



UNIVERSITY *of* NICOSIA

Session 1

A Brief History of Money

DFIN 511: Introduction to Digital Currencies

Session 1: Objectives

The history of currency and money could fill a full course or even a degree program. In this first session, we will attempt to cover it in one class session. Given this, by necessity, we will need to make significant simplifications and cover stretches of hundreds of years of monetary history in one session.

Objectives

- Understand the main functions of currency and be able to apply them when analyzing various types of historical, current or future currencies.
- Understand, at a high-level, the main forms of currencies used over time
- Understand how Bitcoin maps against main functions of currencies



Session 1: Agenda

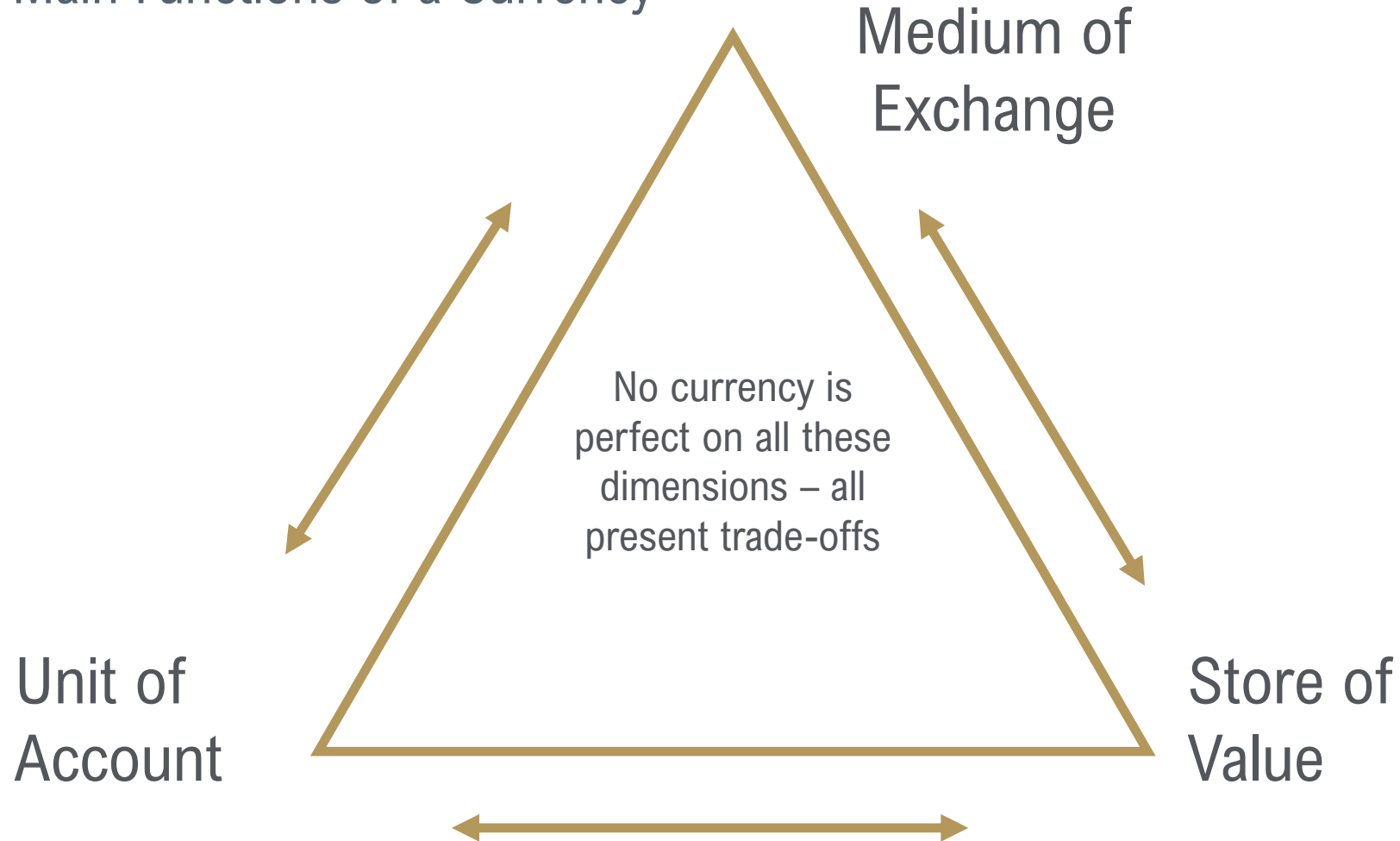
1. The Functions of Currencies
2. Barter through Coinage
3. Coinage through Fiat Currency
4. Bitcoin as a Currency?
5. Conclusions
6. Further Reading



1. The Functions of Currencies

The Functions of Currencies

The 3 Main Functions of a Currency



The Functions of Currencies

Medium of Exchange

What is a medium of exchange?

- An instrument that can be used to facilitate the exchange of products and services. In modern economies, the medium of exchange is primarily the national (sovereign) currency
- Currencies represent a more efficient way to exchange products and services than the barter system (which requires a “double coincidence of wants”- see slide 10)
- In this regard, currency serves the role of an intermediary between the products or services that people want to trade

What makes a good medium of exchange?

- **Durability:** Can the currency can be used without the danger of wear and damage? This is generally a solved issue for current sovereign fiat currency, but there is a slight danger of damage and wear for cash. Note that most modern money supply is now digital, not ‘cash’
- **Transportability:** Can the currency can be easily transferred? In the last decades, there has been a shift to online transfers, but physical / cash payments are still a significant proportion of transactions
- **Divisibility:** Can the currency be subdivided? 10-Euro bill can be exchanged for two 5-Euro bills; 1 Euro can be sub-divided to 100 cents.
- **Fungibility:** Is the currency identical and mutually interchangeable? In other words, is each \$1 the same as any other \$1
- **Non-counterfeitability:** Can the currency be counterfeited? This is a long-standing and non-trivial problem for cash; less so for digital money supply

The Functions of Currencies

Unit of Account

What is a unit of account?

- Prices are quoted in terms of currency rather than other goods.
- Prices can indicate the measurement of the value of goods, services, economic activities, assets and liabilities.
- In each currency zone, the main currency tends to be the unit of account.
- In other words, the menu at a Parisian bistro is denominated in Euros and is not denominated in cows, cowrie shells, shares of Apple stock or bitcoin.

Stability of the value of the unit of account makes it more useful as a unit of account.

- Over the short-term, major sovereign currencies are reasonably stable and certainly more stable than private cryptocurrencies
- Over the long-term, major sovereign currencies tend to be inflationary.
- This means that they lose value over time and so economic results across long periods of time need to be “inflation-adjusted” to make them comparable

The Functions of Currencies

Store of Value

What is a store of value?

- A store of value is a mechanism by which wealth can be saved and retrieved in the future with some predictability about its future value
- Store of value is not a function solely of currencies, but of assets in general
- As all asset prices have greater or lesser degrees of unpredictability, there is no perfect store of value

What drives the ability of something to be a 'store of value'?

- Current expectations of stable or predictably knowable future demand for the asset
- Current expectations of stable or predictably knowable future supply of the asset

Notable Stores of Value:

- Gold / Silver / Diamonds
- Reserve currencies and/or the bonds of reserve currency nations
- Stocks / Bonds / Real Estate
- All these assets are subject to volatility and risk of loss and there is no perfect store of value today

2. Barter through Coinage

Barter through Coinage

Barter

- The earliest form of commerce and trade was through barter, an activity of simply trading goods or services directly, without any intermediary ‘medium of exchange.’
- In small villages or tribes, with limited specialization of production and similar needs and wants, this was an acceptable approach
- Barter suffers in a modern specialized economy from the need to uncover a “double coincidence of wants” (William Jevons, Carl Menger, late 19th century).
- If you assume that everyone is both a seller and buyer of goods and services, the seller has to believe that the good / service that they are receiving from their buyer will, in turn, be acceptable to the sellers that they buy from, a “*double coincidence of wants*” that imposes significant costs.
- What is perhaps surprising, in this light, is barter’s resiliency in some pockets of **modern economies**:
 - **Gift exchange** is a form of barter that has not, on the whole, been supplemented with more efficient methods like cash transfers
 - Even as late as the 1980s, there were many bilateral agreements, most notably with the Eastern Bloc and Iran, that primarily involved **commodities (such as oil or grain)** being exchanged for heavy industrial equipment and products

Barter through Coinage

Primitive Money

All money that is not coin or, like modern paper money, a derivative of coin”
– P. Grierson, Professor of Numismatics at Cambridge

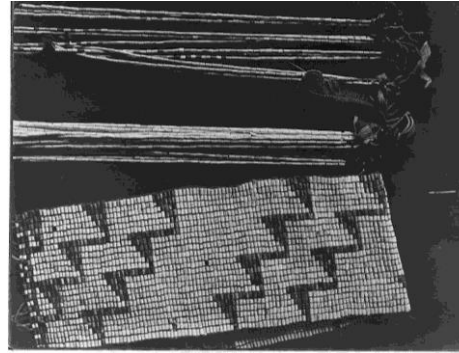
- Primitive money was the only form of money until coinage was invented in Lydia (Greece) in the 7th Century BCE
- Remained in heavy parallel use through the 19th century - e.g. tobacco was made legal tender in Virginia in 1642 and remained so for nearly two centuries
- Remains in parallel use in isolated economies – e.g. cigarettes in prisons
- While an improvement on barter in terms of efficiency, can suffer as a medium of exchange in the areas of transportability, durability, fungibility and divisibility
- It is also vulnerable to positive and negative supply shocks that cause price volatility, making it, at times, unstable as a store of value and unit of account

Barter through Coinage

Notable forms of Primitive Money



Cowry Shells



Wampum Belts



Cattle



Whale's Teeth



Grain



Tobacco

Image Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Chinese_shell_money_16th_8th_century_BCE.jpg https://commons.wikimedia.org/wiki/File:Detail_of_wampum_belts_-_NARA_-_523578.jpg
https://commons.wikimedia.org/wiki/File:Necklace,_sperm_whale_teeth,_Fiji,_c_1895_-_Staatlichen_Museums_f%C3%BCr_V%C3%B6lkerkunde_M%C3%BCnchen_-_DSC08281.JPG

Barter through Coinage

The Curious Case of the Rai of Yap



- The Rai are large stone disks used on Yap island in the Western Pacific. They were “minted” from the limestone deposits of the nearby island of Palau and used as a currency until the 20th century.
- Given their size (up to 9,000 pounds), Rai stones were not moved when spent, but simply changed owners. Every transaction was ‘recorded’ orally within the small community, with the stone’s ownership history becoming common knowledge. Eventually, the “transaction history/ledger” became the only part that mattered (e.g. a stone was once dropped by the canoe transferring it to Yap and sank. The stone was deemed to still be valuable, since it still exists, even though no one has seen it since, or had access to it)
- This is particularly important, because it demonstrates a naturally occurring use of a ledger of transactions.
- This ledger was shared orally between the inhabitants, attributed ownership and delegated property without a single stone moving, because everyone agreed on it
- Does this indicate any similarities between Rai ledger and the blockchain?

Image Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Yap_Stone_Money.jpg

Barter through Coinage

The Invention of Coinage

- Modern coinage was first invented either in ancient China or ancient Greece, depending on how one defines the separating line between primitive money and modern coins
- China created metal cowries (along with spades, hoes and knives) as early as 1200 BCE – these metal objects can be considered either institutionally standardized primitive money or early modern coinage
- They eventually evolved into standardized circular coins around 200 BCE, though solely of base metals, and, therefore, in very low denominations.
- An interesting etymological note: As Portuguese trade emerged with China in the 15th century, these coins became known by their Tamilian (South Indian) name of கசு / kāsū / coin money. Today, that name survives, for money in small denominations, in the English word “cash”
- The first clearly modern coinage was developed in Lydia, a Greek kingdom (in modern-day Turkey) in approximately the 7th century BCE, in stamped coins of electrum (a gold/silver mix).
- While ingots previously existed in Cappadocia and Crete, the Lydian coins are generally accepted as the first modern coinage in form and style and marked a big step forward in transportability, standardization and institutionalization.



Barter through Coinage

The Invention of Coinage



Early 6th Century BCE Lydian Coins



Western Han Ban Liang (“Cash”)

Image Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Lydian_coin.jpg [https://commons.wikimedia.org/wiki/File:S561_banliang_Qin_1_\(8213170667\).jpg](https://commons.wikimedia.org/wiki/File:S561_banliang_Qin_1_(8213170667).jpg)

Barter through Coinage

The Era of Coinage

- After coinage was invented in Lydia, it spread through the Greek city-states and was eventually adopted by the Romans.
- In aggregate, metal coinage became the dominant form of currency in Western economies well into the 18th or 19th century and was issued in a bewildering number of permutations and combinations. A money changer's manual published in Amsterdam in 1606 listed 341 silver and 505 gold coins
- The fact that coins contained valuable commodity metals led to ongoing difficulties with debasement and shaving/clipping
- Coin issuers were perpetually tempted to debase coins (reduce the quantity of valuable metals in coins)
 - Users of coins were also tempted to shave or clip coins, a minor benefit on a per-coin basis, but in aggregate a profitable exercise.
 - Debasement led to Gresham's law that "Bad Money drives out Good Money" – in other words, people prefer to hold on to clearly good money and spend clearly bad money until only bad money is in circulation
- Changes in the prices of the underlying metals change the effective value of the coin relative to its initial value, making useful comparisons across time difficult (unstable unit of account)

3. Coinage through Fiat Currency

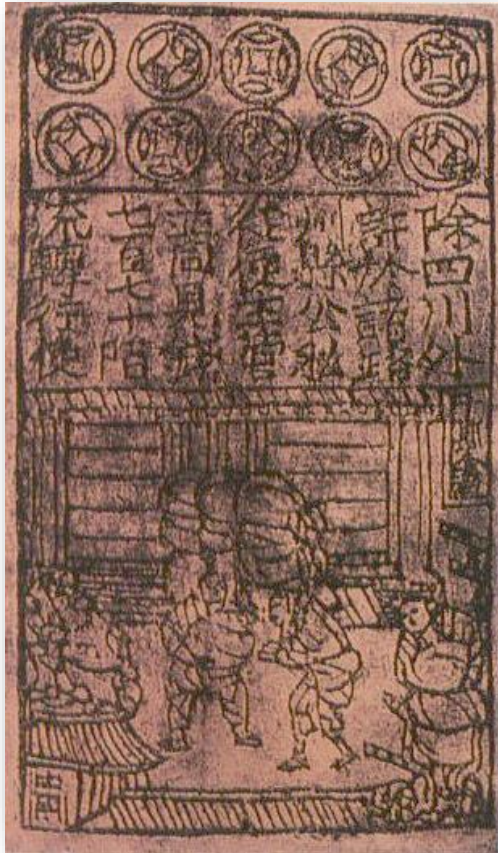
Coinage through Fiat Currency

Some Useful Definitions

- **Commodity money:**
 - Money that has some other non-monetary use and value (e.g. gold for jewelry). Both primitive and modern money can be commodity money
- **Gold standard:**
 - This is a form of commodity-backed money or, under some definitions, representational money, where paper notes were redeemable for gold (or, in alternative models, silver)
- **Fiat money:**
 - Any legal currency defined as money by government law or regulation which is not backed by a physical commodity
- **Legal tender:**
 - A payment method which is recognized as legal when it is offered to meet a financial obligation
- **Bank notes:**
 - Also: bill, note, paper money. A form of promissory note made by a bank, payable to the bearer on the stated sum

Coinage through Fiat Currency

Jiao Zi: The First Paper Bank Note



Chengdu, Sichuan Province, China
~10th century AD

Image Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Jiao_zi.jpg

Coinage through Fiat Currency

Paper Currency Emerged in China

- General consensus is that paper currency emerged in China
- The origins of paper currency in China, began with receipts of deposits of coin currency (a pattern repeated hundreds of years later in Amsterdam)
- Chinese 'cash' coinage was in very small denominations, making it unwieldy for large commercial transactions
- Merchants would deposit their coinage at a small number of government-authorized deposit shops and use their receipts to trade more conveniently
- By 1120, the government had recognized the potential of paper money and started issuing the first generally circulating banknotes, granting itself a monopoly in the area.
- Currency remained regional until 1265 when the Song government produced a national currency, with notes representing 1 to 100 strings of 'cash'

Coinage through Fiat Currency

Marco Polo On Chinese Paper Currency

“With these pieces of paper, made as I have described, he [Khubilai Khan] causes all payments on his own account to be made; and he makes them to pass current universally over all his kingdoms and provinces and territories, and whithersoever his power and sovereignty extends. And nobody, however important he may think himself, dares to refuse them on pain of death. And indeed everybody takes them readily, for wheresoever a person may go throughout the Great Khan’s dominions he shall find these pieces of paper current, and shall be able to transact all sales and purchases of goods by means of them just as well as if they were coins of pure gold. And all the while they are so light that ten bezants’ worth does not weigh one golden bezant.

Furthermore all merchants arriving from India or other countries, and bringing with them gold or silver or gems and pearls, are prohibited from selling to any one but the Emperor. He has twelve experts chosen for this business, men of shrewdness and experience in such affairs; these appraise the articles, and the Emperor then pays a liberal price for them in those pieces of paper. The merchants accept his price readily, for in the first place they would not get so good a one from anybody else, and secondly they are paid without any delay. And with this paper-money they can buy what they like anywhere over the Empire, whilst it is also vastly lighter to carry about on their journeys.”

Marco Polo and Rustichello of Pisa, “Book Second, Part I, Chapter XXIV: How the Great Kaan Causeth the Bark of Trees, Made into Something Like Paper, to Pass for Money over All His Country,” in *The Book of Ser Marco Polo: The Venetian Concerning Kingdoms and Marvels of the East*, translated and edited by Colonel Sir Henry Yule, Volume 1 (London: John Murray, 1903)

Coinage through Fiat Currency

The Bank of Amsterdam, Part I

- Depository receipts for precious metals had existed in Southern Europe countries for centuries, but the first true public bank was the Bank of Amsterdam, founded in 1609
- The Bank of Amsterdam was guaranteed by the City of Amsterdam and was tasked with bringing order and efficiency to the wide range of coinage in circulation in Amsterdam, a major commercial center at the time
- The Bank accepted local, foreign and debased coins, valued them according to common standards, and then gave credit in an account in a common value, 'bank money,' for which it issued a receipt (and charged a small administrative fee)
- This standardization of values significantly diminished the incentives to debase money (and the profitability of doing so) and was an important step in making European currency more efficient
- As in China, we see that the first step toward paper money was a receipt for metal coinage, that itself became tradeable
- Bank of Amsterdam, however, also presaged several other modern Central Banking and banking concepts including:
 - A state guarantor, while maintaining an independent entity from the Treasury
 - A form of legal compulsion (the bank money was required to be used for transactions above a certain value)
 - Fractional reserve lending (something we will discuss in the next page)

Coinage through Fiat Currency

The Bank of Amsterdam, Part II

- The Bank of Amsterdam, initially operated solely as a depository institution, on a 100% reserve basis
- In other words, none of the precious metals on deposit were loaned out to other parties.
- In time, however, the Bank of Amsterdam started lending money to the Dutch East India Company, initially on a short-term basis, out of the deposits of others
- This activity is known today as ‘fractional reserve banking’ and is a key aspect of how money is created and how money supply is managed in a modern economy.
- We will discuss this later in the course, in the session on Central Banking, but, for now, it suffices to note that this was one of the earliest steps toward modern fiat money, generating notes that were only fractionally backed by metal deposits
- Unfortunately, the Dutch East India Company fell on progressively harder times and eventually defaulted to the Bank of Amsterdam
- So, in a manner that would be repeated by thousands of banks over the ensuing centuries, the Bank of Amsterdam become an early victim of overly optimistic lending, was taken over by the City of Amsterdam in 1791 and wound up in 1819.

Coinage through Fiat Currency

Bank Notes & Legal Tender: UK Case Study

- Many people believe 'legal tender' means 'you are required to use this currency' and this subsequently gives currency its value
- The Anglo-Saxon definition is quite different and narrow, simply stating that a debtor cannot refuse settlement of an existing debt in the legal tender of the nation. In other words, the legal tender can be used as a Medium of Exchange for outstanding debt (but does not require its use for prospective transactions nor as a Unit of Account)
- **In the UK:**
 - The Bank of England is the only bank authorized to issue banknotes in England & Wales and its notes are legal tender in both
 - In Scotland and Northern Ireland, however, banknotes are still issued by seven retail banks (thanks to an Act in 1845), provided they keep equivalent assets on deposit at the Bank of England. These banks are, in Scotland, the Bank of Scotland, Clydesdale Bank, Royal Bank of Scotland and, in Northern Ireland, the Bank of Ireland, AIB Group, Northern Bank, Ulster Bank

Coinage through Fiat Currency

Bank Notes & Legal Tender: UK Case Study

- Interestingly, neither the bank notes of the Bank of England, nor the bank notes of the private banks in Scotland and Northern Ireland, are considered legal tender in Scotland or Northern Ireland
- In fact, no bank notes of any kind are legal tender in Scotland and Northern Ireland (though some coinage is in limited amounts)
- Bank notes are, of course, accepted for day-to-day trade in Scotland and Northern Ireland as a matter of convention without being legal tender
- This is an excellent reminder that almost all currencies are accepted largely as a matter of convention



Coinage through Fiat Currency

Bretton Woods: The Quasi-Gold Standard



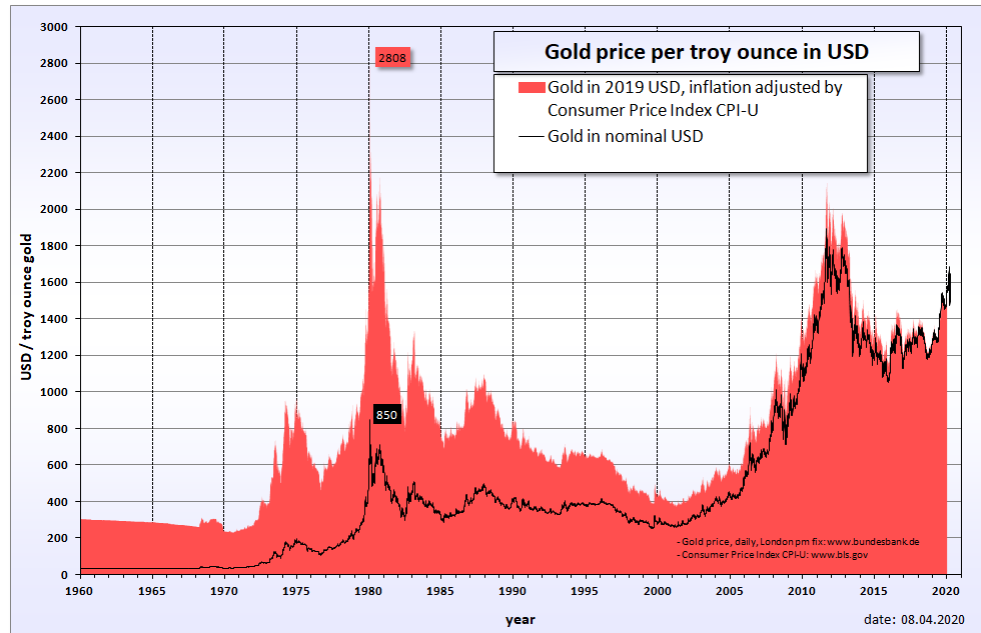
Mount Washington Hotel, Bretton Woods, New Hampshire

Image Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Mount_Washington_Hotel_2003.JPG

- Toward the end of World War II, at the Bretton Woods conference (July 1944), many major world economies attempted to regulate future intra-country financial flows and currency ‘competition’ through fixed exchange rates pegged to the USD, itself pegged to gold.
- The structure of Bretton Woods was based around the USD
- The USD would remain redeemable for gold at \$35/ounce
- Ratifying countries pegged their currencies to the USD (generating an implicit gold standard for them)
- The newly formed International Monetary Fund would act as a bridge for payment imbalances among the ratifying countries.
- This gold standard was not available to citizens, just to counter-party Central Banks so it is not considered a full gold standard.

Coinage through Fiat Currency

Bretton Woods: The Quasi-Gold Standard

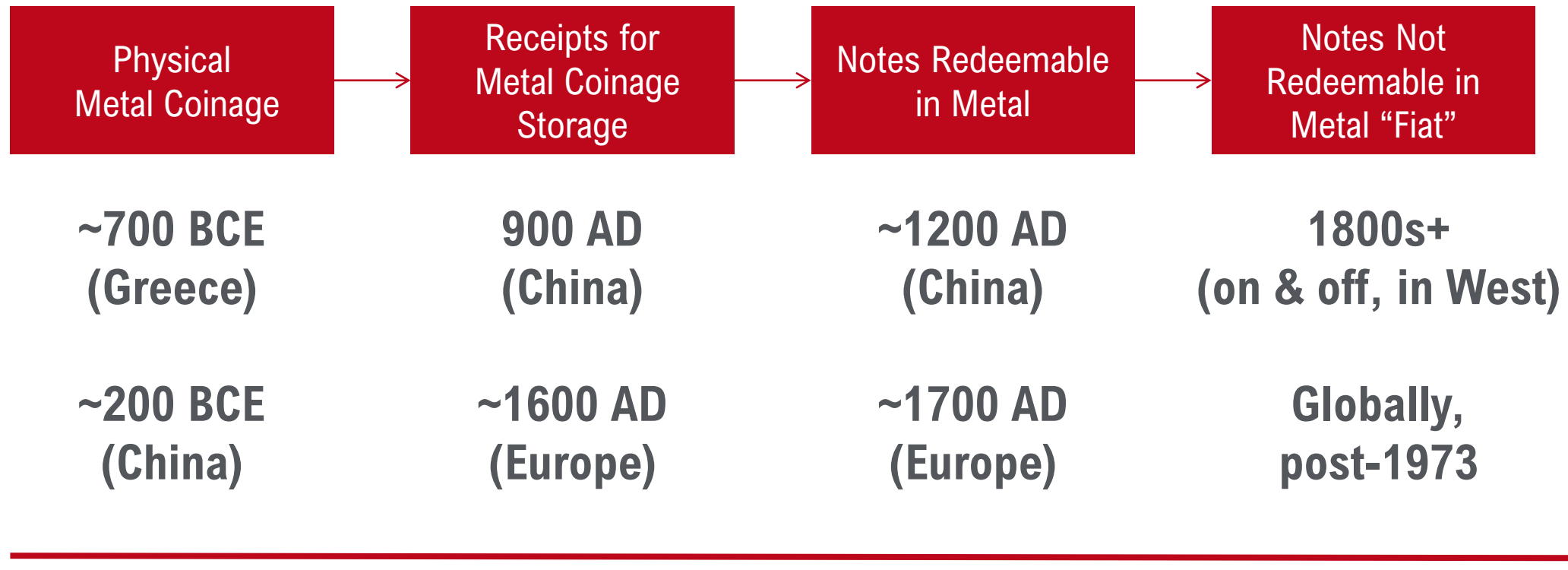


- The peg to gold ran into severe difficulties in 1968
- The USA, abandoned the Bretton Woods agreement in August 15, 1971
- Gold could no longer be exchanged at a fixed rate with US Dollars (also called the “Nixon Shock”)
- This action effectively marked the end of metal-backed sovereign currencies and the move from commodity money to fiat money
- Currently no countries use a gold standard – all sovereign currencies today are fiat currencies
- The price of gold has rise 52x since then from \$35/oz to \$1,841/oz

Source: By Realterm - Own work, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=8898512>

Coinage through Fiat Currency

Simplification: From metals to paper



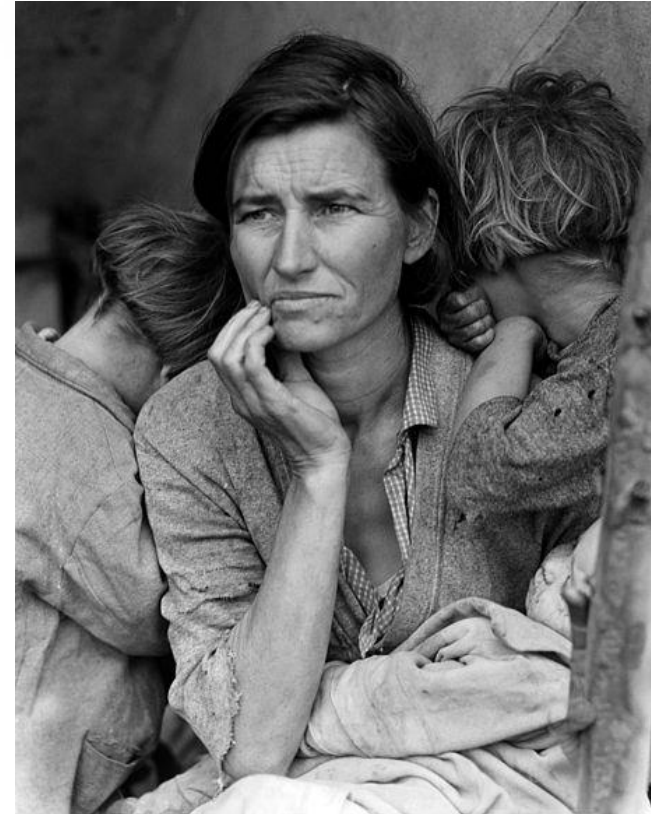
Primitive / commodity money has continued to exist in parallel through most of this period

Coinage through Fiat Currency

When Currency Goes Wrong: Deflation & the Great Depression



Bank Run, American Union Bank



Destitute Migrant Workers, 1932

Image Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Bank_Run_on_American_Union_Bank.jpeg

<https://commons.wikimedia.org/wiki/File:Lange-MigrantMother02.jpg>

Coinage through Fiat Currency

When Currency Goes Wrong: Deflation & the Great Depression

- The stock market collapse of 1929 triggered a recession in the United States
- Constrained by the gold standard, the Federal Reserve constricted money supply, causing severe deflation. Deflation, by making debts larger in real-terms, tends to create a self-fulfilling trap for economies, with progressive defaults, and increased unemployment (and loss of productive output caused by that increased unemployment)
- The Great Depression effectively caused the end of the domestic gold standard in the United States. In 1933, with severe deflation ravaging the economy, Congress and President Roosevelt took the following measures:
 - Devalued the dollar in gold terms
 - Suspended the gold standard (except for foreign exchange)
 - Revoked gold as universal legal tender for debts
 - Banned private ownership of significant amounts of gold coin in order to increase Treasury holdings of gold
- Some parts of Southern Europe (e.g. Greece) faced a modern form of the same issue via their use of the Euro in the Euro-crisis of 2011 to present.
- Given their severe economic depression, the natural response would be to allow their currency to depreciate, making their products and services less expensive, increasing demand for them and increasing employment
- They are, however, locked into an 'expensive' currency that is functioning like a gold standard and forcing the adjustment in prices to happen through internal devaluation (deflation), which is leading to Depression-level unemployment figures (nearly 30% in Greece)

Coinage through Fiat Currency

When Currency Goes Wrong: Hyperinflation



Using German Marks as wallpaper



Zimbabwean Notes, 2008

Image Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Bundesarchiv_Bild_102-00104,_Inflation,_Tapezieren_mit_Geldscheinen.jpg https://commons.wikimedia.org/wiki/File:Zimbabwe_Hyperinflation_2008_notes.jpg

Coinage through Fiat Currency

When Currency Goes Wrong: Hyperinflation

- In extreme circumstances, paper currency is vulnerable to hyperinflation if the money supply is not controlled. Two of the examples in the 20th century came from over-printing to meet war obligations
- **Germany, 1923:** Germany had very high war reparation obligations after World War I that it had to meet in foreign currency.
 - Unable to meet its obligations, it tried to print more Marks to buy foreign currency, triggering a further drop in Marks, necessitating more printing and creating a vicious spiral
 - Once the Mark was untradeable on foreign markets, the printing was used to finance government operations.
 - The paper Mark traded at 6.7 Marks to the US dollar in 1919
 - By November 1923, the US dollar was worth 4,210,500,000,000 Marks.
- **Hungary, 1945:** Hungary is believed to have had the single worst episode of hyperinflation in history (for similar reasons – an economy devastated by war and high reparations). Its inflation peak was at 1.3×10^{16} percent per month (which approximately means that prices doubled every 15 hours)
- Inevitably, in cases of hyper-inflation, the country re-denominates its currency and has to start anew. [See here](#) for the most known examples

Coinage through Fiat Currency

When Currency Goes Wrong: Hyperinflation

- While there is no hard line, aside from extreme cases like the above, it is believed that once inflation reaches double-digits, it starts having negative coordination effects in the economy in terms of requiring constant re-adjustment of prices and wages to stay in sync
- Most credible modern Central Banks try to keep inflation in the 2-3% range, which is considered a good balance between the risks of deflation and the risks of inflation



4. Bitcoin as a Currency?

Bitcoin as a Currency?

Bitcoin: Key Parameters

Private:

- Not issued by an official state authority

Decentralized:

- No centralized issuing party / counter-party, instead units are issued to a decentralized group of users

Digital:

- Fully electronic currency, no physical coins or notes

Strong anti-counterfeiting guarantees:

- Anti-counterfeiting is conducted through a mix of cryptography and game theory

Type:

- It is an open question whether Bitcoin is a “fiat” currency (whose value comes from use/convention) or a form of commodity currency (where the commodity in question is the use of the Bitcoin blockchain)

Bitcoin as a Currency?

Bitcoin: The Blockchain

- Bitcoin's most important innovation is the concept of a public "blockchain", a publically reviewable ledger containing a verified record of every bitcoin transaction that has no single trusted operator
- Bitcoins act as the mediums of exchange in this network and exist only as entries in the decentralized Bitcoin ledger
- The Bitcoin blockchain is a decentralized data structure that allows untrusted participants to transact directly with each other and stores the history and state of these transactions
- Blockchain is an ownership database that needs no central issuer, controller, verification or storage
- The mechanism of how the Bitcoin blockchain operates will be covered in subsequent sessions



Bitcoin as a Currency?

Bitcoin: Monetary Policies

The network facilitated by the same protocol has a number of interesting features from a **monetary perspective**.

- **Fixed supply with decreasingly inflationary issuance schedule:**
 - The money supply is regulated from the protocol itself and only 21,000,000 bitcoins (BTC) will ever exist
 - They are being issued on a declining schedule (currently 6.25 BTC every approximately 10 minutes).
 - The money supply halves roughly after 4 years, and the next halving of supply to 3.125 BTCs per 10 minutes is estimated to occur in March 2024.
- **Transparent “monetary policy”:**
 - This policy is available to everyone to examine and verify, as the protocol is based on open-source code
 - Any node operator can verify the supply
- **Driven by consensus:**
 - Each user chooses to agree on the **proposed set of rules**, propose their own, or recreate the whole network with their own set, but independently from the original (as the changes would not be compatible)
 - Key characteristics (like money supply) can’t change unless most participants in key parts of the system vote to change them

Bitcoin as a Currency?

Bitcoin: Medium of Exchange

- Bitcoin generally scores well on the parameters of a medium of exchange:
- **Highly durable:** No way for it to degrade/break, the Bitcoin blockchain is backed up on thousands of computers globally
- **Highly portable:** No intermediaries, worldwide, initial confirmation in about 10 minutes and near-irreversibility in an hour
- **Highly fungible:** All bitcoins have the same value, regardless of who owns them or what their history is. There is some fungibility risk due to future regulatory pressure (e.g. regulators 'tainting' some coins as being used for illegal activities and not allowing their use in regulated entities, noting that this has not happened in a meaningful way to-date)
- **Highly divisible:** Each bitcoin can be divided into 100 million units
- **Highly resistant to counterfeiting:** Bitcoin funds are assigned to a specific address and verifying the validity of this assignment can be done by any node operator

Bitcoin as a Currency?

Bitcoin: Medium of Exchange, Continued

- There are also several practical considerations contributing to, or hindering bitcoin's appeal as a medium of exchange.
- **Bitcoin transactions as taxable events:** In some jurisdictions, like the USA, every transaction in cryptocurrencies (including bitcoin) is treated as a taxable event, with users required to report any gains or losses. This creates administrative burden and hinders the use of cryptocurrencies for (micro)transactions.
- **Bitcoin as legal tender:** El Salvador has become the first country to adopt Bitcoin as legal tender. This is expected to facilitate the use of bitcoin as a medium of exchange and reduce remittance fees within the country. However, this approach was not without its challenges in the form of technical problems and even identity theft attempts.
- **Bitcoin and the Lightning Network*:** The Lightning Network can be used for lower-value transactions, while the Bitcoin network -which irrevocably settles transactions within 10-16 min- can be used as a high-value settlement, and/or a tool for government or companies. This can contribute to Bitcoin's appeal as a medium of exchange especially compared to traditional financial institutions, where transactions settlement may require several days

**The Lightning Network is a peer-to-peer routed payment protocol of bi-directional channels that works as a second layer on top of a blockchain, designed to improve enable smaller, faster, and cheaper transactions. The idea behind Lightning Network is that not all transactions need to be recorded on-chain; instead, they can be handled through a series of scalable off-chain commitments, while still being backed by the underlying security of the Bitcoin network (We discuss the Lightning Network in detail in Week 5).*

Bitcoin as a Currency?

Bitcoin: Unit of Account



- The price of bitcoin price is highly volatile
- This makes it mostly unattractive as a unit of account at present
- There is an open question about whether the price will become more stable over time, but this does not appear to be imminent

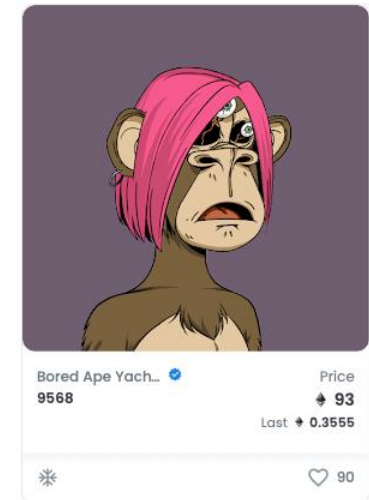
Chart Source: [Messari.io](https://messari.io), 26, Jan, 2022

Bitcoin as a Currency?

Bitcoin: Unit of Account, Continued

- From a more practical perspective:
- **Price Quotes:** Bitcoin can't be considered as a unit of account. Virtually every price today, whether that is for goods, services, salaries, etc., is quoted in fiat currencies such as the euro and dollar.
- **Non-Fungible Tokens*:** A notable exception would be Non-Fungible Tokens (NFTs), which have recently proliferated. Ether (ETH), Ethereum's native token is now, for the first time, adopted as a unit of account for NFTs in some crypto circles. Crypto Punk prices for instance, are typically quoted, reported, and discussed in ETH, instead of USD or EUR. **When it comes to NFTs, ETH is both the unit of account and the medium of exchange**, since it is used for NFT purchases/sales.

**Non-Fungible Tokens (NFTs) have unique properties, meaning they can be distinguished from another and cannot be duplicated. They can be associated with unique digital art, property, antiquities etc. and can easily and securely be transferred over the blockchain, tracking ownership in a tamper-proof manner (We discuss the NFTs in detail in Week 7).*



Bitcoin as a Currency?

Bitcoin: Store of Value



- Bitcoin is usually associated with high price volatility, which does not make it a good store of value, at least short-term
- However, the price of Bitcoin has an upward trend over time, which makes it a good store of value in the long-term
- From a Central Banker's view, Bitcoin with its fixed supply would not work as a national fiat currency, which is devalued over time, via increasing the supply of fiat currency
- Some of its properties i.e. fixed supply- slightly deflationary has made it to be considered as digital gold, thus now considered a form of investment – a new asset class

Chart Source: [Messari.io](https://messari.io), 26, Jan, 2022

Conclusions

- Currency has three functions:
 - Medium of Exchange
 - Unit of Account
 - Store of Value
- No currency plays all those roles perfectly. There are always trade-offs, between efficiency and stability, ease of use and counterfeitability, inflation risks and deflation risks, and so on. Bitcoin in particular could have all three functions of money, depending on how we choose to examine it.
- Currency has passed through the following phases, though long overlapping cycles exist:
 - Barter, Primitive Money, Commodity Money, Fiat Money
- The decentralized aspect of Bitcoin is a huge leap: from barter – to coinage – to decentralized cryptocurrencies
- Are private cryptocurrencies the beginning of a new form of money? Innovation in the cryptocurrency space is exploding: first Bitcoin, then Ethereum, now Decentralized Finance, Non-Fungible Tokens and multichain transactions
- Convergence of Blockchain (the underlying technology of Bitcoin), with other innovative technologies i.e. Artificial Intelligence, Machine Learning, Robotics, Big Data and the Internet of Things, will have a huge impact in every aspect of our lives: Government, Business, Education, Society, as part of the 4th industrial revolution (*We discuss convergence in week 11*)

Some Further Reading

Andreas Antonopoulos: “Mastering Bitcoin, Unlocking Digital Crypto-Currencies”

<https://github.com/aantonop/bitcoinbook/blob/develop/ch01.asciidoc>

(book available for purchase, but also in Github for public feedback and contribution)

Nick Szabo : Shelling Out – The Origins of Money

<http://nakamotoinstitute.org/shelling-out/>

The history of money: from barter to bitcoin

<https://www.telegraph.co.uk/finance/businessclub/money/11174013/The-history-of-money-from-barter-to-bitcoin.html>

Money in the Modern economy: An Introduction (Bank of England)

<https://www.bankofengland.co.uk/quarterly-bulletin/2014/q1/money-in-the-modern-economy-an-introduction>

What drives Bitcoin volatility?

https://lusem.lu.se/media/kwc/working-papers/2018/KWC%20wp%202018_3%20web.pdf

Some Further Reading

Why Bitcoin Matters, Marc Andreessen

<https://dealbook.nytimes.com/2014/01/21/why-bitcoin-matters>

(article explaining the basic Bitcoin characteristics, by a Bitcoin evangelist)

Bitcoin, Cryptocurrencies and the relation with Yap

<https://www.sciencenews.org/article/yap-stone-money-bitcoin-blockchain-cryptocurrency>

Bitcoin: Money or Financial Investment?

https://files.stlouisfed.org/files/htdocs/publications/page1-econ/2018/03/01/bitcoin-money-or-financial-investment_SE.pdf

From Barter to Bitcoins

<https://www.globalbankingandfinance.com/the-evolution-of-international-money-transfers-from-barter-to-bitcoins/>



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Questions?

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