

BITCOIN, THE REGRESSION THEOREM, AND THE EMERGENCE OF A NEW MEDIUM OF EXCHANGE

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ABSTRACT: A recent controversy has brewed over whether or not the emergence of bitcoin, as a new medium of exchange, is in accordance with Mises’s regression theorem. The main question in the debate seems to be, is bitcoin valued in direct use? The present paper contends that with respect to the regression theorem, this issue has no bearing on bitcoin’s genesis, because it is relevant only when a new medium of exchange arises out of a pure barter economy. The debate is therefore predicated on a misinterpretation of the theorem. However, the issue of bitcoin’s direct-use value, if it has one, *does* have relevance in assessing the likelihood it will become a *generally-accepted* medium of exchange—i.e. money.

KEYWORDS: money, bitcoin, regression theorem, Mises

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I. INTRODUCTION

In the last couple of years, there has been much debate online, particularly in Austro-libertarian circles, concerning the economic nature of crypto-currencies, and in particular the origin and potential future of the first crypto-currency to emerge; namely, bitcoin. There are two areas in which this debate has been focused. The first asks: “is bitcoin money? And if not, does it have the potential to become money?” The second question is: “does bitcoin have a direct-use value, and if not, does its obvious emergence as a medium of exchange therefore not refute Mises’s regression theorem?” To that end, the commentators have been either searching for this value or criticizing the theorem, depending on which side they take. A subsidiary issue is whether or not it matters if bitcoin’s direct-use value, if it has one, is intangible.

Most commentators agree that bitcoin *is* a medium of exchange—that is to say, there are at present market actors who willingly accept bitcoins in exchange for real goods and services, and then use them to buy other goods—but that bitcoin is *not* money, at least not yet, insofar as money is usually defined. This requires that the item be a *general* medium of exchange, acceptable to most people for purchases and sales, and at least as of 2015, bitcoin has not (yet?) achieved that status. Of course, there is a clear praxeological distinction¹ to be made between goods that are valued as media of exchange, and those that are valued only for their direct use. Thus, we must draw a clear distinction also between an economy where individuals rely on indirect exchange in some capacity, and one where they rely solely on barter.

However, there is no *praxeological* difference between a medium of exchange and money. For the difference here boils down merely to one of how one defines the word “money,” and to what extent the medium in question is accepted in the market in order to meet the definition. Menger (2009, p. 11) defines money as the “universal medium of exchange,” meaning it must be accepted by everyone, while Mises (1998, p. 398) more reasonably maintains it must be “generally-accepted and commonly-used,” leaving some room for

¹ On praxeology, see Block (1973), Hoppe (1991, 1995), Hülsmann (1999), Mises (1969, 1998), Polleit (2008, 2011), Rothbard (1951, 1957), Selgin (1988).

the possibility that not everyone need be willing to accept it. But no matter which definitional version one chooses, it seems fairly clear that bitcoin has not yet reached the threshold of either of them.

Whether it can reach that tipping point at some point in the future is *not* a praxeological question, and is something that will be discussed in a later section. First, in Section II we turn to the issue of bitcoin and the regression theorem. Section III considers in further detail Mises's regression theorem. Section IV asks whether bitcoin violates the regression theorem, and Section V asks whether bitcoin can become money. Section VI is devoted to a hypothetical: suppose bitcoin evolved directly from barter; would this then constitute a violation of the regression theorem? We conclude in Section VII.

II. THE PRESENT DEBATE CONCERNING BITCOIN AND THE REGRESSION THEOREM

The debate has been framed by most commentators in the following way: the regression theorem refers to the emergence of a medium of exchange, where a good that was once valued only for its services in some direct use (either in consumption or production) becomes valued for its function in indirect exchange. According to these authors, bitcoin fits within the broad category of a medium of exchange. So its presence in the market must either refute the theorem on the grounds that it has never been valued directly, and certainly not as a tangible commodity like gold; or, the theorem is intact. And this can come about in one of two ways: (a) because bitcoin did indeed have some value prior to its becoming a medium of exchange, and (b) because the theory allows this value to involve an intangible good.²

² A smaller number of commentators maintain that the regression theorem refers to the emergence of *money* rather than a mere medium of exchange, and because bitcoin is not yet money, they claim it is not necessary to reconcile bitcoin's presence in the market with the theory. Indeed, say these authors, the theory proves bitcoin never will become money. However, as Murphy (2013b) points out, this argument overlooks the fact that the regression theorem is a praxeological theory, which does not concern itself with the question of why or when a medium of exchange becomes money. The transition to money is a process governed solely by the liquidity of the good in question and the psychological response of the actors, and the point at which it occurs is determined arbitrarily according to

For example, Graf (2013a, 2013b) sets out to demonstrate that bitcoin does not violate the regression theorem on the grounds that it does indeed have a prior direct-use value. Graf lists the reasons why he thinks actors might have valued bitcoin prior to it becoming a medium of exchange; for example, as a digital object for use in testing the network, or for a game, or simply because it was seen as advancing a cause. He contends there is no economic reason why a medium of exchange has to start out as a physical material as opposed to an intangible good. While Menger maintains that money has to originate as a commodity—implying that the good must be tangible—in the modern age we should consider all goods to be contenders for becoming a media of exchange, whether or not they possess any physical attributes, says Graf.

In the same vein, Tucker (2014) also searches for bitcoin's non-monetary value, noting it has an independent direct use as a payment system, this attribute of bitcoin being contained within the network and the blockchain.³ As a result of this value, Tucker is also of the opinion that bitcoin does not invalidate the theorem.

Surda (2012, 2014) contends that if one denies that bitcoin complies with the regression theorem, one denies the *a priori* character of the theorem itself, "shooting oneself in the foot in the process." As an *a priori* argument this is incontrovertible. Since the theorem implies a medium of exchange must start out as a commodity, and it is undeniable that bitcoin *is* a medium of exchange, it must necessarily be the case that bitcoin *was* valued as a commodity prior to it being used in indirect exchange. The fact that we might remain oblivious to the motivations of the original actors, or the properties that were (or are) valued by them, has no bearing on the issue.

Faggart (2014a, 2014b, 2014c) also supports the notion that bitcoin must be reconciled with the regression theorem. He observes nevertheless that Surda's argument is circular: Even though the

a defined standard. In effect, the move from an exchange medium to a money occupies a continuum. See on this Block and Barnett (2008).

³ "A blockchain is a transaction database shared by all nodes participating in a system based on the bitcoin protocol. A full copy of a currency's blockchain contains every transaction ever executed in the currency." From https://en.bitcoin.it/wiki/Block_chain.

theorem is apodictic, we cannot simply assume the chains of reasoning used to deduce the theory are correct. Because bitcoin was designed from the ground up to be money, and therefore did *not* appear to have a clearly identifiable original direct use, it is necessary to respond to critics who question the theorem, and we must do so by providing some kind of empirical evidence. To satisfy them, says Faggart (2014c), we must examine the history to identify when bitcoin went from being a “consumer good” to being used in indirect exchange.

Murphy (2013a, 2013b, 2014) maintains that if one wishes to square Misesian theory with bitcoin, it is quite possible to do so by envisaging that the first actors to acquire the crypto-currency did so for ideological reasons. We can compare this to the kind of value people derive from contributing to a cause or to a charity. Because of such motivations, people had a framework for evaluating its purchasing power, says Murphy. He asks if it might be possible for a medium of exchange to emerge on the market without having any direct use at all. For example, says Murphy, consider a person who is willing to be the first to give up something of market value in order to acquire a completely new good—such as a bitcoin—simply because it has the potential for becoming a medium of exchange. This alone could establish its price, and thus set the stage for its actual emergence as a medium of exchange. This assumes, of course, that the good in question has attributes that make it especially suitable for that purpose. In this case, the new medium of exchange, assuming it becomes one, would never be valued for anything other than its use in indirect exchange. Murphy then declares that if this is the case, there must be a “loophole” in Mises’s argument.

Suede (2011) also embraces the idea that an object need not necessarily be valued directly before its emergence as a medium of exchange. Therefore, it is not necessary for us to look for bitcoin’s value as such, or for the point in time at which it transitions from a commodity to a medium of exchange. The argument that market participants always have to experience a good in some direct way before they can use it as a medium of exchange is not true. All that is needed is for them to perceive the benefits of indirect exchange in order to invent the necessary medium. According to Suede, the indirect exchange properties of gold alone would give it value

even if it never had any other use. In a similar vein, bitcoin could emerge as a medium of exchange without any direct-exchange value, and do so even in the absence of an existing price network. As a consequence of these observations, Suede suggests that Mises's whole approach to the origin of money is erroneous.

However, what the arguments above all have in common is that they misinterpret Mises's regression theorem. Indeed, the question of whether or not bitcoin can be reconciled with the regression theorem misses the point entirely. While some of the claims raised by these commentators are very cogent, the debate has been framed in entirely the wrong terms. In order to understand why, a review of the regression theorem is appropriate.

III. MISES'S REGRESSION THEOREM

Before *The Theory of Money and Credit* was published in 1912, no one had been able to employ the lessons learnt during the marginal revolution, concerning subjective value and marginal utility theory, and apply it to money. Goods *other* than money had marginal utility, which could explain their demand and supply schedules in terms of money, but money itself could not have marginal utility—or so it was thought. How could it, asked the economists of the time? If marginal utility were applicable to money, its demand schedule could only be explained by analyzing it in terms of all the other goods on the market. But if all these goods are valued in terms of money, and yet money is valued in terms of *them*, then clearly this is a circular argument, they said. Accordingly, money was separated from praxeological theory, and from individual action.

Mises's accomplishment was to show, *without* introducing a circular argument, that the demand schedule for money *can* be explained using marginal utility theory, and that it has a downward sloping curve like any other good. In addition, he demonstrated that the demand for money is to hold for future exchanges. It is comprised of an exchange demand by those who wish to obtain money and a reservation demand by those who already possess it. Mises was able to avoid the circularity problem by introducing a time element into the argument as follows: Money is subjectively evaluated (in terms of other goods) *not* by simultaneously, and

subjectively, assessing the prices of other goods (in terms of money), but rather by employing the *objective* prices that already exist. Put another way, the subjective exchange value of money (to hold) today takes place using as a starting point the objective exchange values of yesterday. This is the crux of the theorem. Menger had laid the groundwork for establishing the technical features of money, but Menger's contribution did *not* explain how money derived its (subjective) value. As Mises ([1912] 1953, p. 116) states,

Neither Menger, nor any of the many investigators who have tried to follow him, have even so much as attempted to solve the fundamental problem of the value of money. Broadly speaking, they have occupied themselves with checking and developing the traditional views and here and there expounding them more correctly and precisely, but they have not provided an answer to the question: What are the determinants of the objective exchange-value of money?

In *The Theory of Money and Credit*, Mises (1912) ably disposed of all the previous erroneous notions concerning the value of money: that its value was tied to the cost of production, that it was dependent on money income versus real income, or that it could be reduced to mathematical formulae, using equations of exchange and untenable variables such as the velocity of circulation.⁴

But there remained a problem, claimed the critics, for if the value of money is determined in part by the array of prices that existed yesterday, and yet those prices were derived by using a value of money that was based upon the prices extant the day before, then does this not lead to an infinite regress? No, said Mises, for if taken back far enough, there comes a point at which money first emerges as a medium of exchange out of a pure barter economy. Prior to this, it is valued only for its non-monetary uses as a commodity. The demand for money is therefore pushed back to the last day of barter, where goods are traded only in direct exchange, and where the temporal element of the regression theorem ends. It is in this way that all charges of circularity are obviated.

The regression theorem is first and foremost an argument based on praxeological deductions. It can be seen, however, that the

⁴ See Rothbard (2004, pp. 831–842) and (2011, pp. 685–708) for a criticism of the equation of exchange and the notion of the velocity of money.

theorem involves two distinct elements. The first part is a causal-realist explanation of the marginal utility of money, while the second is a causal-genetic explication that deals with the origin of money. The second element explains why there is not an infinite regress, and how an economy transitions from a state in which there is only direct exchange—a state of barter—to one where indirect exchange is present.

With reference to this second element, Mises ([1912] 1953, p. 110) states:

If the objective exchange-value of money must always be linked with a pre-existing market exchange-ratio between money and other economic goods (since otherwise individuals would not be in a position to estimate the value of the money), it follows that an object cannot be used as money unless, at the moment when its use as money begins, it already possesses an objective exchange-value based on some other use.

It is important to emphasize that what Mises refers to in this passage is the origin of a new money—*de novo*—i.e. from a pure state of barter, where there are no existing money prices. To that end, the second part of the regression theorem only explains the genesis of a new money where none existed before. It explicates how a barter economy—where all economic calculation is conducted ordinally—becomes a monetary economy in which calculation is performed cardinally. It should *not* be interpreted to mean that once a calculational framework in terms of money prices is established, that all future media of exchange (or monies) within that economy must arise from having a prior non-monetary use. The theory therefore is *not* an explanation for the origin of *all* monies or all media of exchange.

Indeed, Mises fully recognized that a new medium, such as a fiat currency, can piggyback onto any existing price framework, and that in this case, the new currency need never have been valued directly as a commodity itself. The only requirement is that the paper money's exchange value can be traced back in time, sequentially, to when only a commodity money existed, and ultimately to the point when that commodity was last used solely in barter.

From a historical perspective, fiat currencies and other paper currencies, such as "credit money," have come into existence by

being *redeemable* for the commodity money. In this way, confidence is created in the public that the new medium will be accepted in exchange. It then becomes a money. But as Mises makes clear, a paper currency can continue its monetary function even when it is no longer redeemable, provided the public continues to have confidence in its acceptability.

But there is an important point to make here. The regression theorem has nothing to say about the question of *why* subsequent currencies become established, why they continue to be accepted, or why they displace existing ones. Nor does it have anything to say about the rate at which a new currency is exchanged with the old.

Certainly, in the case of an emergent fiat currency, its redeemability at a fixed rate for the prior currency (or commodity money) is mandated by law, initially. And it might appear that this is a necessary requirement for its adoption. Moreover, it might seem that once its connection to the prior monetary system is dropped, and it becomes a true paper currency, it can do so only through the enforcement of legal-tender laws. But, empirically, we can observe that the initial legal requirement for redemption and rate-fixity is *not* a necessary condition for a new money to piggyback onto an existing one. Credit money,⁵ for example, can arise without any statutory stipulations whatsoever; the redemption that it initially possesses may be based upon a contractual agreement only. Moreover, since it arises as a *credit* instrument, its initial redemptory feature is certainly not instantaneous, and not at a fixed rate. And yet despite this, and without the benefit of any legal-tender laws, it emerges as standalone currency and continues to do so, even when all connections to the previous monetary regime are severed.

How is this possible? To ask this is to ask a psychological question, because ultimately *any* money's acceptability, as an exchange medium, is determined *solely* by the psychological impulses of those using it. Credit money is possible only because individuals have enough confidence that others will accept it in exchange, once they have done so themselves. The question of why the first person accepted it as such can be answered only by delving into his mind. But even the acceptability of a fiat currency is determined by the

⁵ See Mises (1912) pp. 61–62.

psychology of individual actors. One need look no further than past hyperinflations to see that legal-tender laws are no guarantee that fiat money always continues to function.

The acceptability of any new currency is not a praxeological issue. Redeemability may give market participants the confidence that the new currency will be accepted by others such that they will demand it for themselves, and legal tender laws give added impetus to these beliefs, but these notions are not related to any praxeological phenomena that govern the genesis of money. Nor is it deducible from the logic of action that once this confidence has been established, the fiat currency can continue to function as money after the redeemability has been eliminated. Historically, these sequences of events have certainly occurred, but because they are dependent on the confidence of the public, they are merely psychological phenomena.

What praxeology has to say, and what matters as far as the regression theorem is concerned, is that it is logically impossible for any new money to emerge unless there is some sort of existing price structure in place. Without prior prices present in some form, actors cannot *calculate* using the new money. And, therefore, if no price ratios have been established monetarily between the various goods and services, they can only be obtained through a process of direct exchange in the barter economy. This is the crux of the regression theorem. But there is no praxeological necessity for the new money to be redeemable for the old in law, or to trade at a fixed rate with it. Praxeology has nothing to say on the sequence of events during the transition. It merely prohibits the adoption of a new money without a calculatory framework.

After *The Theory of Money and Credit* was published, a number of economists criticized Mises on the grounds that the theory failed to explain how entirely new paper currencies can replace existing fiat monetary regimes. An example is the German Rentenmark, which was introduced to replace the paper mark in 1923 as a result of the hyperinflation that Germany experienced during the early 1920s. Clearly, this new currency neither possessed an objective-exchange value based on some other use, nor even a previous exchange value based on a commodity money. But these criticisms of Mises were misplaced, because they were founded on a misinterpretation of the regression theorem. That theorem does not contend that a new

or subsequent money must arise out of a state of barter. Nor does it attempt to explain why new monies that have *not* arisen from barter replace existing ones. It merely implies that in order for the new money to be used in economic calculation, there must be an existing price system in place upon which the new money can be superimposed, which was clearly the case with the Rentenmark.

However, the establishment of the Rentenmark is an interesting example of how the *psychological* factors come into play when a new currency replaces an existing one.

As Bresciani-Turoni (1968, p. 347) explains,

In October and in the first half of November [of 1923] lack of confidence in the German legal currency was such that, as Luther wrote, 'any piece of paper, however problematical its guarantee, on which was written "constant value" was accepted more willingly than the paper mark.' ... But on the basis of the simple fact that the [Rentenmark] had a different name from the old, the public thought it was something different from the paper mark, believed in the efficacy of the mortgage guarantee and had confidence.

The reason the Rentenmark could be used for *economic calculation* was because the memory of a price structure still existed under the paper mark, despite the latter's hyperinflation; it was this previous structure that enabled the Rentenmark to serve as a unit of account, entirely in accordance with the regression theorem. But the reason it was *accepted*, and thus came into general circulation, was purely psychological.

As Parsson (2009, pp. 11–12) states, "The Rentenmark was placed in circulation beside the devalued Reichsmark and carried no real value of its own but the naked avowal that there would be only so many Rentenmarks and no more."

A more recent example of paper money supplanting paper money is the euro, which superseded a number of existing national fiat currencies beginning in 1992. The regression theorem implies that without a price structure under the old system, it would have been impossible for the euro to become money. However, beyond this fact, the reason the euro was accepted by individuals as money was due to its anticipated acceptability in exchange. This involved various psychological factors, created in the minds of the public, by legal

tender laws, by various assurances of the government, and by its redeemability (for a while) against older currencies, that gave rise to the necessary confidence.⁶ For example, initially, the exchange rates of the national monies were locked at fixed rates against each other, and then at an arbitrary rate against the new euro.

It might be objected that these examples are not sufficient to demonstrate why bitcoin does not violate the regression theorem. It might be argued, for example, that bitcoin has not been established with the aid of legal tender laws or at a fixed rate with the prior currency. But it would be a mistake to think that because other currencies have been established through fiat, that the praxeological argument with respect to bitcoin is unconvincing. Praxeological arguments can neither be proven nor disproven using empirical data. The examples we give above are merely illustrations; and the intent is only to contrast the psychological factors that can come into play with the praxeological ones. The important point to make is that psychological factors have no bearing as far as the regression theorem is concerned.

IV. DOES BITCOIN VIOLATE THE REGRESSION THEOREM?

There are no clearly definable psychological requirements for a medium of exchange to arise. This is in contrast to the praxeological necessities dictated by the regression theorem. From a praxeological perspective, it is clear from the foregoing discussion there are two separate circumstances in which a new medium of exchange can start to function as a means of calculation and unit of account: (1) The new medium emerges from a pure barter economy, in which case it must have some previous direct-use value, or (2) it emerges when there is an existing money-price structure in place, or at least the memory of one.

In this case, the new medium, whether tangible or intangible—need not have any value as a commodity in direct use, need not necessarily be “backed” by or redeemable for anything, and need not be established at a fixed rate. None of this violates or invalidates the regression theorem. Historically it is true that new media have

⁶ Also, governments announced that they would only accept this new currency for tax purposes.

often incorporated some of these features as a means of creating the necessary psychological reaction to induce its acceptance, but they are not a praxeological necessity from the perspective of economic calculation. As long as prices exist in terms of the old money, this is all that is required to satisfy Mises's theorem.

What does this mean for bitcoin? Clearly, this quasi money emerged onto the scene in the presence of an existing monetary regime. Therefore, to ask whether or not it had any value in direct use prior to its becoming a medium of exchange is irrelevant as far as the regression theorem is concerned. If it was (or is) a commodity that had (or has) a non-monetary value, then to fret over whether this good is intangible or not, is also of no consequence to the theory. Since an existing price structure was in place, the regression theorem has nothing more to say on the matter. And it is not incumbent upon advocates of the regression theorem to explain how the *price* of bitcoin in terms of the existing currency was established in the absence of any legally-imposed conversion process, when the theorem has nothing to say on the matter. Beyond this, what was the critical element that bitcoin needed in order to emerge as a medium of exchange? It was for at least some actors to have enough confidence that when it was first obtained by them for goods they wished to sell, it could be spent for items they wished to buy. It may well be the case that the reason they had this confidence was because bitcoin did indeed have a prior non-monetary value. But analyzing the actors' motivations, and the factors that induced their confidence is beyond the scope of the regression theorem or any praxeological discussion. It is nevertheless an interesting question, because if bitcoin ultimately becomes money—i.e. a *generally-accepted* medium of exchange—then it would be the first non-commodity money to succeed in the absence of legal-tender laws, government assurances, or some kind of institutional backing.⁷

It would not, however, be the first non-fiat *medium of exchange* to arise this way. For example, in Argentina during the recession and financial crisis of the early 2000s, privately-issued media of

⁷ Almost the very opposite is true. Bitcoin faces actual government opposition. See https://www.google.ca/?gfe_rd=cr&ei=EXk7VIS8Is2GoQT8xoHQDQ&gws_rd=sl#q=government+opposes+bitcoin.

exchange circulated widely as a means of facilitating commercial interaction. According to Colacelli and Blackburn (2005), approximately 7 percent of the country's population traded with the so-called "Credito" during 2002. It should be pointed out this medium of exchange did not arise out of barter itself; in other words, it had no direct-use value at all. Rather, the Credito was issued by private clubs in the form of a paper chit. Even though it was initially pegged at a nominal fixed rate to the existing fiat currency, it was not redeemable for that currency. It was therefore not a money substitute, but rather a separate monetary implement. It succeeded, at least for a time, because users had enough confidence that it would generally be accepted within the orbit of the particular clubs that issued it. The Credito ultimately failed, however, as a result of counterfeiting and inflation, and because government actions to shore up the Peso led to a greater confidence in the regular fiat money. The Credito never had the attributes necessary to overcome the legal protections of the Peso, or the optimum technical properties to become a new money. It nevertheless demonstrated, before the advent of bitcoin, that privately-issued paper media of exchange can emerge in the presence of an existing currency. This example showed that it can do so without any governmental backing or promises of redeemability by the issuer; even in the face of government opposition. The question of whether or not *bitcoin* can progress to being money is discussed next.

V. CAN BITCOIN BECOME MONEY?

Carl Menger laid out the necessary attributes a good must possess in order to succeed as money; that is, to become a universal medium of exchange. It should be noted that his argument was not praxeological, in that it did not examine money on the basis of its *marginal utility*. Nor did it trace the genesis of a medium of exchange backward in time, via the kind of analysis Mises would later provide in the regression theorem. Rather, Menger's contribution was to provide an empirical and historical analysis of the origin of money, specifically when it arises from a pure barter economy.

To that end, Menger concludes that the most fundamental attribute a good must have before it can become a medium of

exchange—and ultimately the dominant medium and hence money—is its degree of saleableness (market liquidity, marketability) in direct exchange. Market liquidity, it will be noted, is subjective. It is not measurable. It has no praxeological explanation, because it is a psychological phenomenon. Liquidity depends upon several factors, according to Menger: First, upon the intensity of the demand for the commodity in question; second, upon the purchasing power of those who demand it; third, upon the availability of its supply; fourth, upon the divisibility of the commodity; fifth, upon the development of the market, in particular the level of speculation. And finally, upon the type and number of political or social restrictions that may be imposed upon it. Menger then lays out the spatial and temporal limits on its liquidity, which include the distribution and permanence of its demand, its transportability, its durability, and its storage costs, etc. Other important technical aspects are its homogeneity, its recognizability, and stability in price in terms of other goods.⁸

The greater the number and intensity of these attributes, the more likely a good will be used in indirect exchange. When a less liquid good is brought to market, the seller will seek to exchange

⁸ Menger was certainly not the first to discuss the necessary attributes of money, in general, or the precious metals in particular. For example, Aristotle in *Politics*, Book I, Section IX discusses how money should be transportable, divisible, and “intrinsically useful” (having a direct use). He says, “When the inhabitants of one country became more dependent on those of another, and they imported what they needed, and exported what they had too much of, money necessarily came into use.” Adam Smith in his *Wealth of Nations* discusses how durability and divisibility are important characteristics of money. According to Smith ([1776] 2005, p. 26) “Metals can not only be kept with as little loss as any other commodity, scarce any thing being less perishable than they are, but they can likewise, without any loss, be divided into any number of parts, as by fusion those parts can easily be re-united again; a quality which no other equally durable commodities possess, and which, more than any other quality, renders them fit to be the instruments of commerce and circulation.” With respect to precious metals, Jean Baptiste Say ([1821] 1971, p. 222) lists many of the same features: Precious metals are divisible, homogenous, resistant to friction (i.e. durable), sufficiently rare, and capable of being stamped. John Stuart Mill ([1848] 2009, p. 338) says that the reasons precious metals became money were that they “pleased everyone to possess,” they are transportable, easily hidden, divisible, homogeneous, and “their purity may be ascertained and certified.” And Jevons ([1875] 1898, pp. 30–39) lists the necessary attributes of good money as follows: utility and value, portability, indestructibility, homogeneity, divisibility, stability of value, and cognizability.

it not just for the good which he requires directly, but if this is not possible, for the most marketable commodity he can use indirectly. This presupposes that the actor has sufficient knowledge and confidence that the commodity in question, which is not necessarily valued by him in its direct use, can be resold. It is this information and assurance regarding a particular good's liquidity, among an increasing number of actors over time, that results in the good emerging as the most commonly-used medium. As Menger ([1892] 2009, p. 45) states,

The reason why the *precious metals* have become the generally current medium of exchange... is because their saleableness is far and away superior to that of all other commodities, and at the same time because they are found to be specially qualified for the concomitant and subsidiary functions of money.

Of course, Menger's analysis does not refer to the emergence of paper money from a commodity money, or paper from paper. In the case of a *fiat* currency, where government mandates the money's acceptability and hence its liquidity through legal tender laws, the currency clearly has no direct use, even though many of the technical factors, such as divisibility, durability, transportability, and consistency, are still desirable.

But what about a non-fiat, non-commodity money? As discussed in the previous section, there is no praxeological necessity for any new medium of exchange to have a direct use unless it emerges from pure barter, and then only because there is no existing monetary price structure in place. But if a new medium of exchange, such as bitcoin, is set to emerge in the presence of an existing currency, then having some non-monetary uses undoubtedly increases its liquidity, which can aid in its emergence, and hasten its transition to money. Saleability inspires confidence that the new money will be accepted by others, and that the person who purchases it as a medium of exchange will not be left holding the bag at the end of the day. Once the new medium of exchange becomes established, and demand for its monetary use increases, then demand in direct use becomes less important, but at least in the beginning, non-monetary demand surely provides an important boost.

Prior to it becoming a medium of exchange, bitcoin's non-monetary demand was clearly rather limited, but it must have had

utility in some form—perhaps as a digital object, a game, a cause, a badge of membership etc.—because it began to be exchanged for fiat currency during 2009. Then, on October 5, 2009, the first exchange rate with the U.S. dollar was published. This step, and the advent of bitcoin exchanges such as Mt. Gox, demonstrated that bitcoin could be sold for the most liquid of all goods, the extant currency, and was therefore gaining in liquidity itself, even though there is no record of it being used as a medium of exchange at this point. However, given that bitcoin was designed from the ground up to be money, with all the technical features normally associated with a functional money (and many more besides) it was not too long before it started to be used in indirect exchange. According to Surda (2014), the first such documented case occurred on May 22, 2010, when Laszlo Hanyecz purchased two pizzas for 10,000 bitcoins. Obviously, at this stage, the purchasing power of bitcoin was relatively low, but as more and more people recognized its liquidity, and the possibility that it might one day become money, demand increased, primarily from speculation.

Speculation in bitcoin has at times raised its purchasing power and its exchange rate with the dollar, and given rise to the view that the “greater fool theory” is at play. Many expect that the market for bitcoin represents a bubble that will ultimately crash. North (2013) even argues that the creation of bitcoin is something akin to a Ponzi scheme. But as Rothbard ([1962] 2004, pp. 130–136) points out, speculation does not necessarily indicate economic error. To the contrary, economic agents engaging in this type of behavior might well be correct in their predictions, in which case their actions can be viewed as beneficial, for they hasten the adjustment of the commodity toward its equilibrium price. The question therefore is this: Is the increased speculative demand for bitcoin justified? No one can say for sure.⁹ But while bitcoin’s initial liquidity was not particularly impressive *before* it became a medium of exchange, it nevertheless possesses some truly unique features that should enhance its utility, and possibly its marketability now that it *is* a medium of exchange.

Graf (2013b) outlines some of the monetary attributes of bitcoin; it is infinitely durable, it has a finite supply, it has very small

⁹ This is basically an entrepreneurial issue, not one of praxeological economics.

transaction costs, it cannot be counterfeited, it is apolitical, and it has no cross-border limitations. It also has no weight and is easier to transact with than gold. Suede (2011a) mentions that this quasi money cannot be confiscated since the files in which it resides can be replicated and hidden. Political restrictions might pose a problem, but the fact that it is peer-to-peer means the government would have to shut down the web to stop it; an unlikely prospect. Another feature is that when it is exchanged, it is done so over a network and transmitted electronically, but it is not a bitcoin substitute that is sent; rather, it is these very coins themselves. This, and the fact that bitcoin obviates the need for commercial banks, means there would be no need for money substitutes, and fiduciary media might no longer be able to be produced. Coupled with bitcoin's finite stock, it is possible that an added benefit would be the permanent termination of the business cycle,¹⁰ provided of course bitcoin became universally used, and displaced all fiat and commodity monies. See also (Surda (2012) on this issue.

The truly unique functions of bitcoin, as detailed by Surda (2014), are *non*-monetary, and include the following: It can act as an effective means of notarization, it can act as "smart property,"¹¹ it can perform conditional transfers,¹² it eliminates the need for intermediaries, particularly in multi-party transactions, it can act as a form of stock ownership eliminating the need for separate stock exchanges, it can record transactions for auditing purposes, etc. etc. These factors are of course closely associated with (but not the same as) the monetary function. This raises the interesting possibility that as bitcoin becomes more widely exchanged, and not just hoarded for speculative purposes, these unique features will become more apparent to more users, thereby increasing the demand even further, in a virtuous circle where demand and liquidity reinforce each other.

¹⁰ For the Austrian business cycle theory that supports this contention, see Hayek (1931), Mises (1998), Rothbard (1993).

¹¹ Smart property is where an ownership title is contained within the blockchain. The title could be for a house, car, stocks, etc. Titles held in this way can be traded or used as collateral with very low probability of fraud. It was first proposed by Nick Szabo (1997).

¹² Any transfer that is conditional on some action or event occurring. e.g. stock options, futures, gambling.

Casey (2011) takes the view that because bitcoin is not backed by anything, it will ultimately fail. His comments are fairly typical of those who view the market as a bubble: “bitcoins are just an electronic abstraction. They can’t be used for anything else, nor are they made of something that can be used for anything else...”

Now it is true historically that commodity monies such as gold and silver have had a direct use as jewelry, etc. But as Mises makes clear, once a medium becomes generally accepted by the public, and hence money, the underlying direct use can disappear entirely, even though the commodity still continues to function as money. Liquidity gives rise to more liquidity as confidence in the new money increases. Thus, the cause of the original liquidity—its direct use—becomes less and less important. Moreover, money *always* functions only as long as people have confidence in it, and this is true even if it *does* have a concurrent direct use. Even if gold were once again to become the universally accepted medium of exchange, it would not be “backed” by something of equal value. This is because, *ceteris paribus*, when a commodity becomes money, the increased exchange demand causes its price (in terms of other goods) to become higher—typically orders of magnitude higher—than the price it would be if used as a commodity only. Since the increased exchange demand can be said to represent people’s confidence, anticipation, expectation etc., that it will continue to be universally accepted in indirect exchange, it must be the case that if people’s confidence were to fail, its price would fall. If gold’s ability to perform its function as money suddenly evaporated in the minds of market participants—let us say another money were discovered that was generally recognized as being superior—gold money users would soon find their money was “backed” by relatively little.¹³ This of course is true also of a fiat currency, where initial confidence is provided by government guarantees and maintained by legal tender laws and tax policy. If all confidence in the government is lost, the underlying true very limited or non-existent value of the paper is soon revealed.

VI. A HYPOTHETICAL

Posit that bitcoin evolved as money directly from barter; would this then constitute a violation of the regression theorem? Before

¹³ But not nothing. This metal would still be useful for jewelry, false teeth, etc.

we attempt to answer this question, we note that this supposition is patently false. Bitcoin is a product of the twenty-first century, quite distant from the time in which barter was the generally accepted way of facilitating trade, if it ever even existed. Moreover, it is highly doubtful that a digital object requiring an extremely complex infrastructure, such as the internet, could ever develop in a pure barter economy, where the division of labor is almost non-existent.

Why make this query then? We step out of reality in this manner so as to make an important economic distinction. Economists do not have controlled experiments at their disposal, and thus must be excused for engaging in contrary to fact conditionals.

So assume bitcoin has arisen, *de novo*, from a pure barter economy. If the regression theorem says that money can only arise out of a commodity, and “commodity” means tangible good, then that theorem is wrong. Assuming bitcoin is a money (it is not yet generally accepted, although one day it might be) the regression theorem is wrong because bitcoin is not, and was never, a commodity. On the other hand, if the regression theorem says that money must arise out of something that is of value, then the regression theorem is correct. Bitcoins were something “of value” to at least some people even at their inception. So what does the regression theorem actually say?

How does the analysis of those analyzing the regression theorem stack up against this criterion? Most speak of it in terms of a commodity, not something of value.

For example, Rothbard clarifies (1963; emphasis added by present authors):

This process: the cumulative development of a medium of exchange on the free market—is the only way money can become established. Money cannot originate in any other way, neither by everyone suddenly deciding to create money out of useless material, nor by government calling bits of paper “money.” For embedded in the demand for money is knowledge of the money-prices of the immediate past; in contrast to directly-used consumers’ or producers’ goods, money must have pre-existing prices on which to ground a demand. But the only way this can happen is by beginning with a useful *commodity* under barter, and then adding demand for a medium for exchange to the previous demand for direct use (e.g., for ornaments, in the case of gold). Thus, government is

powerless to create money for the economy; it can only be developed by the processes of the free market.

And in the view of Mises (1912; emphasis added):

The unsatisfactory results offered by the subjective theory of value might seem to justify the opinion that this doctrine and especially its proposition concerning the significance of marginal utility must necessarily fall short as a means of dealing with the problem of money. According to his argument, the objective exchange value of money is not determined at all by the processes of the market in which money and the other economic goods are exchanged. If the money price of a single *commodity* or group of commodities is wrongly assessed in the market, then the resulting maladjustments of the supply and demand and the production and consumption of this *commodity* or group of *commodities* will sooner or later bring about the necessary correction. If, on the other hand, all *commodity* prices, or the average price level, should for any reason be raised or lowered, there is no factor in the circumstances of the *commodity* market that could bring about a reaction. Consequently, if there is to be any reaction at all against a price assessment that is either too high or too low it must in some way or other originate outside the *commodity* market.

When Mises and Rothbard penned these words, there were no digital goods in existence. For these economists, intangible goods (in the broadest sense) were labor services, trademarks, goodwill, etc., and various financial assets such as insurance policies, stocks and bonds.

Now it is very difficult to explain how intangible goods like these could ever become media of exchange, let alone money. For example, suppose Smith sells a cow to Jones, in exchange for 20 hours of Jones's labor, and then Smith, instead of asking Jones to work for him, exchanges this labor (or some portion of it) with Green to buy, say, a bushel of wheat. It is true that Jones's labor is being used by Smith in an indirect way to sell his cow and buy a bushel of wheat from Green. But it is certainly very doubtful that Jones's labor could ever become money. One immediate problem is that Jones cannot be everywhere, and therefore there would have to be multiple Jones's, all agreeing to use their labor as media of exchange. But labor is never completely nonspecific, so there would be no homogeneity. It could never serve as a unit of account. This lack of homogeneity is true for all other (non-digital) intangible assets. Therefore, it would never have occurred to Mises and Rothbard that intangible goods

could ever be used as money. It seems absurd. It would not be unreasonable for them to assert that *de novo* money must arise from a tangible good.

However, for the modern economist, the digital age changes the notion of an intangible good. Intangible digital goods can be replicated to create identical units; they can be completely homogeneous. In an important sense, they can be even more homogenous than any physical good can ever be. Moreover, they can be instantly transportable over the internet, and almost infinitely divisible and durable. Until the development of bitcoin, digital goods would not have made a good money. However, bitcoin combines the features of an algorithm that limits supply, with a method of verifying transactions (in the blockchain) that limits double spending, and employs asymmetric cryptography that uses elliptic curve functions with no solution. In this way digital objects can be made to be extremely secure, with a supply that cannot be counterfeited or inflated.¹⁴ In short, there now exist intangible goods that can have all the characteristics of money.

Let us assume that by using the word “commodity,” Mises and Rothbard meant a *tangible* commodity, like gold, and not an intangible one. If so, were they in error when they said that money that arises from barter must be a “commodity?” Would it have been more correct to say that it must have direct-use “value,” thereby encompassing *all* goods, not merely tangible ones? It seems a bit harsh to say they were wrong, knowing what we now know about digital goods, and positing an almost impossible world where digital objects like bitcoin emerge in a pure barter economy. But strictly speaking, in order to account for all possibilities, even unlikely ones, it would indeed be more complete to say that the regression theorem *should* imply that when money first emerges from a pure state of barter—and a cardinal calculational framework is created for the first time—the good in question must have prior *value* in direct use.

VII. CONCLUSION

Mises’s regression theorem is a praxeological analysis of the marginal utility of money. It states that the subjective money

¹⁴ Inflated beyond a finite amount; in the case of bitcoin, 21 million units.

prices used in calculation, today, are based in part on the objective money prices of yesterday. For any good to be used as a medium of exchange, an objective framework of prices must already be in existence. Because the very first medium of exchange to emerge must have done so when there were *no* money prices, it follows that this good must originally have been valued, and bartered, in direct exchange. The regression theorem does *not* say that all subsequent media of exchange must have been exchanged directly or have a direct-use value.

Menger's earlier discussion on the origin of money is an empirical and historical analysis. It says that because money—the generally-accepted medium of exchange—is the most liquid good, it follows that items with a high degree of liquidity in direct exchange are the most likely to emerge as money in indirect exchange. But there is no praxeological necessity that money must have a direct use in order to be salable. The marketability of money depends on the confidence of market participants. Liquidity is a psychological phenomenon.

Those who seek to determine if bitcoin violates the regression theorem, by asking whether or not it has been valued directly, are barking up the wrong tree. Bitcoin does not *need* to have a direct-use value in order to be a medium of exchange, because it did not emerge from a pure barter economy. This medium of exchange therefore does not violate the theorem. Clearly, it *does* have such a value, because it was directly exchanged for other goods, including the U.S. dollar. This provided the initial liquidity, which helped it to become a medium of exchange. Will bitcoin ever become liquid enough to become generally accepted, and hence money? It is unique among all previous media of exchange¹⁵ in that it incorporates numerous novel features, many of which offer up their services only when it is *used* as a medium of exchange. This means that as it becomes more widely adopted, it is probable its liquidity will increase, not just because more people will accept it for its monetary uses, but also because more people recognize the advantages of its non-monetary uses. Whether or not it can ever become money remains to be seen.

¹⁵ For example, Hayek's (1978) "ducat." For a critique, see Rothbard (1992).

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