Commodity Money to Fiat Money and Now to Crypto: What Does History Tell Us?

Discussion by Randall Morck

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ABFER, NBER, ECGI

Commodity, Fiat and Crypto: What does history tell us? By B. Eichengreen

- **Evolutionary economics explains why state monopolizes money creation**
  - **National defense (debasement as aggression) & efficiency (rationally reliable uniformity)**
  - **Peace of Westphalia (1648) + irreg. US monetary history + stability ➔ maybe CBDC viable**
  - **Fragility (CBDC becomes prime hacking target, solar flares, etc.)**

Bad money drives out good.
- Sir Thomas Gresham

The best way to destroy the capitalist system is to debauch the currency
- V. I. Lenin

The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust.
- Satoshi Nakamoto

The Social Welfare Value of Money

Unit of account

- Uniformity
  - Widespread acceptance
  - Divisibility

Medium of exchange

- Uniformity
- Purity & portability
  - Low cost verification of purity, …
  - Portability, high value / weight v/v common transactions, …

Store of value

- Uniformity
- Purity & portability
- Stability over time
  - Central banks v miners

The Social Welfare Value of Monies

Egypt used multiple commodity monies from 3100 BC to start of modern era (ca 333 BC)

- **Absolutely no coins until 4th century BC**
  - **Foreign (e.g. Lydian) coins from 5th C BC valued as lumps of metal**
- **Standard units of grain used for small every-day transactions (hktt, ḥr, …)**

1  = 1 hkt (barrel) = 4.8 liters

also the double & quadruple heket

1  = 1 ḥr (sack) = 20 

1 standard 

- **Standard weights of metals for larger transactions, in dbn, qdt, or š'ty**

1  (ring, also )= 1 dbn = 13.6 g.

1  = 1 qdt (?) = $\frac{1}{10}$ 

1  = 1 š'ty (seal) = $\frac{1}{12}$ 

1 standard 

- **Standard weights of olive oil, in hnw or hkt**

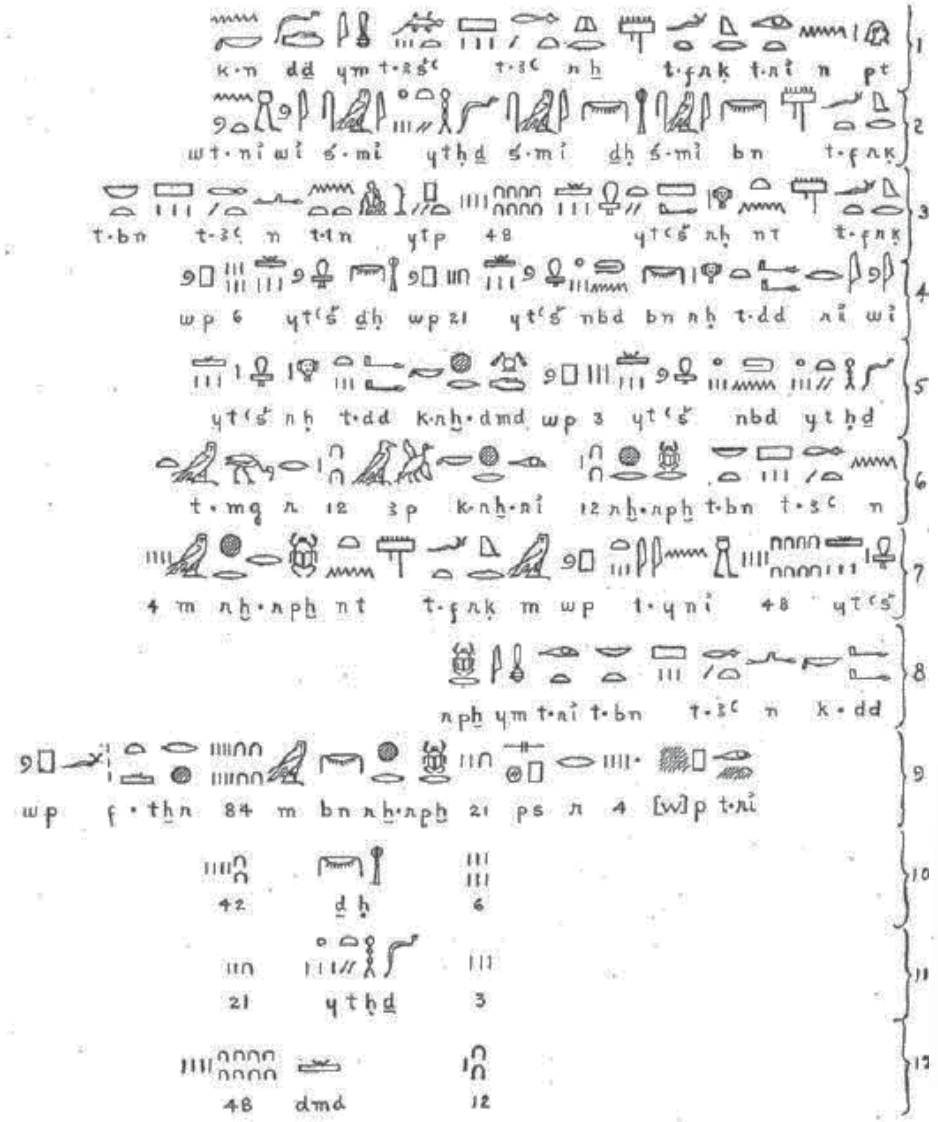
1  = 1 hnw (jar)= $\frac{1}{10}$ 

Market Transactions Using Multiple Monies

Issues Running Multiple units of Account Simultaneously

- **Standard weights and volumes provided in temples/markets & overseen by official scribes**
- **Surviving mathematics textbooks show scribes learned to convert units in transactions records, contracts, IOUs,**

Examples in Ahmose's (Rhind) Mathematical Papyrus



Problem 62

tp n ir·t[1] ḳrf·t ḫr ʿ·t šʿ·t my ḏd n · k ḳrf·t nb im[3]·ś ḥḏ im·ś ḏḥty im·ś

Example of making a bag under[2] precious metals various. If is said to thee, A bag, gold in it, silver in it, lead in it;

iw[4] in·tw ḳrf·t tn[5] ḥr šʿty[6] 84 pty nt·t n[7] ʿ·t nb·t

is bought bag this for sha'ty 84. *What is that which there is to precious metal each?*

iw[4] ir[8] dd[9]·t ḥr nb dbn šʿty 12 pw ḥḏ šʿty 6 pw ḏḥty dbn šʿty 3 pw

As for what is given for gold, a deben, sha'ty 12 *this is; for silver* sha'ty 6 *this is; for lead, a* deben, sha'ty 3 *this is.*

dmd·ḥr · k dd[9]·t ḥr šʿty[10] n ʿ·t nb·t ḫpr[11]·ḥr 21. ir·ḥr · k p 21 r gm·t šʿty 84

Add thou what is given for a sha'ty *of precious metal each; there become* 21. *Make thou the* 21 *for the finding of* sha'ty 84;

iny·t pw m ḳrf·t tn ḫpr ḥr m 4 dd[12] : k n ʿ·t nb·t

what was bought, this is, in bag this; there become : 4, *which assignest thou to precious metal each.*

ir·t my ḫpr

The doing as it occurs:

ir·tw p[w][14] 4 r sp 12 ḫpr·ḥr nb m 48 rḫt : f pw

Multiplies one[13], this means, 4 *up to times* 12; *there becomes gold :* 48; *the amount of it this is.*

6		ḥḏ *silver*	24
3		ḏḥty[15] *lead*	12
21		dmd	84
	Total		

Unit of Account Residuals as a Store of Value as a Medium of Exchange

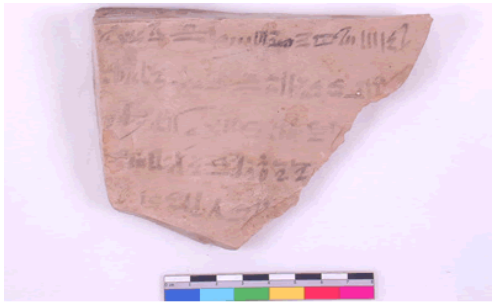
Ruins of artisans' village at Deir el Medina, Luxor

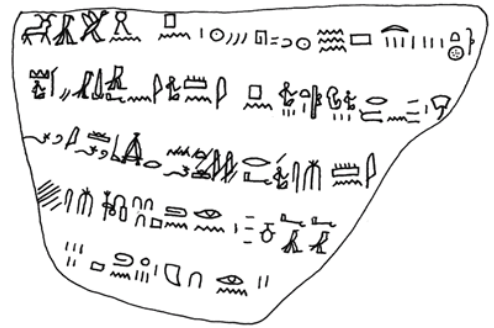
- **Numerous transactions records on ostraca (pottery fragments)**
- **Copper to silver to gold to grain to olive oil records varied over time**
- **Gresham's Law in play: Records cease using a commodity when we have reason to think its price spikes relative to others**
- **Residuals noted on ostraca appear to record debts**
- **Did ostraca records make obligations tradeable?**
- **Ostraca preferred to papyrus for durability? Or survived?**

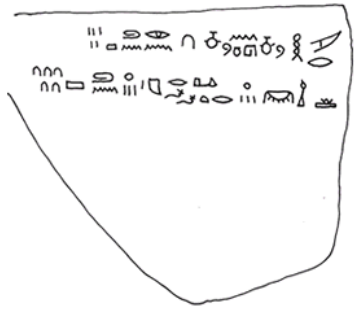
Example: DEM UC ostracon 39606

Year 4, month 3 of summer day 12; on this day purchase of the bull of the crew member Penamun by the security guard Amenmes; amount given in exchange for it:

Meat(-fat) aaat-jar, 1	*making 30 dbn*
Fine woven linen, shirts, 2	*making 5 copper dbn*
Oil, 10 hnw	*making 5 dbn*
Total of value (lit. silver) given for it	*50 copper dbn*







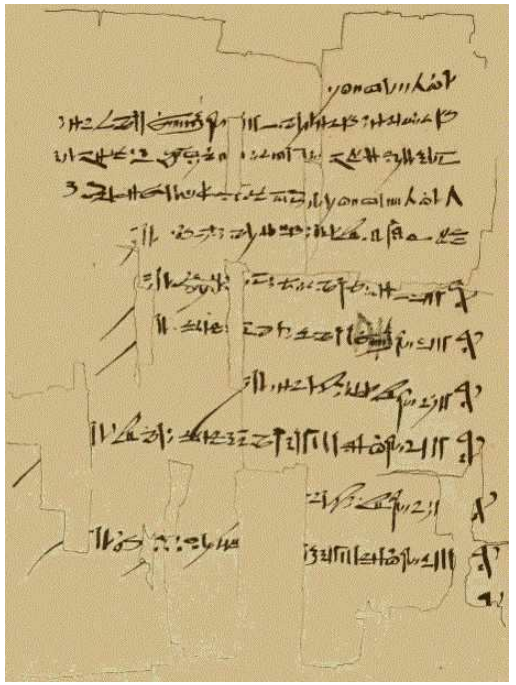
- **Residual = 10 dbn of copper = value of ostracon?**

Positive Interest Rates on Private-sector Loans

Literary allusions indicate people could invest wealth to earn interest

The Instruction of Any, 21st-22nd dynasty, in M. Lichtheim Ancient Egyptian Literature Vol. 2, p.138f

Wealth accrueth to him who guardeth it;
Let thy hand not scatter it to strangers, lest it turneth to loss for thee.
If wealth be placed where it beareth interest, it returneth redoubled;
Make a storehouse for thine wealth, thy people shall find it on thy way.
What is given small returneth made great.



Extremely high (e.g. 100%) interest in 22nd Dynasty (period of institutional decay) note ➔

Möller, Georg. 1921. Ein ägyptischer Schuldschein der 22. Dynastie. Sitzungsberichte der preussischen Akademie der Wissenschaften, Verlag der Akademie der Wissenschaften, Berlin 1921, 298ff.

Petekhons, son of Djedekhonsefankh, speaketh to the prophet of Amen, supervisor of Pharaoh's Treasury, Ankhefenchons, son of Naatefnakht: Thou hast entrusted [me] with 5 dbn of silver from the Treasury of Harsaphes. I shall return them to thee, them being 10, in the year 14, Pakhons, day 11, without having to exchange a word with thee.

– promissory note dated Pakhons 11th, Year 13

Some court records (~ 2600 BC) record no interest in repayment judgments & disputes about commodity exchange rates and item valuations

Gentet, Didier & Jérôme Maucourant. 1991. La question de la monnaie en Egypte ancienne. Revue du Mauss 13, 155-64

Plaintiff: "I acquired this house against payment from scribe Chenti. I paid ten š'ty for it, namely fabric (worth) three š'ty; a bed (worth) four š'ty; material (worth) three š'ty".
Defendant: "Thy payments (of ten š'ty) were made completely by "conversion" through items representing these values"

– court record from approx. 2600 BC

State Grain Bank System

Grain as money

- Most people were farmers & had to pay their taxes in grain
  - Scribes developed geometry to calculate sizes of irregular fields
  - Grain tax due based on field size

(Some Egyptologists think) people

- Deposited grain in state grain banks after taxes deducted
- Used grain bank deposit receipts as a means of payment

The central grain bank imposed a negative interest rate

- Negative 10% per year in some records
  - Official reason = vermin & rot + storage fee
  - Encouraged consumption rather than saving?

Government finances operated mainly in grain units

- Farmers' taxes payable in grain
- Negative interest from grain banks
- Intertemporal arbitrage: State grain bank accumulates grain taxes during good crop years & sells grain during bad crop years
- Also production from state copper mines in the Sinai

Monetary stimulus

- Mete out state grain to individuals in 7 years of famine
- Can focus money drop on the needy

Scribes measuring fields, calculating taxes, organizing grain shipments

Ruins of State Grain Bank silos, Luxor

How Digital Currencies Compare to Historical Antecedents?

	Grain	Metals	S$	Digital Currency	CB Digital Currency
				MOS	MAS
Unit of Account	❑ Officially decreed value ❑ Divisible ❑ Quality homogenized by state grain banks	❑ Officially decreed value ❑ Divisible ❑ Purity of metal, but can use metal verified by scribes	❑ Officially decreed value ❑ Divisible ❑ Difficult to counterfeit	❑ Not accepted anywhere ❑ Indivisible ❑ Proliferating near-perfect substitutes	❑ Would probably largely replicate the entries under the S$ ❑ Value contingent on prudence of MOS & political stability of Singapore, advent of quantum computing, … ❑ Odysseus-like block chain technology allow a central bank to credibly tie itself to the mast? ❑ Or a mechanism for more nuanced discretionary monetary policy?
Medium of Exchange	❑ Universally accepted (including by the state as payment for taxes) ❑ Bulky to carry around, but papyrus depository receipts are portable	❑ Universally accepted ❑ Portable ❑ Gresham's law flips different commodities in & out of use until official exchange rates adjust	❑ Universally accepted (including by the state as payment for taxes) ❑ Portable	❑ Block chain alters scope for fraud ❑ Portability TBA ❑ Not useful for buying anything or paying taxes	
Store of Value	❑ A dry climate ❑ Value (marginal utility) varies inversely with crop yields ❑ Negative interest rates associated with rot & rats	❑ All but gold oxidize ❑ Values fluctuate inversely with mining sector activity ❑ Readily stolen	❑ Value contingent on prudence of MOS & political stability of Singapore ❑ Hackable bank accounts?	❑ Coin supply expands with players' ability to predict the stock market, sports scores, … ❑ Value contingent on ethics of insiders, advent of quantum computing, …	

Positive Externalities of a Central Bank Digital Currency

"When the famine had spread over all the land, Joseph opened the storehouses and sold (וַיִּשְׁבֹּר, 3rd per. sing. imperf., lit. he *returned*) to the Egyptians; for the famine was severe in the land of Egypt. And every nation came to Joseph in Egypt to buy grain, because the famine was severe over all the earth."

Genesis 41 56-7

- **Could a modern central bank with a Central Bank Digital Currency replicate such a stimulus?**

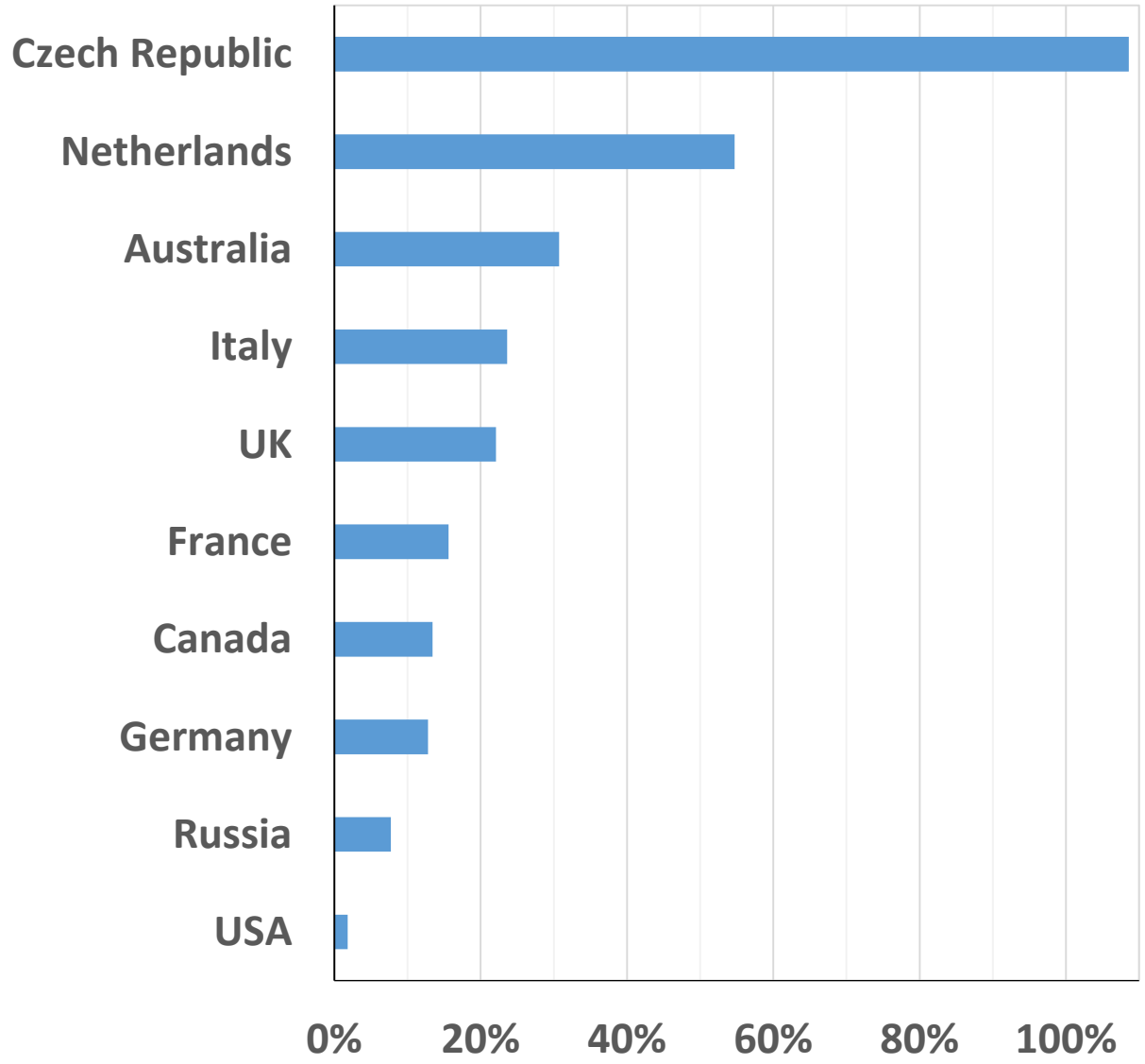
State Grain Bank at Tel-Edfu

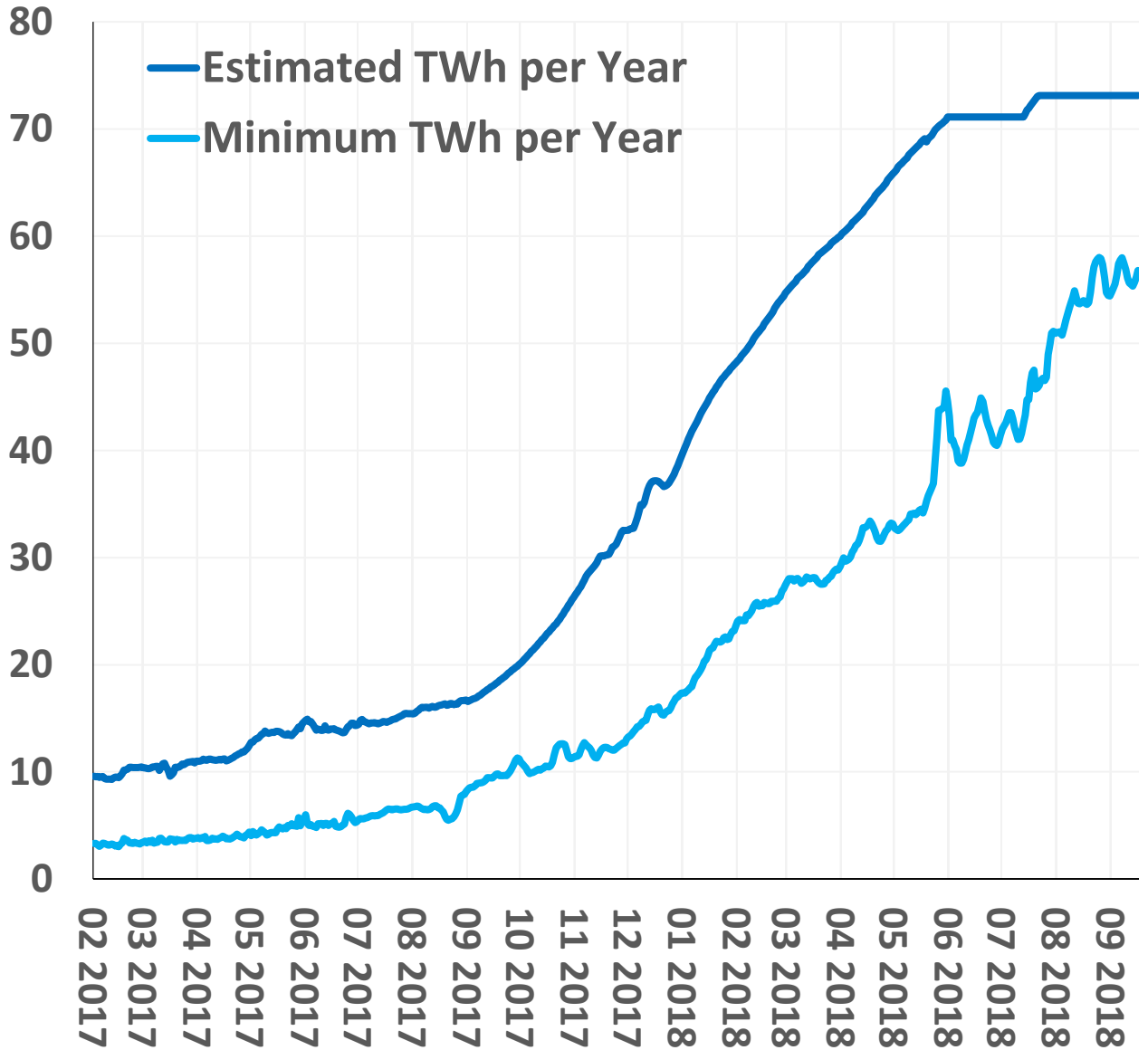
- **Newer construction (17th Dynasty, 1630-1520 B.C.) consist of at least 7 round silos of diameters 5.5 - 6.5 m.**
- **Earlier stratum is columned hall (early 13th Dynasty, 1773-1650 B.C.) of the sort where official scribes did accounting, opened & sealed containers & dictated or read letters. Ostraca (inscribed pottery shards) in this stratum list commodities**

University of Chicago excavation site

Negative Externalities of a Private Sector Digital Currency

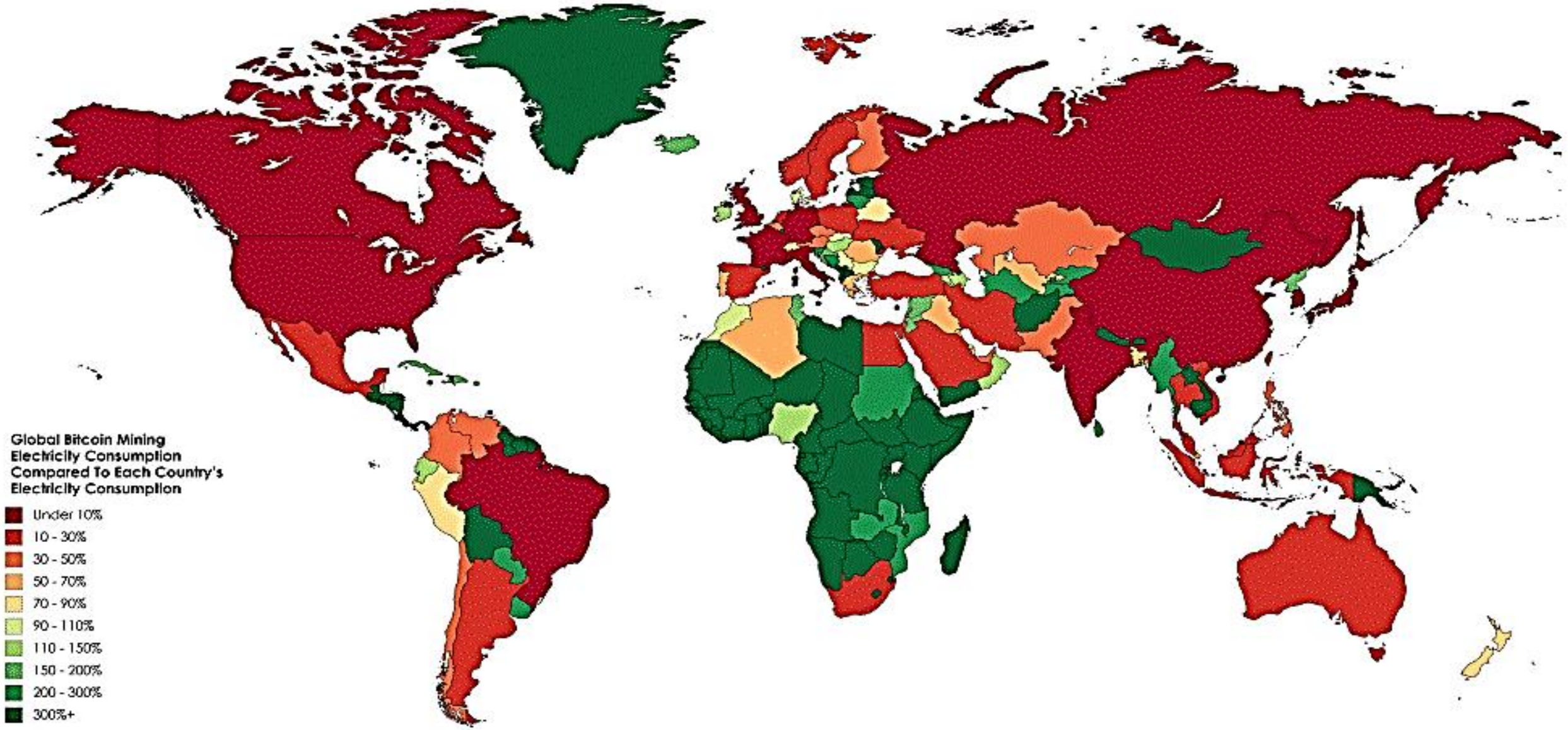
Bitcoin Energy Consumption as % of National Total Energy Use





Source: https://digiconomist.net/bitcoin-energy-consumption

Bitcoin Energy Consumption Compared to National Economies

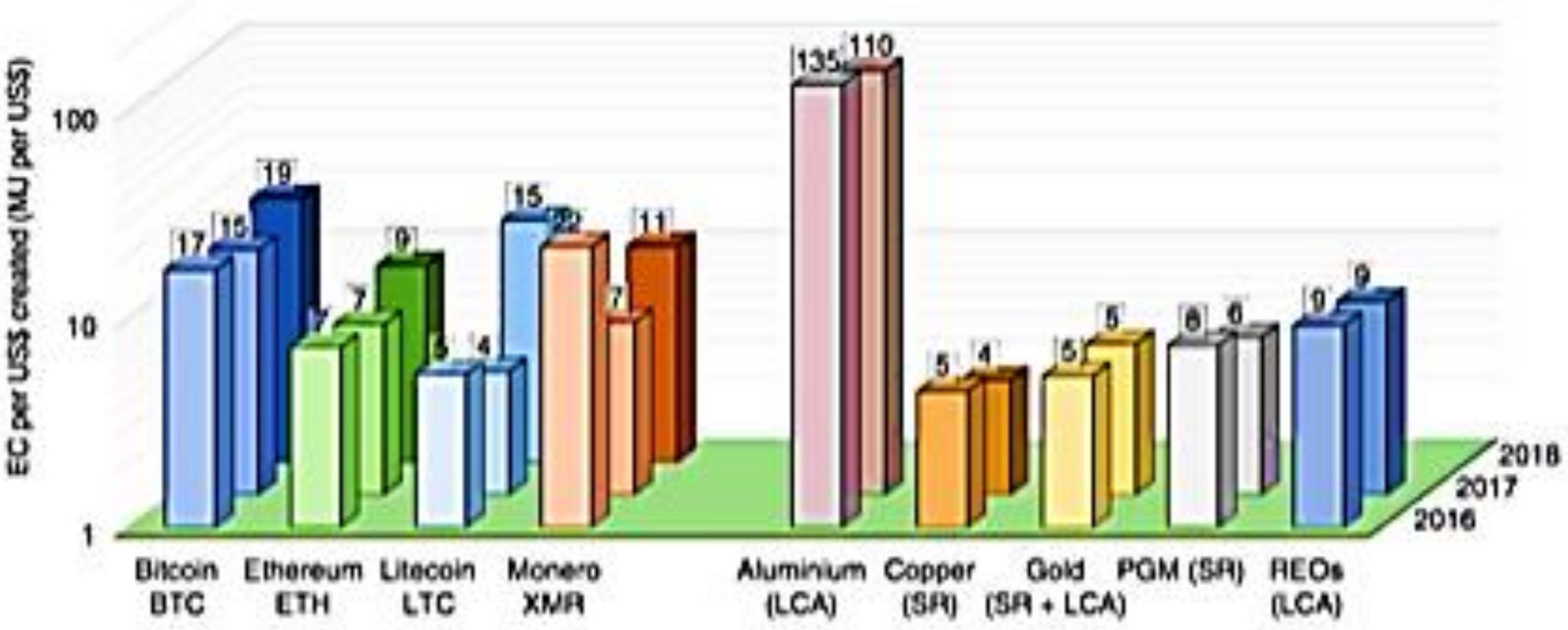


Source: https://powercompare.co.uk/bitcoin

Expensive Barbarous Relics

Max J. Krause, Max & Thabet Tolaymat. 2018. Quantification of energy and carbon costs for mining cryptocurrencies. Nature Sustainability 1, 711–718

- **Mining cryptocurrencies requires more energy than mining metals**



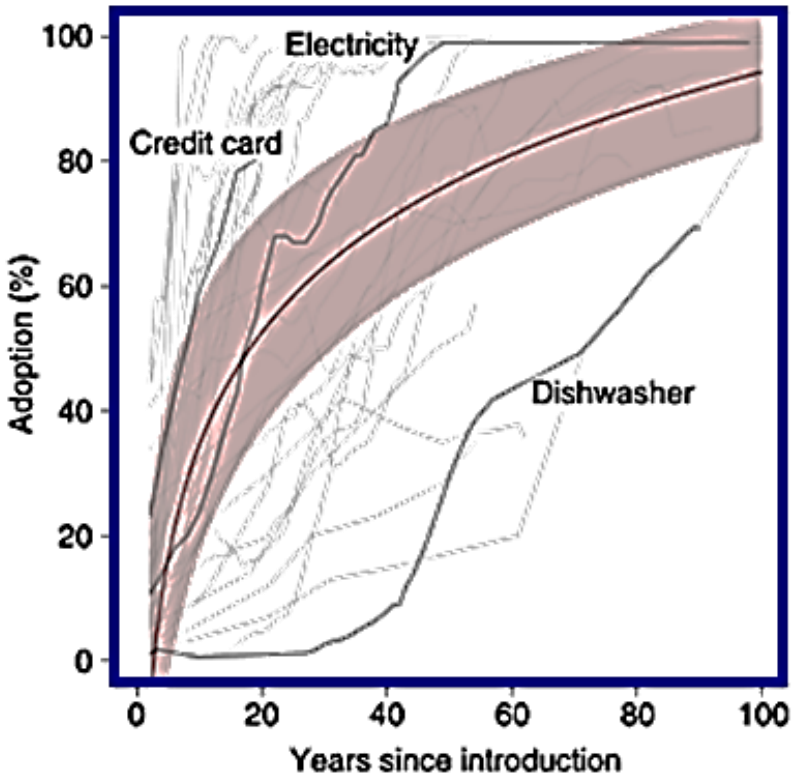
Negative Externalities of a Private Sector Digital Currency

Bitcoin Energy Consumption Becoming Major Contributor to Global Warming

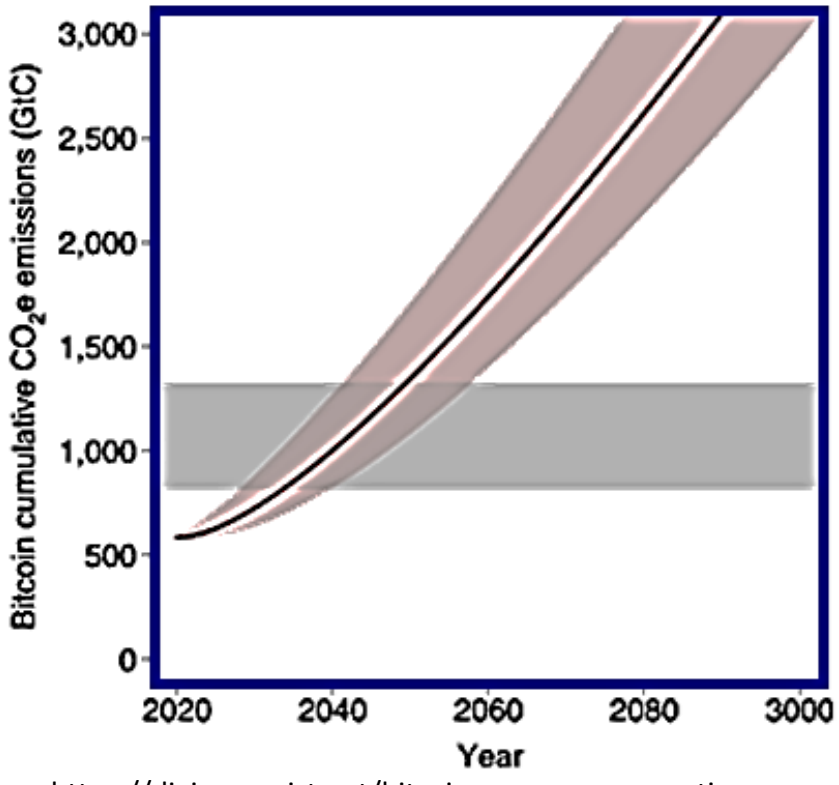
Camilo Mora, Randi Rollins, Katie Taladay, Michael Kantar, Mason Chock, Mio Shimada & Erik Franklin. 2018. Bitcoin emissions alone could push global warming above 2°C. Nature Climate Change 8, 931–33.

- **Projected Bitcoin usage, should it follow the rate of adoption of other broadly adopted technologies, could alone produce enough CO2 emissions to push warming above 2 °C within less than three decades**

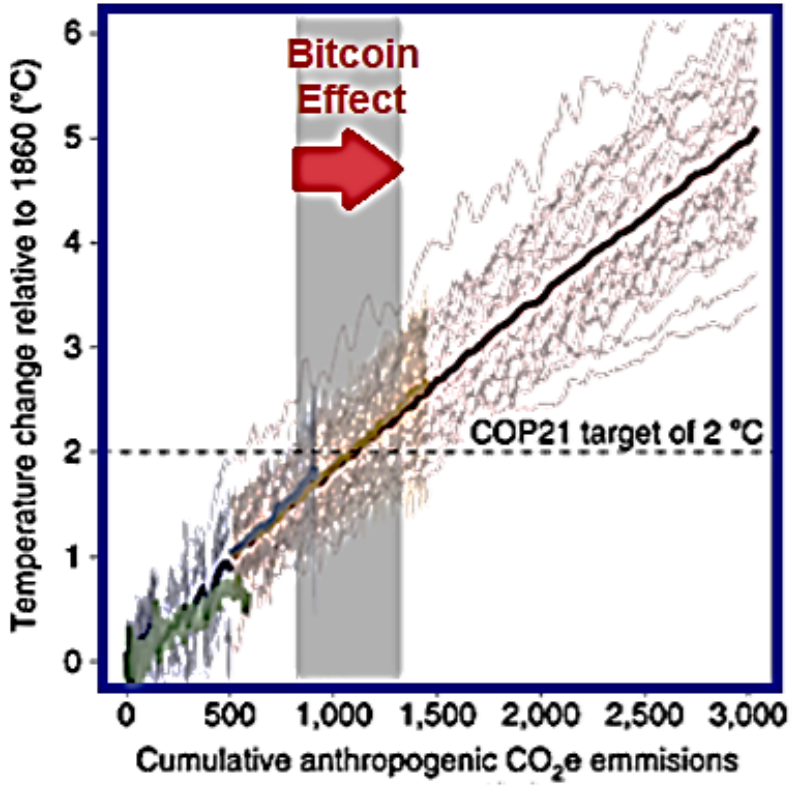
Technology Adoption Path Estimation



Est. Bitcoion CO_2 Emissions | Est. Path



Est. Climate Model Temperature Change



Source: https://digiconomist.net/bitcoin-energy-consumption

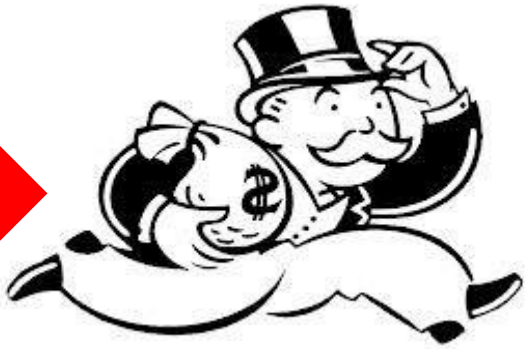
Positive Externalities of a Central Bank Digital Currency

Inequality issues associated with standard monetary policy

Money expansion via open market operations, quantitative easing, …

- Central bank buys fixed income securities, raising asset prices
- Higher prices lower yields, putting downward pressure on interest rates
- Cost of capital to banks falls ➔ more bank lending at lower rates
- Cost of capital to firms & households falls ➔ more investment & consumption

direct effect



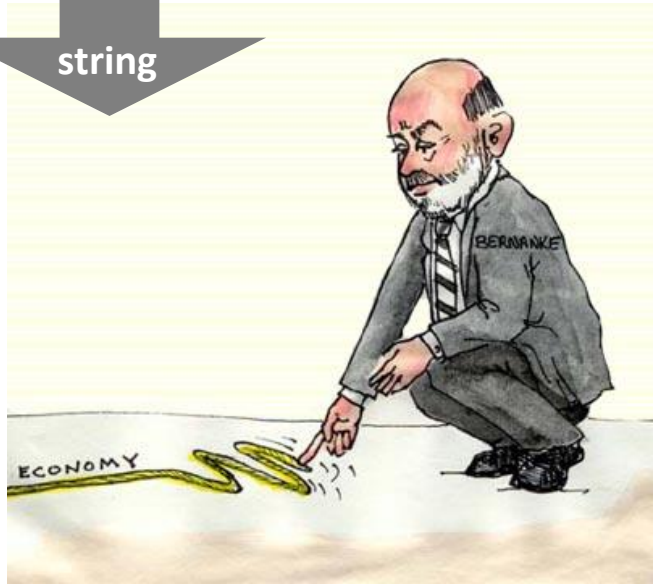
Owners of financial assets (the rich) become richer

pushing on a string

Monetary expansion via CB digital currency creation

- Potential could emulate pharaoh's grain bank distribution of stimulus
- All firms & households have digital currency accounts with central bank
- Central bank simply adds new money to firms' and/or households' accounts
- Better than helicopter money because central bank can do precision money drops on <u>e.g. low-income households with highest marginal propensities to consume?</u>

Precision targeted helicopter money?



Transmission to the real economy = chains of events that may or may not actually happen

Positive Externalities of a Central Bank Digital Currency

Each citizen has a direct account with the treasury or central bank for

- Transfer payment (credits)
  - Micro monetary stimulus; micro fiscal stimulus too
- Tax payment (debits)
- Taxable income payments (credits)
- Bill payments (debits)
- National health care indirect billing & payments

Left v right disagreement on the sign of the externality

- The pharaoh cannot create grain out of nothing. Greenspan can.
- Does block chain technology make Greenspan more like a pharaoh?

Libertarian central bankers?

Alan Greenspan & Ayn Rand

"The art of taxation is to pluck the goose to get the most feathers with least hissing."

Jean Baptiste Colbert

Who To Trust More, Central Banker or Internet Genius?

Thank You