From the Ground Up: Understanding Bitcoin for High School Students

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Note: This is not an information article about Bitcoin. It is instead a teaching resource intended to be read and taught alongside students for reflection and discussion.

Anything having to do with currency is a sticky problem. It becomes very difficult to imagine how something like money came into existence. We can easily see how bartering works from experience. Do you remember the last time you traded one food item for another with a friend? Bartering is quite clear in its structure since it involves the mutual benefit of exchanging items.

We also have little difficulty seeing how species currency works, where the coin itself is a valuable material, such as gold or silver. The coin itself is a valuable item I can exchange for an item I want.

But things get a little more complicated when it comes to our conventional form of currency, like the U.S. dollar or Chinese yuan, which is often referred to as *fiat currency*. It has no value in-itself since it is not an item we can use (as in barter) and not made of valuable material (like a gold coin). So what is going on with such currency?

To make things even more complicated, there's cryptocurrency. How does Bitcoin stand as a currency? Is it merely a technological form of fiat currency?

I'm a philosopher of work and economics by training, and I am a firm believer that in order to understand the fundamentals of any economic system, it's best to understand basic economic relations and human behavior. In other words, I think that in order to grasp the essence of something like Bitcoin and how it works, you can do so without being a savvy economist, expert coder, or technological wiz. You just need to understand the basics of exchange and how our desires drive exchange.

Having said that, let's slowly step into the issue of Bitcoin by beginning with what we often take to be the core of what drives economic exchange—*desire to use*. I will later contrast this with the *desire to own*.

But learning the fundamentals is not necessarily easy or quick. Hence the length of this article! But I'd wager that it will be worth your time and effort in coming to get your head around Bitcoin. If nothing else, it'll give you some insights into the basic functionings of the economy.

1. Desire to Use

Imagine you live in a small community where everyone has a specific role with regard to what they like to do as a form of work. So, there is a nice balance of skilled and unskilled work, creative labor and practical labor, physical talent and intellectual talent. In this scenario, you are a cobbler who likes to make shoes. Your livelihood is based on the desire of others who want shoes in order to do what they do—whether it's simply for walking or something more specific, like hiking or running.

Desire to use is often referred to by economists as *utility*. And we can more clearly see it in terms of *need*.

A need is what one requires in order to persist or survive. Need can be broken down into *biological need* and *social need*. Biological need is basically what you require in order to continue living—in the way of food, shelter, clothing, etc. Call these biological necessities.

Social need encompasses a variety of goods—including companionship, freedom, leisure, a range of institutions that provide services like health, finance, security, etc. Social needs are those things that contribute to making our lives fuller, or if you prefer, more human. Very few of us would want to live a life simply based on fulfilling biological needs; we'd like to have friends, technological gadgets, education, health care, sports, entertainment, and the arts. Call these social necessities.

It goes without saying that you cannot have social needs without the realm of biological needs being satisfied. Can you continuously play your computer game without having continual access to food, sleep, etc.? What is important to note with regard to currency is that economic exchange is predicated or based on the satisfaction of these biological and social needs.

2. How Value Works in the Desire to Use

The question of how value functions in an economy is a very difficult one. In fact, it has never been fully resolved by economists or philosophers. After the 1870s, economists ceased inquiring as to how value arose and instead concentrated on how value is already at work in the economy in terms of price (the price of a thing is not necessarily its value). In other words, economists just wanted to focus on how our existing modes of exchange worked instead of pursuing the great philosophical problem of how value arises—that is, how something like a chair becomes valuable.

Consider, for example, trying to answer questions such as: Does value arise because of the amount of labor we put into making something? Or does it arise because a person wants to pay a certain amount for it? Or does it have to do with the materials used or where it is made?

If we say "all of the above" it seems like value is something quite arbitrary. But in economic exchange we tend to think the opposite. Value is something quite definite, and we want to pay specific amounts that we think are fair.

This conundrum is what the philosopher Karl Marx (1818-1883) referred to as the *transformation problem*—or trying to understand how value arises in the process of huamns taking natural material and reshaping it into something else. Can you detect where value arises when a lumberjack cuts down a tree and a carpenter fashions it into a cabinet for a customer?

If you want to learn more about this problem, you can read a separate academic essay that I wrote here.

The basic principle of exchange

For our purposes, we need only to note that when we desire to use something to satisfy our biological or social needs, we face the following dilemma:

> *Do I go about making the thing I need myself?*
> *Or, do I buy the thing I need instead?*

In other words, I am basically asking myself "Should I take the trouble to spend my own time, materials, and labor making what I need?"

So, you might make your own sandwich for lunch. Or, if you can't be bothered or don't have time, you might buy one from the local deli. You may have come across the economic term *opportunity cost*, which involves the decision of whether or not you want to give up something you own in order to get what you need and don't have. In essence, you are making a decision to trade something of value you own in order to avoid having to undergo the labor and use of materials required to make a sandwich.

What will you trade? In a barter system, you might trade something in your possession that you made or something that you acquired. As a cobbler, you could trade a pair of shoes, assuming the owner of the deli wanted shoes. If s/he did, then it would just be a matter of working out how many sandwiches are equivalent to the shoes being traded.

In our economy today, we don't usually barter. In fact, no society (ancient or modern) really used bartering as their main form of exchange. It's a misnomer that our ancestors did. Instead, prior to a currency, societies traded based on a rudimentary credit system.

What's interesting in today's economy is that we usually don't have to come to an explicit agreement with someone about the value of an exchange. How often do we barter with cashier at a store? We tend to just pay the price tallied. Or in our example, we simply "agree" to the price that the deli owner has listed on the menu. If we think it's fair—that is, if we think that price is fair enough to pay *instead* of making

the sandwich ourselves—then we go ahead and make the trade.

One complication

Of course, sorting out the desire for goods we want to use is not so simple. In any society where trades and talents are specialized and developed, there will be things we simply cannot do ourselves because we lack the skill, materials, and/or know-how. So in many instances, we simply have to trade and cannot ask "Should I make this thing myself?" (Try making a mobile phone!)

But we nevertheless do ask ourselves, "Should I pay the price being asked?" If not, I can either do without the item or seek a better price elsewhere.

The upshot is that we attempt to satisfy our desire for things we need to use in our life by trading what we have or have produced ourselves according to what we think is fair. Is the opportunity cost reasonable?

Having said that, there are a lot of factors that will determine what one thinks is fair. Scarcity of an item and urgency to get the item instead of spending time going elsewhere are just two factors that might cause you to accept a higher price.

3. Money and the Desire to Use

The history and philosophy of money is extremely complex. As an academic researcher in the philosophy of work and economics, I would by no means say that I have grasped the entirety of the topic! But understanding basic relations involved in the use of money can help us gain some clarity, especially with respect to Bitcoin.

To recapitulate, in a barter system we can easily see how the things being traded—shoes for sandwiches in our example—both have value. They have value because they are things we desire to use. I want a sandwich because I am hungry and need nourishment to continue conducting my business that day.

But when we start to think of fiat currency, like the US dollar, things get a bit vague. Fiat currency is essential a paper or coin currency that a government "declares" is the official (or legal) tender to be used in that country for exchange. We accept using this fiat currency because in part we trust it and in part, as my colleague likes to say, the government can enforce us to do so (bullets behind dollars).

There is a simple way to understand how money works for our purposes. In an economy we have seen that value arises because things are being made that we all desire to use to satisfy biological and social needs. Think of all the goods and commodities out there in a society—150,000 pairs of shoes, 1 million pieces of candy, 12,000 phones, and so on. Economists often refer to this as *gross domestic product* (GDP), or what a nation has produced by means of its citizens laboring in their respective work.

How can we ascribe a value to this? It would be cumbersome to keep listing the items or to list the value of all the items according to just one of them—e.g. the US produces the equivalent of 1 billion clogs in a year. What fiat currency provides is a universal measure of all items across the spectrum of a nation's production.

There is a rather arbitrary starting point for this valuation since there has to be a moment when we start ascribing value in terms of the fiat currency. This is a complex topic, but it basically comes down to the convention of people agreeing to the valuation of something and this convention being backed (sometimes enforced) by financial and governmental institutions.

What this universal measure allows is for us to trade things more easily. I don't have to barter. I can make my shoes, exchange them in the marketplace for fiat currency and then use that currency to buy a sandwich. Hopefully, the pricing system will be such that it is fair for me. I get $100 for my shoes and am happy to pay $5 for a sandwich.

4. Who Controls the Money?

You may have already seen one of the problems with fiat currency. It is controlled by a central authority. This is not so much of a problem at the everyday level of exchange, but it is a problem with regard to having access to more money in the event that I need more "cash" in order to cover an important cost that I can't afford in the present. That is, I don't have the money "now" to do what I want to do and so need to ask for a line of credit from someone who does have the money. If get the money from them *now*, then I have to pay them back *later*.

Think of it like this: In everyday exchanges (shoes for sandwiches), there is no need for credit in the transaction. I don't really need the deli owner to trust me (credit) because I can simply give him or her a five-dollar bill. In essence, we trust the fiat currency to do the work of holding value in the exchange. If we didn't trust it, we wouldn't accept it. Economists will therefore often speak of fiat currency being *a measure of value* (i.e. allowing us to equate shoes to sandwiches) as well as *a store of value* (i.e. holding value across transactions).

But for those occasions where we need access to money beyond our ways and means (e.g. buying a car, home, or the latest iPhone), we have to gain the trust of someone or some institution that has this money. We need credit with them.

Credit is thus the idea that someone or some institution trusts me to pay back an amount of money given to me; it therefore gives me credit. The extent to which they trust me is represented by how much they will give me. An easy example: When you apply for a credit card, the level of trust a credit card issuer has in you is represented by your spending limit. If you have very little credit, that limit is usually around $250. The more you spend and pay off your credit on time, the more the trust builds, and the more your limit is raised. (Well, not always. A cynical thought is that limit increases are not based on your ability to pay back the entire amount, but only enough to make the minimum periodic payments so that interest due accrues on your account.)

But fundamentally speaking, being given credit is a way for the financial institution to say, "I trust that in giving you this line of credit *now*, you will pay this back in a specified amount of time." The penalty for not doing so is either an interest rate fee; or an interest rate fee *and* a drop in credit score.

Each one of us has a *credit score* that basically represents our economic trustworthiness. (You might scoff at this, but it's important to make sure this score is maintained with integrity; otherwise, you will not be afforded any credit when going to make purchases outside your ways and means.)

5. Bitcoin, Finally!

Now imagine if there were access to money that was legitimately accepted by others yet was not controlled by any central authority. This was allegedly the reason for creating Bitcoin. Remove central authority, and citizens of the world would have greater spending and investing power since we would not be constrained by government regulation of currency or meeting credit qualifications for loans.

However, there were at least two main obstacles to this project. One was the problem of duplication, which the journalist Josh Daniels explains in an article from *The New Yorker*:

> Banks, however, do much more than lend money to overzealous homebuyers. They also, for example, monitor payments so that no one can spend the same dollar twice. Cash is immune to this problem: you can't give two people the same bill. But with digital currency there is the danger that someone can spend the same money any number of times.
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> Nakamoto [the as-yet unfound creator of Bitcoin] solved this problem using innovative cryptography. The bitcoin software encrypts each transaction—the sender and the receiver are identified only by a string of numbers—but a public record of every coin's movement is published across the entire network. Buyers and sellers remain anonymous, but everyone can see that a coin has moved from A to B, and Nakamoto's code can prevent A from spending the coin a second time.
>
> Nakamoto's software would allow people to send money directly to each other, without an intermediary, and no outside party could create more bitcoins. Central banks and governments played no role.

A second obstacle involved where the currency would be minted. In addition to cryptography removing the possibility of the duplication of transactions, its blockchain platform allowed for currency to be minted via all the computers, or *nodes*, involved on the blockchain. The more users, the more nodes; the more nodes, the greater processing capacity of that blockchain to enable transactions.

In other words, while a fiat currency is centralized, cryptocurrencies like Bitcoin are *decentralized* across all the nodes in its network. The term therefore used today to describe this alternative form of finance is decentralized finance, or *DeFi*.

You may have questions about the security and trustworthiness of DeFi and the blockchain, and this is where the specifics of the blockchain technology provide safeguards against bad transactors. This topic lies outside the scope of our purposes, but you can read more on this in my blog on blockchain basics.

In short, the advantages of a decentralized finance system:

- you can apply to gain access to more money as a loan without worrying about credit limitations (DeFi liquidity pools);
- transactions can occur instantaneously, instead of according to banking hours or waiting for the approval of a banker;
- cryptographic coding means transactions are of public record but also anonymous (the specific identities of transactors are hidden);
- blockchain technology ensures security and anonymity by providing a permanent (unchangeable) ledger/record of the transactions that is both public and encrypted.

6. Why Hasn't Bitcoin Been Adopted More Widely?

There are a lot of ways of answering this question. One is that central banks and governments don't like DeFi because it is a direct challenge to the existing system of economic exchange and investment which we've had for centuries. Another answer is that the interfaces to use and trade Bitcoin are still difficult to navigate for the common person who lacks technological know-how.

But there is another noteworthy answer which I want to consider in closing this article; and it refers us back to the distinction I made at the beginning between the *desire to use* and the *desire to own.*

Owning and ownership economically speaking

By *own* I mean something very specific here. We know the common meaning of the word "own" in terms of possessing or holding something according to some length of time. In cases of personal property, this ownership often means "in perpetuity", or until I choose to exchange it, pass it on, or give it up.

When ownership of an item that is desired by others is motivated to capitalize off this desire, it is called *economic speculation.* When one owns most of it, if not all, of what others desire, speculation becomes morally questionable, if not reprehensible. We call this kind of ownership a *monopoly.* But this worry goes goes down a different line of (moral) inquiry. So let me unpack the drive to own a little more economically.

It becomes very tempting to own a great deal of something that others desire for two reasons:

1. owning something that others desire increases one's equity or economic value of one's holdings; and
2. assuming that what is desired is limited in quantity or cannot be gained very easily, the more one owns, the more its value will increase (more people will want less of what is available).

In our examples above, desire and access have to do with fair price/exchange. I may not have access to a sandwich, but I can easily do so if I pay $5. The deli owner is not going to deny this price because s/he knows I can simply go elsewhere. The limited supply of sandwiches is not really an issue or factor upon which the deli owner can gain advantage (in terms of increasing the price).

But what if the supply of sandwiches were scarce? Then, those holding those sandwiches or the capacity to make sandwiches would gain from this condition of scarcity. Gaining this kind of leverage via ownership is not just a happenstance in trading but a strategy. The more one owns what is wanted, the more one stands to gain.

This in part is what I am calling the *desire to own.* It's the desire to own most or all of some stock of a thing in order to take advantage of others who want access to that thing I own.

Whatever you think about the morality of this strategy (I think it is questionable in specific instances), it is worth noting the shift. A thing that is essential to our *desire to use* in order to live has been turned into a something we cannot easily access in order to live. One's desire to use is supplanted by another's desire to own.

Another example may help illustrate: What if I owned all the land in town? As someone who didn't own any

land, you'd either be forced to pay me what I ask to gain access to a piece of land (call this fee *rent*) or move to a town where you could acquire your own land.

Land very much satisfies our *desire to use* in so far as we all need to use land to work and live. But if I buy land simply to withhold it from use (for others to work and live), then it is my *desire to own* land that is active and actually stymies and complicates other people's desire to use!

Owning Bitcoin

With Bitcoin the desire to own is not as inimical. The speculative strategy here is to get in early enough on the ownership of something that others need or think they need and sell it at a higher price than you paid. In this case, the desire to use is still supplanted by the desire to own, but in such a way that the item in question does not really have any use beyond its involvement in buying and selling it in order to gain a higher price than one paid. This is the essence of financial trading.

While Bitcoin is a currency, instead of being used widely for exchange, it is essentially a trading commodity. Investors and traders in Bitcoin are essentially banking on the idea that the desire to have it will increase.

The hope for those owning things people want is that their value will increase over time and that people will not just want these items but pay for them.

But things are rarely so simple. Bitcoin has experienced a lot of ups and downs, and if you bought and sold at the right moment . . . well, it's what traders call a moonshot. Moonshots are when you can increase your initial investment by a hundred- or thousand-fold.

So if you bought one Bitcoin when it was worth a fraction of a penny in 2010, held on to it, and then sold it on April 14, 2021, that one Bitcoin would be worth $64,800. The eleven-year period is longer than what one would expect for a moonshot, which would be a shorter period of investment with less gain. But you get the picture.

So the story is not that simple. Bitcoin's value is volatile. One of the main reasons for this is that because Bitcoin has no real utility at the moment and because it is mostly a speculative commodity, it lies prey to the whims of whether or not people think it will retain its value. In contrast, with fiat currency, like the US dollar, our need for it is directly linked to how to satisfy our biological and social needs—our desire to use. So there is a much more predictability and stability to the role and value of fiat currency. We lie prey to our biological and social needs to use, not our desires to own it in order to gain through speculative trading.

Having said that, there may be a point in time where Bitcoin can become more widely used because its volatility settles down. One might imagine a scenario where enough countries take the leap of faith and adopt Bitcoin as an official currency, thus providing a stable venue of exchange versus just speculation alone.

There is one last, very important thing to note. Not all cryptocurrency is like Bitcoin—that is, mostly a speculative commodity. Other coins like Ethereum are also speculative. But investing in them is more a way to invest in their technological platforms to provide decentralized services to its users. In other words, there is a linkage to use/utility for such coins.

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