists would have a ready answer for the environmentalist. Harold Hotelling (1931) made some simplifying assumptions and then demonstrated that in our scenario, the spot price of oil would rise with the interest rate. For example, if the spot price of oil were \$100 today, and the interest rate were 5 percent, then the spot price of oil would rise (exponentially) to \$105 in twelve months' time.

On the margin, the owner of the oil would be indifferent between selling an additional barrel today at the spot price, and then lending out the money at interest, versus leaving that barrel in the pool to appreciate and sell it next year. Consumers, in turn, would adjust their purchases based on the steadily rising spot price of oil. In the early years, they would buy more barrels, with their quantity demanded steadily falling over time. Early on, barrels of oil would be allocated to relatively trivial uses, whereas in the last years, as the supply of oil dwindled to nothing, the small number of barrels sold each period would be devoted to very important uses.

Our point is *not* that Austrians need to embrace the mathematical formalism of neoclassical economics. Rather, the point is that the mainstream economists have an elegant solution to the problem of "equilibrium" price in a case of nonrenewable resources, whereas the Austrians do not. Notice too that Hotelling's rule is quite intuitive from a Misesian viewpoint: the higher the interest rate, the faster the spot price of oil rises, meaning that (in a dynamic equilibrium) the faster the oil is consumed. Thus, the higher the social rate of time preference, the greater proportion of the fixed resource is devoted to present and near-term uses, and the smaller proportion handed down to future generations. Thus, contra the claim of the environmentalist, the price system *does* take into account the concerns of future generations, but their "votes" are discounted by time preference.

An "Austrian" Dynamic Equilibrium Construct

What I am proposing is simply an elaboration of Hayek's notion of intertemporal equilibrium laid out in his 1937 article. Rather than confining their equilibrium constructs to *static* (or steady-state) situations where the data of the market are fixed, Austrians instead should define a *dynamic* equilibrium construct where quantities, prices, resources, technologies, and even "spot" consumer preferences can evolve over time, *but in a perfectly predictable manner*.

In this construct, equilibrium would still go hand-in-hand with zero entrepreneurial profits and losses. Consequently, Austrians could use this (much looser) construct to distinguish between profit and interest, with the important caveat that it would be the *nominal* rate of interest. As we have taken pains to demonstrate above, in a dynamic equilibrium the spot prices of various goods and services can change over time, meaning that the economist cannot point to “the” natural or real rate of interest in such an economy.

In a dynamic equilibrium, the economist can certainly point to the (equilibrium) nominal rate of interest for any time period, and to the (equilibrium) money-price of a basket of commodities, in order to compute a “real” interest rate. The important point, however, is that the “real” interest rate so computed, would vary depending on the composition of the commodity basket.

Meeting Sraffa’s Objection

In this final subsection we will elaborate on Hayek’s insightful response to Sraffa, by illustrating a simple economy in which an initial dynamic equilibrium is disturbed by credit expansion. In the interest of brevity, we won’t go through a full-blown simulation of an Austrian business cycle theory proper, but our sketch should point the way toward a more complete description.

Suppose we have an economy with three goods: wheat, barley, and fiat dollar bills. There are two groups of people in this economy, Capitalists and Farmers. In period 1, the Capitalists start out with a stockpile of wheat and barley, while the Farmers have nothing. Based on spot prices and the nominal rate of interest, the Capitalists then decide how much of their stockpile to (a) sell into the market, (b) eat, and (c) carry forward into period 2. With the dollars they raise from selling wheat and barley, the Capitalists also advance money loans in period 1.

For their part, the Farmers in period 1 look at the prices and decide how much money to borrow. With the borrowed dollars, the Farmers enter the spot markets and buy present wheat and barley for consumption. Eating this food in period 1 allows them to stay alive until period 2, when their next harvest occurs.

Moving ahead to period 2, the Farmers sell whatever portion of their harvest is necessary to raise enough dollars to pay off their money loans. The Capitalists, on the other hand, receive payment from their money loans and use it to buy wheat and barley. Let us assume everything works out so that the Farmers raise just enough wheat and barley to pay off their loans (plus interest). This means that period 2 begins with the Capitalists owning all of the present food and the Farmers having no debt. In other words, the situation has returned to where we began the description in period 1. At this point, if the Farmers want to eat anything in period 2, they will have to take out new loans and buy back some of their harvest.

Suppose the following price structure corresponds with the dynamic equilibrium we just described for this economy:

PRICES POSTED IN PERIOD 1 (observed in period 1)		**PRICES POSTED IN PERIOD 2 (as expected in period 1 *and* as realized in period 2)**	
1 bushel wheat	$10	1 bushel wheat	$10
1 bushel barley	$10	1 bushel barley	$11
11 dollars in period 2	$10		

Table 3—Stipulated Dynamic Equilibrium Prices In Monetary Economy

To repeat, simple inspection of Table 3 wouldn't allow us to determine whether the economy is in equilibrium or not; we are simply stipulating that the above price structure corresponds with the dynamic equilibrium we have described involving the Capitalists and the Farmers.

It is important to note that in Table 3, there is no single natural rate of interest. The own-rate or natural rate of interest on wheat is 10 percent, whereas the own-rate or natural rate of interest on barley is 0 percent.[7] Lachmann is correct when he says that there is no incentive for people to borrow in barley and lend in wheat, because the spot dollar-price of barley rises from period 1 to period 2.

Now suppose that we introduce a third group of people into our economy, the Bankers. Rather than directly lending their dollars to the Farmers, now the Capitalists lend them to the Bankers, who in turn lend them to the Farmers. Assuming that the Bankers acted as mere intermediaries, the dynamic equilibrium would be unaffected.

However, suppose that in addition to passing along the savings of the Capitalists, the Bankers print up an additional stockpile of dollar bills and lend those to the Farmers as well. Now the price structure might look like this:

PRICES POSTED IN PERIOD 1 (observed in period 1)		***EXPECTED* PRICES FOR PERIOD 2**		***ACTUAL* PRICES IN PERIOD 2**	
1 bushel wheat	$20	1 bushel wheat	$10	1 bushel wheat	$25
1 bushel barley	$20	1 bushel barley	$11	1 bushel barley	$30
11 dollars in period 2	$10.50				

Table 4—Disequilibrium Price Structure Caused By Circulation Credit

[7] Someone starting out with 10 bushels of wheat in period 1 could sell them for $100, then lend the money out at interest. In period 2, the investor would receive $110, with which he could buy 11 bushels of wheat. Thus, he would have transformed his 10 bushels of wheat in period 1, into 11 bushels by period 2, for a 10 percent real return, measured in bushels of wheat. A similar analysis shows that the return measured in barley is 0 percent, because 10 bushels of barley in period 1 could only be transformed into 10 bushels in period 2.

The reader shouldn't spend too much time comparing Table 3 to Table 4, because the prices in the latter are fairly arbitrary. The important point is that with their freshly created dollar bills, the Farmers in period 1 are able to bid up the spot prices of wheat and barley. Because the Capitalists do not fully understand the situation, they (quite naïvely) expect the spot prices to remain the same in period 2 as in the original equilibrium.

However, the Capitalists act differently in this new scenario, compared to their (optimal) behavior when facing the prices depicted in Table 3. Now, because they erroneously believe that they can transform a bushel of present wheat or barley into far more bushels in period 2, the Capitalists choose to sell more of their holdings in period 1 into the open market. Furthermore, they don't choose to *carry* any of their wheat and barley in their silos, because they (falsely) believe they can earn a much more lucrative return by selling any saved food in the spot market, and lending the acquired dollars at interest. It's also reasonable to suppose that the Capitalists increase their consumption of wheat and barley in period 1, because they anticipate having so much more in period 2. We also note that because the Farmers have been supplied with dollars from the Bankers, and because the Capitalists feel so much wealthier, the nominal rate of interest falls in period 1.

For their part, the Farmers are able and willing to borrow much larger amounts (measured in dollars) when the Bankers provide cheap loans. Thus the Farmers increase their consumption of wheat and barley in period 1, relative to what would have happened in the original equilibrium.

When period 2 arrives, the Capitalists are in for a shock. The spot prices of wheat and barley are much higher than they had expected. It is true, once the Farmers sell their harvest and pay off their loans, the Capitalists have more dollars than they would have possessed in the original equilibrium in period 2. But because the spot prices of wheat and barley are so much higher, the Capitalists can only afford to buy the same number of bushels as before (namely, they acquire the entire harvest of period 2). But because the Capitalists didn't physically store any of their holdings in the silos in period 1, the *total* amount of wheat and barley in period 2 is lower than it would have been in the original equilibrium.[8]

In truth, our story was not really an illustration of the Misesian trade cycle theory. In particular, we didn't really exhibit malinvestments in longer production processes, but instead we merely showed a case where the Bankers caused people in earlier periods to consume too much, because they were misled about the future state of the economy. A better example would have featured two different processes for transforming present units of food into future units, where one process takes one period to complete while the other takes two periods. However, such a model would take a dedicated paper to flesh out completely.

In summary, Austrians should familiarize themselves with the construct of a dynamic equilibrium, in which spot prices and other data can evolve over time, but where entrepreneurs fully anticipate such changes and squeeze out all pure profit opportunities. In this setting, there is no such thing as an objective real or natural rate of interest, so the Austrians cannot cling to their prescription that the banks ought to set the market rate to "the" natural rate.

However, as our last scenario above hoped to convey, it still *is* true that an intertemporal, dynamic equilibrium can be disturbed if commercial banks inject new money into the credit markets. If a Misesian boom-bust cycle ensues, the reason is *not* that the banks charged a money right below "the" natural rate, because there is no such thing. Yet the basic Misesian analysis still holds true, that the bankers have suddenly augmented the purchasing power of one segment of the population, which not only redistributes real wealth but also leads to distorted money prices and more mistakes than otherwise would have occurred.

[8] The purist might object that in the original equilibrium, there was no reason for the Capitalists to physically store wheat in order to earn (at best) a 0 percent real return, when a 10 percent return was available through monetary lending. There would also be little reason to physically store barley, when at best the Capitalists could match the real return of 0 percent available through selling at spot and lending the dollars. I agree with such an objection and plead that the model was already quite complicated for the simple point I am trying to make.

IV. THE YIELD CURVE AND ABCT

In addition to its other shortcomings, a drawback with the ERE is that it requires a perfectly horizontal yield curve. In the ERE, all important economic variables remain the same, period after period, including short-term interest rates. Therefore—so long as we abstract away from the possibility of unexpected change, which of course we must do in the ERE—longer-term interest rates must all have the same value as well, regardless of maturity. In *Man, Economy, and State*, not only does Rothbard affirm this fact, but he goes further and argues that even outside the ERE, there is a *tendency* toward a flat yield curve:

> It is clear that the natural interest rates are highly flexible; they tend toward uniformity and are easily changed as entrepreneurial expectations change. In the real world the prices of the various factors and intermediate products, as well as of the final products, are subject to continual fluctuation, as are the prices of stock and the interest return on them. It is also clear that the interest rate on short-term loans is easily changed with changed conditions. As the natural interest rate changes, the new loans for short periods can easily conform to the change….
>
> It is clear that, in the ERE, the interest rates for all periods of time will be equal. The *tendency* toward such equality at any one time, however, has been disputed in the case of *expected future changes* in the interest rate. Although surprisingly little attention has been devoted to this subject, the prevailing theory is that, on the loan market, there will not be a tendency toward equalization if a change in interest rates is expected in the near future. Suppose that the interest rate is now 5 percent, and it is expected to remain there. Then the interest rate on loans of all maturities will be the same, 5 percent. Suppose, however, that the interest rate is expected to increase steadily in the near future, say to increase each year by 1 percent[age point] until it will be 9 percent four years from now. In that case, since the short-run rate (say the rate of interest on loans lasting one year or less) is expected to increase over the next four-year period, then the present long-run rate for that period—e.g., the present rate for five-year loans—will be an average of the expected future short-run rates during this period. Thus, the present rate on five-year loans will be 5 percent plus 6 percent plus 7 percent plus 8 percent plus 9 percent divided by 5, equaling 7 percent. The long-run rate will be the average of short-run rates over the

relevant period. Consequently, the long-run rates will be proportionately higher than short-run rates when the latter are expected to increase, and lower when the latter are expected to be lower…

This, however, is a completely question-begging theory. Suppose that a rise in interest rates is expected; why should this be simply confined to a rise in the *short-term rates*? Why should not the expectation be equally applicable to long-term rates so that they rise as well? The theory rests on the quite untenable assumption that it sets out to prove, namely, that there is no tendency for short-term and long-term rates to be equal. The assumption that a change in the interest rate will take place only over the short term is completely unproved and goes against our demonstration that the short-run and long-run rates tend to move together. Further, the theory rests on the implicit assumption that individuals will be content to remain lenders in "shorts" at 5 percent while their fellow investors reap 7 percent on the long market, simply because they expect that eventually, if they stay in the short market, they will earn an average of 7 percent. *What is there to prevent a present lender in shorts from selling his currently earning 5-percent loan, purchasing a 7-percent long, waiting for the presumed rise in shorts above 7 percent after two years, and then re-entering the short market, earning 8 percent or 9 percent?* If he does this, he will not simply earn 7 percent…[instead] he will earn 7 percent plus 7 percent plus 7 percent plus 8 percent plus 9 percent, or an annual average of 7.6 percent. By striving to do so, he will set up an *irresistible* arbitrage movement from shorts to longs, with the rate of interest in the former thereby rising from the sales of loans on the market, and the rate of interest in longs falling, *until the rate of interest is uniform throughout the time structure.*

The same thing occurs in the case of an expectation of a future fall. Longs cannot remain in equilibrium below shorts for any length of time, since there will be a present movement from longs to shorts on the market, until the rates of interest for all time structures are equal and the arbitrage movement ceases.

The interest rate, then, always tends to be uniform throughout its time structure. (Rothbard 2004 [1962], pp. 445-448, italics in original)

This seems to be one of the rare occasions in which Rothbard's analysis is thoroughly confused. In the first place, the view he is criticizing *does* explain how increasing short-term rates lead to increasing long-term rates, so it is odd that Rothbard asks, "Suppose that a rise in interest rates is expected; why should this be simply confined to a rise in the *short-term rates*? Why should not the expectation be equally applicable to long-term rates so that they rise as well?" To repeat, the theory Rothbard is here attacking, is *precisely* one that attempts to show exactly how expected rises in short-term interest rates will translate into rising long-term rates.

Beyond this quibble, the more serious problem with Rothbard's argument is that he is implicitly relying on the ERE construction. Specifically, Rothbard's demonstration only goes through if each period the short-term lenders *are the same people*, so that they are indifferent between, say, lending five times in a row in the one-year bond market, versus buying a five-year bond at the outset. If that were true—and if there were no uncertainty—then yes, Rothbard is right that a steadily rising one-year yield, along with an appropriately averaged five-year yield, would not constitute an equilibrium.

But in a dynamic equilibrium, where conditions change (in a perfectly predictable manner) over time, we can have steadily rising short-term bond yields, just as we can have a steadily rising spot price of oil. Rothbard is simply wrong when he writes, "Further, the theory rests on the implicit assumption that individuals will be content to remain lenders in 'shorts' at 5 percent while their fellow investors reap 7 percent on the long market, simply because they expect that eventually, if they stay in the short market, they will earn an average of 7 percent."

On the contrary, the theory rests on the implicit assumption that sometimes people will be in a situation where they can lend for a one-year term, *but then they will not be net lenders the following period*. For such people, the reason they are content in (say) year 1 to lend out at 5 percent, even though the five-year yield at that point is 7 percent, is that *they need to spend that money in year 2*. In order to reap the higher yield, they would need to part with their present goods for a longer term, and (for whatever reason) they are not prepared to do that.

Moving ahead one year, a similar analysis holds: A *different* group of lenders is again willing to buy bonds, but they want their money back in year 3. They are content to earn only a 6 percent yield, even though the four-year yield at that point would be 7.5 percent, because their circumstances are such that they do not want to wait until year 5 to receive their money.[9]

To be clear: Our analysis here is *not* bringing up the possibility of sudden changes in the data, to explain the real-world divergence from the ERE's horizontal yield curve. It's true, many economists think that the "normal," upward-sloping yield curve reflects "liquidity preference" among investors, who need to be offered a premium for tying up their money in longer-term bonds as opposed to rolling them over successively in shorter-term bonds.

Notwithstanding this popular (and plausible) theory—which explains the slope of the yield curve in terms of uncertainty—in our critique of Rothbard we are pointing out that *even in a world of perfect foresight*, changing conditions can still lead to rising short-term bond yields over time. Therefore, the horizontal yield curve in the ERE is not due *merely* to perfect foresight, but also to its assumption of *no change*.

Rothbard is right that arbitrage will ensure a relation between long-term yields right now, and expected short-term yields going into the future. Using Rothbard's numbers, it is indeed correct that if the expected one-year yields for the next five years are 5, 6, 7, 8, and 9 percent, then right now the yield on a five-year bond must be (at least) 7 percent. This is because the investor today who is willing to tie up his funds for five years, could earn an average annualized return of 7 percent (over the whole period) by successively investing in one-year bonds. (This is exactly the theory that Rothbard was attacking.)

Yet the analysis doesn't work the other way. Just because a five-year investor can earn 7 percent, it doesn't follow that a one-year investor needs to earn as much. This is no more

[9] Note that the investor who buys a five-year bond in year 1, will see its yield-to-maturity rise from 7 percent to 7.5 percent as he carries it into year 2. (This has to be the case, because in year 2 he would have the option of buying a freshly-issued four-year bond yielding 7.5 percent.) Even so, when the investor first buys the bond in period 1, its yield-to-maturity at that time is 7 percent. Just as he can know that short rates will rise over time, he can also know that the yield-to-maturity on his long bond will rise. All of this can occur within a dynamic equilibrium.

mysterious than pointing out that someone who buys in bulk can often get a lower unit price than someone who only wants to buy a smaller quantity.

Rothbard's erroneous treatment of the yield curve is an excellent illustration of the danger in the Austrians' use of the ERE as their primary equilibrium construct. Had his workhorse construct been a dynamic equilibrium—in which there would be no pure profits but conditions could change over time—Rothbard might have realized that short-term rates can be expected to rise (or fall) over time. There is nothing contradictory about this theoretical possibility, and the actual prices from the real-world bond market show that the ERE's horizontal term structure is rather unhelpful.

The Yield Curve's Mysterious Powers of Prediction[10]

One of the most interesting features of the yield curve is its uncanny ability to "forecast" recessions. Specifically, the "normal," upward-sloping yield curve inverts—meaning that the (annualized) yield on short-term bonds rises above the (annualized) yield on long-term bonds—four to six quarters before a recession. As Fed economist Arturo Estrella summarizes, "The yield curve has predicted essentially every U.S. recession since 1950 with only one 'false' signal, which preceded the credit crunch and slowdown in production in 1967" (Estrella 2005, p. 2).

Not only has there only been one false positive[11] (which even here was still associated with a slowdown), but every actual recession in this timeframe has had an inverted (or nearly inverted)[12] yield curve precede it. In other words, there are no false negatives either when it comes to the yield curve's predictive powers in the postwar period. As of

[10] The material in this section is drawn from the research I conducted to assist in the writing of Laffer (2007).

[11] In order to count as a true recession "signal," economists insist that the inversion have persistence. According to Estrella and Trubin: "[W]hen inversion on a monthly average basis is used as an indicator, there have been no false signals [since 1968]. By contrast, negative spreads occurred on 100 days between January 1, 1968, and December 31, 2005, in months that did not turn out to have negative average monthly spreads" (Estrella and Trubin 2006, p. 5).

[12] A popular working measure of the "spread" is the difference between the yield on the ten-year Treasury bond and the three-month Treasury bill. When I manually compute this spread from the data available at the St. Louis Fed's "FRED" database, I find that the spread before the 1961 and 1991 recessions did not *quite* become negative, but it almost did.

this writing in the summer of 2010, it appears the economy is poised for a "double dip" recession, which (according to the standard N.B.E.R. classification) would constitute the first recession in at least 60 years[13] that was *not* immediately preceded by an inverted yield curve.

Mainstream Economists Struggle to Explain the Yield Curve's Power[14]

Mainstream economists have a few different approaches to explain the yield curve's apparent ability to signal impending recessions. One popular avenue (e.g. Harvey 1988) relies on the consumption-smoothing idea going back at least to Irving Fisher (1965 [1930]). In this approach—called "CCAPM" for Consumption Capital Asset Pricing Model—the term structure changes because of investors' expectations about their future levels of consumption.

In this literature, a standard result shows the equilibrium relationship between the short-term interest rate, the subjective discount factor, and the marginal utilities of consumption in the current period and next period:

$$MU_t = (1+r)\,\beta\, MU_{t+1},$$

where $0 < r < 1$ is the net (real) rate of interest and $0 < \beta < 1$ is the subjective discount factor on future "utils." The intuition is that in equilibrium, an investor must be indifferent between consuming a little more today (and reaping MU_t in extra satisfaction) versus postponing consumption until next period, where he will consume more (because of the positive interest rate) but at a lower marginal utility (because the absolute level of consumption is expected to grow). The subjective discount factor β is included to ensure proper accounting of present and future utility. Note that this equation implies that a

[13] It is important to note that the "normal," upward-sloping yield curve is a modern phenomenon. Bordo and Haubrich (2004) find that negative spreads on U.S. commercial paper and corporate bonds were quite common from 1880 to 1910. This suggests that one reason for the higher "normal" yield on long-term bonds in the postwar era, is the increased uncertainty over future price inflation since leaving the gold standard.

[14] The summary of mainstream work in this section relies heavily on Johnson (2002), which itself is an explicitly Austrian attempt to explain the yield curve's predictive power.

higher (real) interest rate must go hand in hand with a higher growth rate of consumption, because of the steeper decline in marginal utility from one period to the next.

Within this type of framework, Breeden tries to explain the empirical behavior of the yield curve:

> If the expectation is that economic growth will be rapid for a couple of years and then decline, the real interest rates should be "high" for short-maturity bonds and relatively "low" for long-term bonds. Thus, if the economy is thought to be entering a short-term rapid growth phase (coming out of a recession), real short-term interest rates should be high and the real term structure downward-sloping (or not rising as much as usual). Conversely, when the economy is believed to be entering a period of decline or of very slow growth relative to its long-term expected growth, the real term structure should tend to be rising. (Breeden 1986, p. 14, qtd. in Johnson 2002, p. 32)

The only problem is that this theoretical explanation is the exact *opposite* of what we need. The empirical reality is that (at least since World War II) periods of rapid growth have been associated with a rising yield curve, while periods of impending recession have been associated with an inverted one. Therefore, it seems that the CCAPM's attempt to relate the yield curve to expectations of future flows of "real income" cannot be the main driver.

Besides the CCAPM approach, mainstream economists also use monetary explanations. These have a much more "Austrian" flavor, but they still are unsatisfactory. Consider Estrella's suggestion for the yield curve's predictive power:

> A rise in short-term interest rates induced by monetary policy may lead to a future slowdown in real economic activity and demand for credit, putting downward pressure on future real interest rates. At the same time, slowing [economic] activity may result in lower expected inflation. By the expectations hypothesis, these expected declines in future short-term rates would tend to reduce current long-term rates and flatten the yield curve. Clearly, this scenario is consistent with the observed correlation between the yield curve and recessions. (Estrella 2005, p. 9)

Although Estrella's observations on short-term rates are sympathetic to the ABCT explanation we will explore below, the remainder of his quotation is based on a faulty Keynesian demand-side view of economic growth and price inflation. Other things equal, a reduction in real output will lead to *higher* consumer prices, because the same stock of money is chasing fewer goods. It is simply a myth that when there is "slack" in the economy, price inflation falls, as the following chart clearly shows:

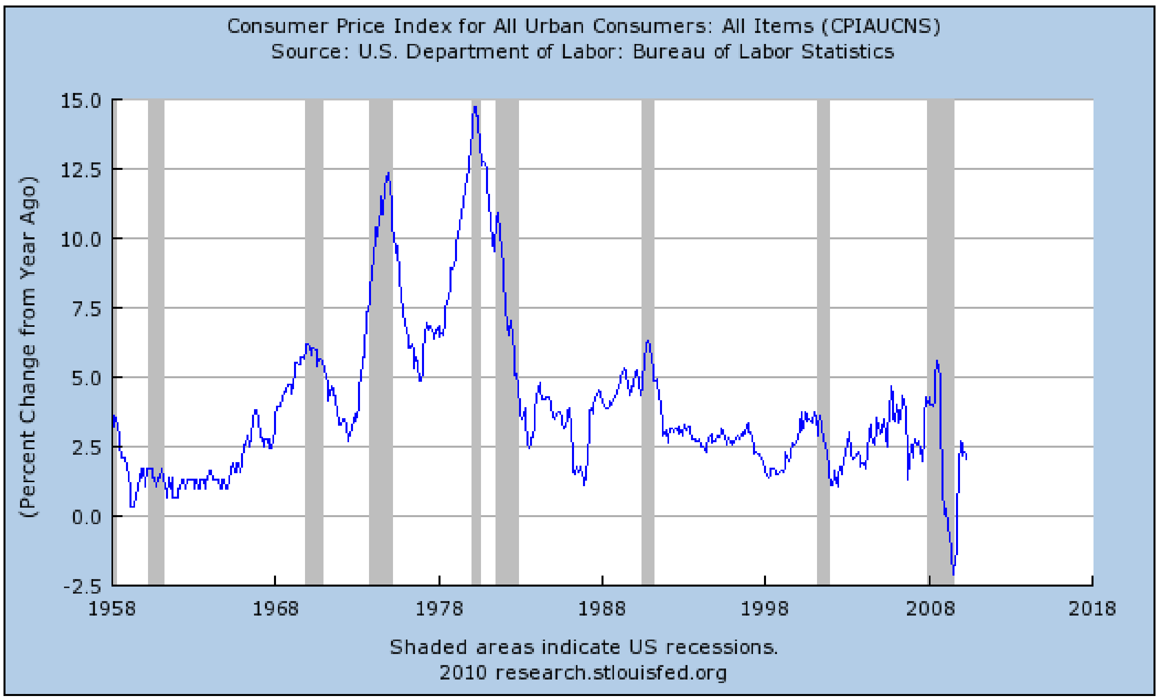

Figure 1—Annual Price Inflation During Recessions

As Figure 1 indicates, the Keynesian story is consistent with some of the postwar recessions, but in several of them CPI inflation *peaks* during the recession.

The Inverted Yield Curve and ABCT

Austrian economists should not be surprised at the yield curve's behavior, for (in retrospect) it is almost a trivial implication of canonical ABCT. After all, the ABCT says that the commercial banks flood the credit markets with fiduciary media, which pushes down "the" interest rate. Yet virtually everyone would agree that the banks have much more control over *short-term* than long-term rates, so "the" interest rate in the standard exposition of ABCT should be interpreted as short rates.

The artificially cheap credit engenders a boom period, which may last for several years. During the boom, prices often begin rising at an accelerating rate, which may shift the entire yield curve up, but may increase long-term rates the most, due to uncertainty over future (price) inflation. In short, the "good times" of apparent prosperity—in the eyes of mainstream economists—are associated with an upward sloping yield curve.

The boom is unsustainable. Regardless of what the banks do, the economy eventually must crash with the complete collapse of the currency. However, in practice the banks often abandon their inflationary policies well before this point, so that the immediate "cause" of the recession is the rise in short-term rates. As Mises explains:

> [I]t must be observed that the banks have never gone as far as they might in extending credit and expanding the issue of fiduciary media. They have always left off long before reaching this limit, whether because of growing uneasiness on their own part and on the part of all those who had not forgotten the earlier crises, or whether because they had to defer to legislative regulations concerning the maximum circulation of fiduciary media. And so the crises broke out before they need have broken out. It is only in this sense that we can interpret the statement that it is apparently true after all to say that restriction of loans is the cause of economic crises, or at least their immediate impulse; that if the banks would only go on reducing the rate of interest on loans they could continue to postpone the collapse of the market. (Mises 1981 [1912], p. 404)

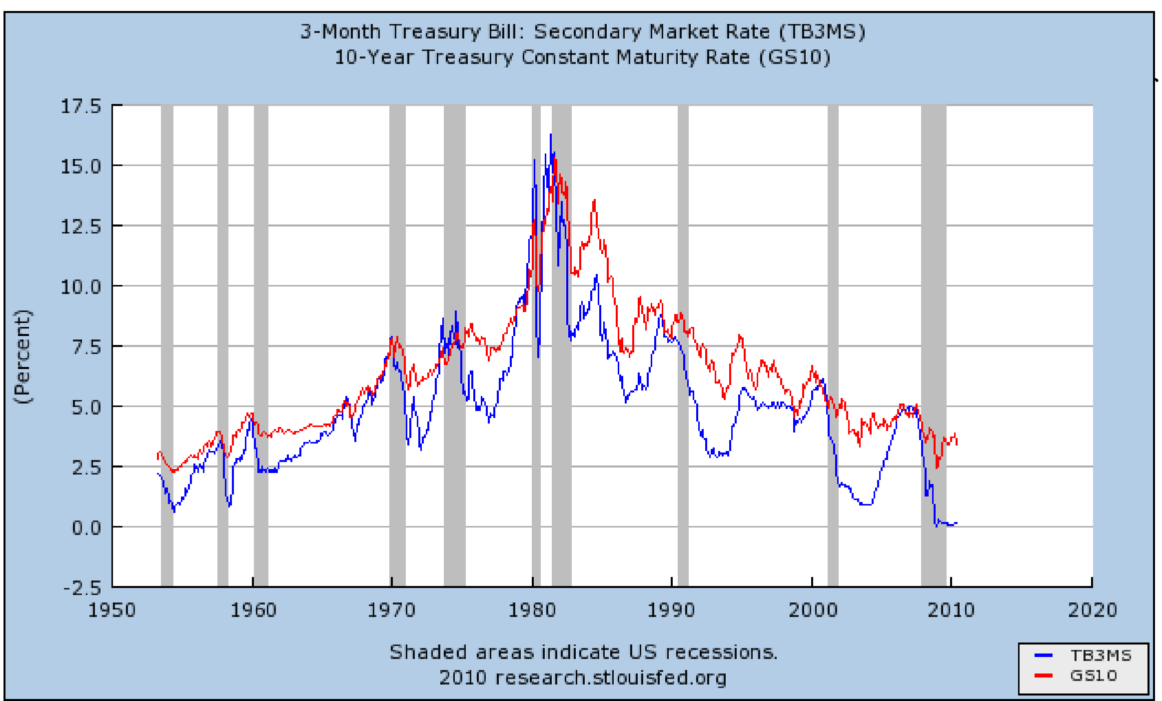

Figure 2—Short- and Long-Term Yields, and U.S. Recessions

There are several observations the Austrian can make regarding Figure 2. First of all, the behavior of short-term rates fits with the Austrian verbal description. The short-term rate spikes before every recession, and then falls rapidly over the course of the recession and into the recovery phase. Another important observation is that the flattening yield curve before a recession typically occurs because the short rate jumps higher than the long rate, rather than the long rate falling below the short rate. (This is particularly pronounced during the last years of the housing boom in the mid-2000s.)

A third—and far more speculative—observation is that Austrians may be able to explain periods such as the early 1980s and again the early 1990s when short term rates (the blue line) spiked, and yet no recession ensued. What is interesting in these two periods is that long rates spiked just as much, keeping the term spread intact. It is possible that these shifts upward of the entire yield curve were due to more fundamental changes in savings behavior, rather than bank policy. In that case, it makes sense that the spike in short-term rates did not lead to a recession, as it so often does at other times in the period surveyed.

As the quotation from Estrella demonstrated, mainstream economists are dimly aware of the connection between monetary (i.e. central bank) policy, short-term rates, and future economic growth. Yet because they lack the Austrians' sophisticated understanding of the capital structure, mainstream economists are reduced to saying that high interest rates stifle economic growth because of "reduced investment." Without even using the term

"Austrian," Austrian economists can contribute much to the mainstream literature on the yield curve because their verbal theory guides them when sifting through the data.[15]

V. BEYOND CERTAINTY: RISK SPREADS AND MATURITY MISMATCHING

So far in this paper we have argued that in order to deal with standard topics such as nonrenewable resources and the term structure of interest rates, Austrians must move beyond the narrow construction of the ERE. With a dynamic equilibrium construct, Austrians can still retain the assumption of perfect foresight, but they must relax the ERE's postulate of no change.

However, even the use of a dynamic equilibrium with perfect foresight will be of little use in most applications involving financial markets. Consider a basic example of the spread between the yield on a 5-year bond issued by a corporation on the verge of bankruptcy, versus the yield on a 5-year bond issued by the U.S. Treasury. Clearly the corporate bond yield will be higher than that of the Treasury bond, because the risk of default is much greater.

Of course, an economist of the caliber of Rothbard is aware of these obvious facts. In his discussion of the actual money rates of return earned in the market, Rothbard explicitly mentions the inclusion of (what a mainstream economist would call) risk premia on top of the underlying pure interest return due to time preference, and he also explains that truly insurable risks can be included as simply a cost of production (Rothbard 2004, pp. 550-555).

Although Austrians are aware of the entrepreneurial component in actual rates of return, their dichotomy between pure time preference and entrepreneurship puts them in an awkward position when analyzing situations that the layman would call "risky." For

[15] Paul Cwik's (2004) doctoral dissertation is an Austrian exploration of the yield curve's predictive power. Other modern Austrian analyses on this topic include Skousen (1990), Hughes (1997), and Mulligan (2002).

example, suppose that a t-shirt vendor goes on vacation and lets his apprentice handle the production and sale of t-shirts for the championship football game at the local college. Because the two teams have a historic rivalry, thousands of fans of both the home and away teams will be present at the stadium.

Normally in a situation like this, the owner would tell the apprentice to look at the bookmakers' odds, and to print up some shirts declaring that the home team won, and another batch declaring that the away team won, with a bias being given in favor of the home team, since there will be more such fans in the stadium and in the parking lot after the game. This way, the owner would hedge his exposure; because his margin is so large on an appropriate t-shirt sold to a drunken and enthused fan, he wants to be ready to cater to either group of customers after the game.

Further suppose that on this particular episode, the owner returns and is shocked to discover that his apprentice has made triple the profit that the owner was expecting. The apprentice explains that even though the home team had been an underdog given little chance by the sports writers, the apprentice "just knew" they would pull it out. Therefore, the apprentice devoted the *entire batch* of shirts to the design saying, "We did it! I was at the Miracle of 2010." Because the home team did in fact win in an amazing upset, the apprentice was able to unload the entire batch of shirts for an extraordinary total profit.

Now how would a Rothbardian analyze this situation? On the one hand, it is tempting to say that the apprentice showed amazing entrepreneurial foresight, and that he adjusted the scarce means of production to satisfying consumer preferences better than the owner would have done, had he remained in town. Yet on the other hand, there is a definite sense in which the lad's actions were *reckless*, even from the economist's point of view. There is a sense in which the preferences of the visiting fans—some of whom would have loved to buy a t-shirt celebrating the victory, had their team won—were not taken adequately into account by the apprentice. It's true, as things turned out these "conditional" preferences were a moot point. But it is at least plausible for the owner *and* the Austrian economist to chastise the apprentice for doing the wrong thing but "getting lucky."

Turning to the financial markets, mainstream economists deal with these subtleties by assuming that investors prefer high expected returns but dislike volatility: their utility from holding a particular financial asset increases with the mean but decreases with the variance of the return. I am not suggesting that Austrians fully embrace this approach, especially because it is based on a mechanistic model where stock returns are "random variables" and have little to do with the underlying real economy and human choices.

Even so, when it comes to analyzing financial markets, the standard Austrian approach to interest and profit runs into the problem of our hypothetical t-shirt vendor. One hedge fund might take on significant debt and earn higher returns over, say, a three-year period than another hedge fund that is not leveraged. The straightforward Rothbardian explanation for this outcome is that the leveraged hedge fund earned pure profits to compensate for its entrepreneurial risk-taking. Yet this seems to *endorse* the hedge fund's bold behavior, when surely in some cases its managers would be analogous to our hypothetical t-shirt apprentice.

The present paper is already too long to permit the elaboration of this train of thought. My point is simply to show that in addition to moving from the ERE to a dynamic equilibrium construct, Austrians must also refine their standard dichotomy between pure interest and pure profit if they want to adequately analyze financial markets.

Maturity Mismatching

A concrete example of a financial practice analogous to our t-shirt vendor is maturity mismatching, i.e. "borrowing short and lending long." Just as Austrians disagree strongly on the efficiency and even the legitimacy of fractional reserve banking (e.g. Hoppe 1994 and De Soto 2009 versus Selgin & White 1996 and Horwitz 2000), so too do they disagree on the efficiency and legitimacy of maturity mismatching.

Barnett and Block (2009a and 2009b) argue that maturity mismatching (borrowing short and lending long) is both fraudulent and economically disruptive. For concreteness, suppose that person A lends $100 to B (the banker) for one year, but that B lends that $100 to person C for *two* years. The banker has the incentive to do this, of course, if the yield curve is "normal" and two-year rates are higher than one-year rates. The potential problem in earning this term spread, of course, is that the banker may be unable to "roll over" his short-term loan. In other words, the banker will owe A his $100 (plus interest) at the end of the first year, but the banker's loan to C will not yet have matured. The banker will need to find some *other* lender willing to give him $100 for a year, in order to satisfy his obligation to A.

On the matter of fraud, Barnett and Block take the same approach that they use to condemn fractional reserve banking in demand deposits:

> In [the case of maturity mismatch], there is still that little matter of over determination of property titles, precisely the shortcoming of FRB [fractional reserve banking]. Consider the situation during the first year of our little scenario. There are not one but *two* people with a valid claim for that $100 at the end of the first year. First of all there is A; he lent the $100 to B for only one year, and has a legitimate claim on this money at the end of the year. And then there is C who was told by B that these monies are not due back until the end of year two. There is thus a logical incompatibility in this scenario, similar to the one that emanates from FRB. (Barnett and Block 2009b)

Putting aside the matter of fraud, what about economic instability? Here too, Barnett and Block condemn maturity mismatching. Although maturity mismatching doesn't create more money (as fractional reserve banking does), it nonetheless distorts interest rates. Specifically, the banker in the above scenario raises short-term rates and lowers long-term rates, relative to what they would be if he provided no "intermediation" and the actual lenders and borrowers had to have symmetric maturities in their loans. If we believe that saving and investment correspond to "real" factors in the economy, such as stockpiles of capital goods and intertemporal preferences, then surely the apparently magical intervention of the bankers—which will penalize short-term investment and favor long-term investment—must disturb the structure of production. As Barnett and Block put it:

> Absent financial intermediaries, all credit would be direct between A and C. There could be no intertemporal mismatch of the term-to-maturity of credit. However, the presence of intermediaries facilitates such mismatches; indeed, makes them possible. Now, A can lend funds for shorter periods and C can borrow those same funds for longer periods. The essence of our thesis is that the intertemporal carry trade, whether of the fractional-reserve-demand-deposit type or of the (improperly matched) time-deposit type, creates time ex nihilo; that is, it creates out of the thin air the period of time that constitutes the difference between the lending period of A and the borrowing period of C. But the efforts to bring about this logical impossibility result in the misallocation of resources of the Austrian business cycle type. (Barnett and Block, 2009a)

Earlier in their paper, Barnett and Block bring up the fact that even something as apparently "nominal" as *liquidity* has a physical counterpart: capital goods such as pickup trucks and hammers are intuitively more liquid than oil tankers and locomotives. Just as the commercial banks don't increase *real savings* when they flood the credit market with fiduciary media, so too (in my interpretation) Barnett and Block argue that the investment banks don't increase *real liquidity* when they borrow short and lend long on the bond market. To the extent that the investment banks lead firms to alter the structure of production, these are malinvestments and may trigger a Misesian boom-bust cycle.

On the other side of the issue are (Austrian economists) Philipp Bagus and David Howden, who argue (2009) that maturity mismatching is definitely *risky*, but not actually *fraudulent* (so long as no deception is involved). After all, *anytime* a businessperson accepts a short-term loan, it's possible that he will be unable to repay at the time of maturity. It seems odd to say that if the businessman defaults because he misjudged consumer demand for his product, that this is legitimate, while if he defaults because he misjudged the future availability of credit, then his actions were fraudulent.

Bagus (2010) agrees with Barnett and Block that *government-supported* maturity mismatch can lead to a boom-bust cycle. He goes so far as to say that 100% reserves (on demand deposits) would not prevent boom-bust cycles for precisely this reason.[16]

To explain why *free-market* maturity mismatching is not a problem, Bagus first notes the important fact (raised by Böhm-Bawerk 1901) that saving is not simply a quantity but also a *time dimension*. For example, Crusoe on his island may save more or less berries, but in a sense they are "short-term" savings because they will soon rot.[17] Therefore, Bagus argues (2010, p. 5) that it is not enough for Austrians to talk of "the" level of savings, and whether they accord with the structure of production. In order for the structure to be sustainable, it is important that the *composition* of society's savings has portions with appropriate durations to complement the needed investments.

After this insightful analysis, Bagus does not offer much to explain the alleged benefits of free-market maturity mismatching. He points out that if Crusoe takes a short-term loan of berries from Friday—even though Crusoe is embarking on a long-term project—and is able to roll over the loan, that there will be no question of an "unsustainable" project. Yet the same could be—and has been—said of fractional reserve banking.

At the very least, it seems clear that *if* someone opposes fractional reserve banking as being economically disruptive, then by consistency he or she should likewise oppose maturity mismatching.

In these discussions, it is important not to lose sight of the quite legitimate intermediary function that bankers serve. For example, by collecting loans from thousands of lenders and paying 3 percent, while advances loans (of comparable maturity!) to dozens of businesses at rates varying from 4 to 10 percent, the bank performs a legitimate service

[16] Bagus classifies fractional reserve banking as a special case of maturity mismatch, where the bank accepts an *infinitely* short-term loan—in other words, a demand deposit—and lends it for a longer period. Although this is an interesting perspective, it may undercut the efforts of De Soto (2009) to treat demand deposits as bailments, not loans—a distinction that Bagus himself acknowledges.
[17] In the quotation Bagus provides, Böhm-Bawerk seems to be making a slightly different point with his example. Even so, I believe I have captured the spirit of the distinction Bagus wants to make.

and makes all participants better off. The bank's contribution in this case is to act as an "insurance" agency of sorts, so that the lenders in the community can pool their risks rather than making bilateral loans to individual businesses. The expertise of the bank's loan officers is another obvious contribution in this enterprise.

For another example, investment banks provide a definite social service when they "provide liquidity" in thinly traded markets. For example, if an airline suddenly has a cashflow problem and needs to dump a large number of oil futures contracts (which it had previously purchased to hedge itself against rising oil prices), the airline might suffer huge losses if its sales of the contracts were restricted to physical oil consumers. Fortunately, as the airline's heavy selling pushed down the futures price, at some point a speculator (such as an investment banker) would swoop in to buy the "undervalued" assets. The speculator would reduce overall asset price volatility, which would encourage airlines and other oil users to use derivatives contracts more liberally and expand output in an economically meaningful sense.

However, in order for the investment bank to actually "provide liquidity," the bank must have *possessed it in the first place*: You can't provide something that you don't own. This is the objection to maturity mismatching. When an investment banker borrows from A (who doesn't *want* to lend at two years) and makes a two-year loan to C, it is not obvious that this is a mere entrepreneurial venture. Rather than taking a collection of resources and deploying them towards a goal that may or may not be realized, it seems that the investment banker engaging in maturity mismatching takes resources *that are not his* and deploys them towards a goal that may or may not be realized.

VI. CONCLUSION

The basic Misesian theory of the business cycle has held up even after a century of criticism and refinement. Austrian economists still have much to contribute to current debates, including the predictive power of the yield curve and the role of maturity mismatching in the boom-bust cycle.

However, a major stumbling block to Austrian progress on these issues is their reliance on the ERE as an equilibrium construct. As a first step, Austrians should begin using a *dynamic* equilibrium construct, in which variables such as spot prices and quantities evolve over time, but in a predictable manner that does not allow pure profits. More radically, Austrians should consider augmenting their standard dichotomy between pure interest and pure profit, to deal with the fact that an investor might reap a high return that is due more to "luck" than entrepreneurial foresight.

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