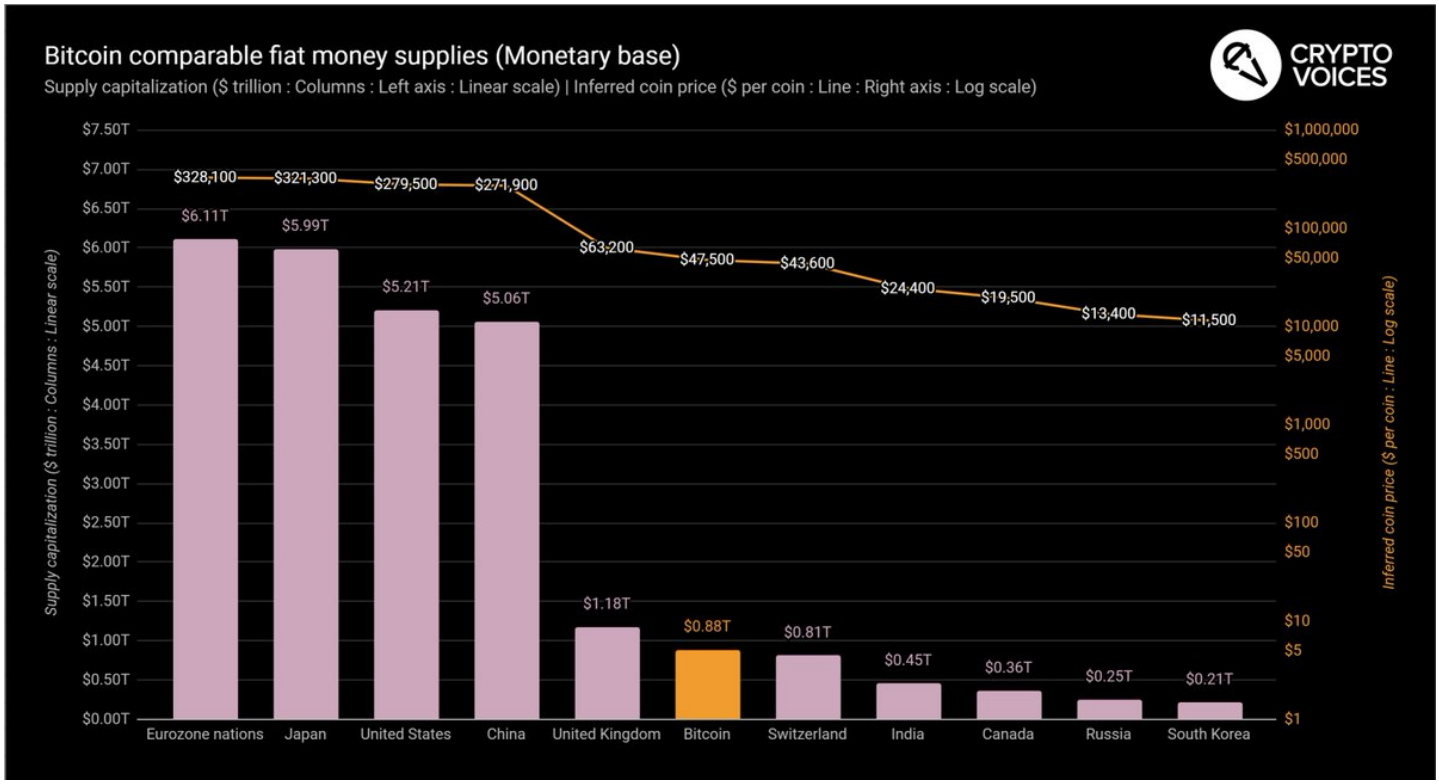
Twitter Thread by Crypto Voices

Crypto Voices
@crypto_voices

As it's yet again been one of those light news weeks for #Bitcoin, let's get down to brass tacks. Bitcoin is now the 6th... largest... currency in the world. ■ It's 7th if you include gold. This is quarterly update #11.



2/ For 12 years the world's been trying to understand #Bitcoin, forget Bitcoin, legitimize Bitcoin, criticize Bitcoin, love Bitcoin, hate Bitcoin. Bitcoin is a protocol, it does what it does. But if you want to speak of its value as money, you gotta understand the monetary base.

3/ What follows isn't a lesson in stimulus or bailouts, whatever the world faces. It's an attempt at painting the monetary landscape around the globe. This is an exercise in perspective. The dollars, euros, and yen we're all familiar with, collectively, are worth $27 trillion.

4/ As many know, the response from governments worldwide to Covid-19 has been drastic, so expect big moves in the data.

5/ Gold & silver is base money of the past. Government fiat is base money today. It comprises both physical cash, *and* a digital cash component. Bitcoin may be base money of the future. Before we show the charts, it's important to clarify exactly what basic money is.

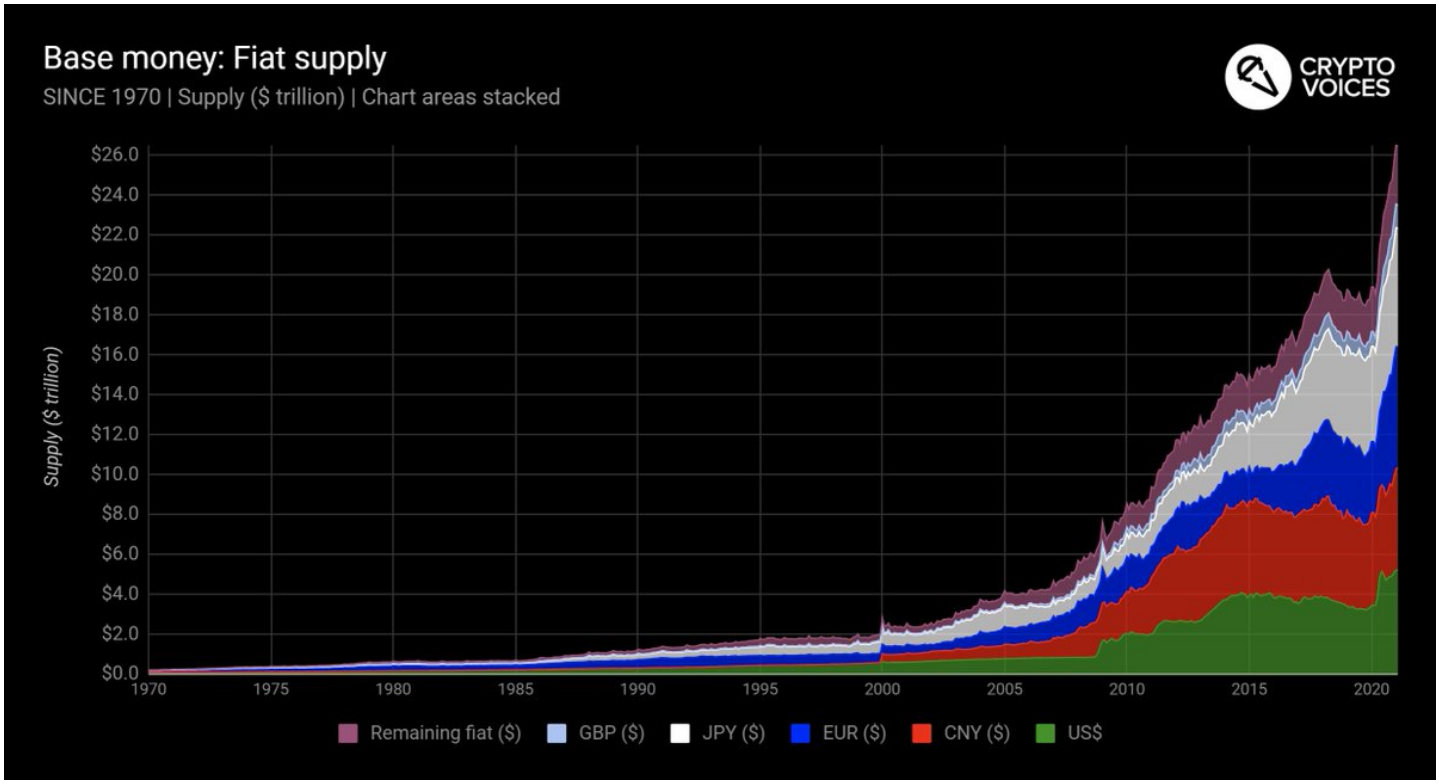
6/ The first thing is everyone looking to value Bitcoin always jumps to the "narrow" or "broad" money supplies (M1/M2/M3). This is incorrect. The reason is those money supplies represent "claims" on something else. What is that something else? Answer: the base money supply.

7/ Fiat base money today includes both physical (notes & coins) and digital (bank reserves at the central bank) components. Think of the digital part as the "account" each bank holds with its central bank. This & only this money supply compares economically with 21 million BTC.

8/ Why? Because that is the end of the line. It's *final*…settlement, in either system. There's no deeper level you can go to in the financial monetary system than the monetary base, and there's no deeper level you can go to in the Bitcoin system than on-chain bitcoins.

9/ Another mistake that's often made when comparing bitcoins to the analog monetary world is looking at a simple chart like US M1, or Eurozone M2. Besides again being incorrect on the M1/M2/M3 comparison, this method is inadequate because Bitcoin is global, and those... are not.

10/ We can't simply look at one or two nation states' base money supplies to gauge any kind of market depth. The sample must be global. We've done that here, tracking the top 30 floating currencies in the world. This is how the real global fiat base money supply looks since 1970.

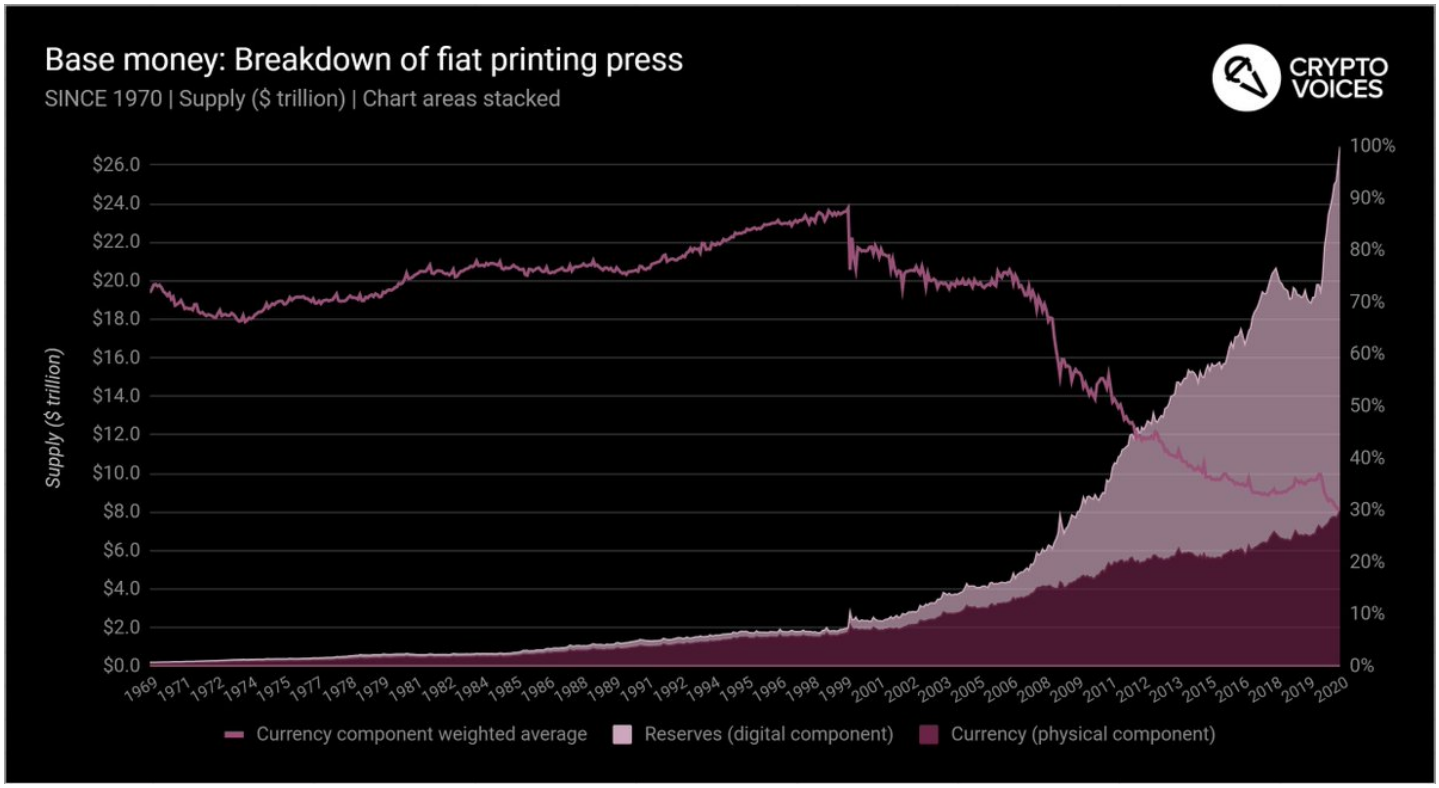


11/ This top 30 base money sample in fact covers 95% of global GDP, 113 countries, and 64 currencies. Why? The euro is one reason. The other is these countries/currencies either use one of these floating top 30 directly, or are legally pegged or

fixed to one via currency board.

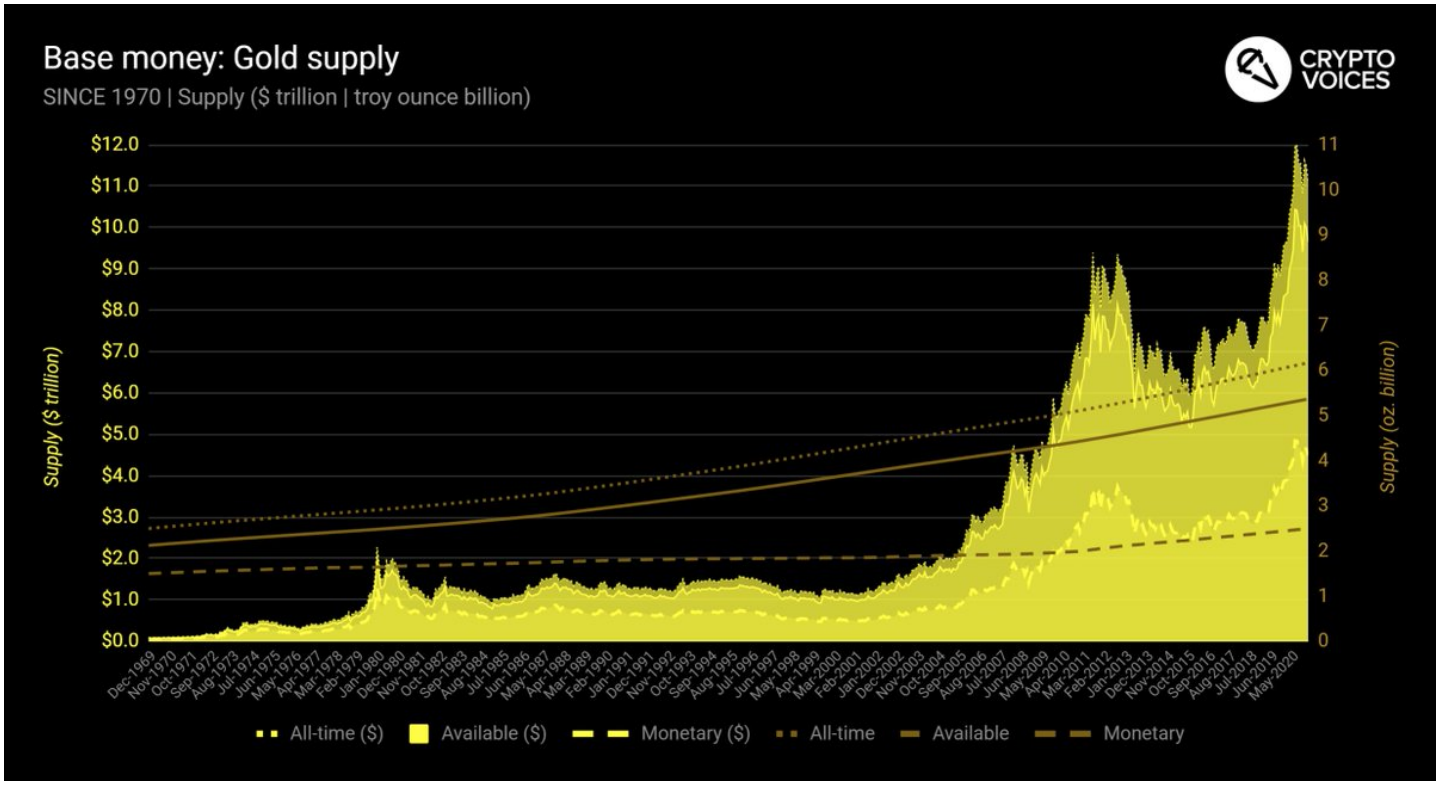
12/ More on the above image. It is essentially ordered by GDP per currency bloc; the one exception is the UK's pound sterling. It's monetary base is larger than India's, which is further down the list.

13/ Let's look again at the global base money supply curve since 1970, but this time see how the split shakes out between physical versus digital base money. Note how bank reserves (the digital printing press) drastically increased its overall % from the 2008 financial slide.

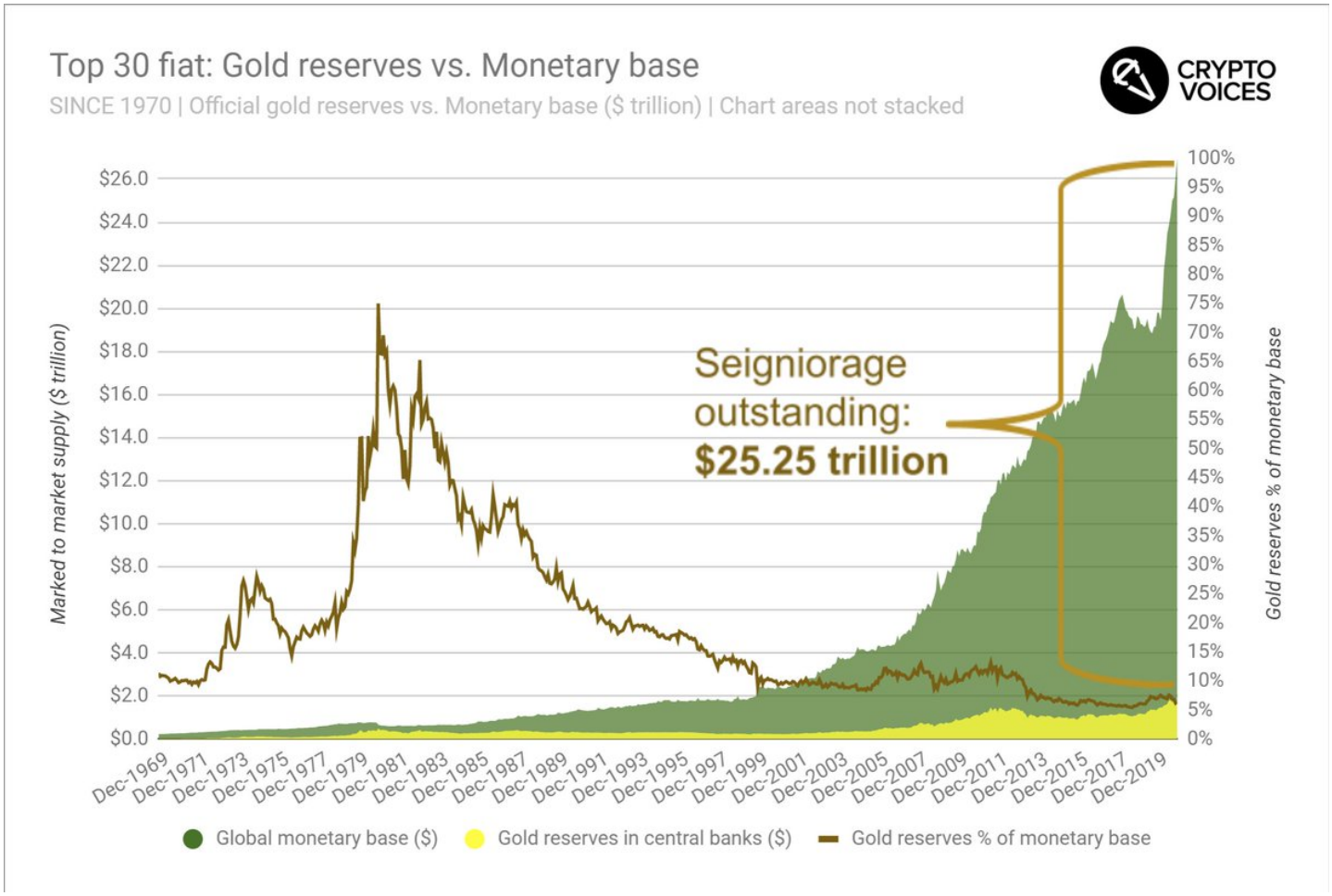


14/ Final point on fiat money. The monetary base is in fact a graph of the money monopoly today; meaning, it is the source of the printing press, and only central banks control this. If you're curious where to find it, the answer is simple: the balance sheet of each central bank.

15/ Now let's look at gold. Central banks still hold gold, but it no longer acts as basic money. A few points coming on this, but everyone should still understand the global gold supply in both its native market unit (ounces), and in today's unit of account (US dollars).



16/ Still on gold, here's a chart you don't see everyday. It's central bank gold holdings vs. their monetary bases. For those that still view gold as a market money, then any fiat money central banks can print above their gold holdings is - by definition - seigniorage.



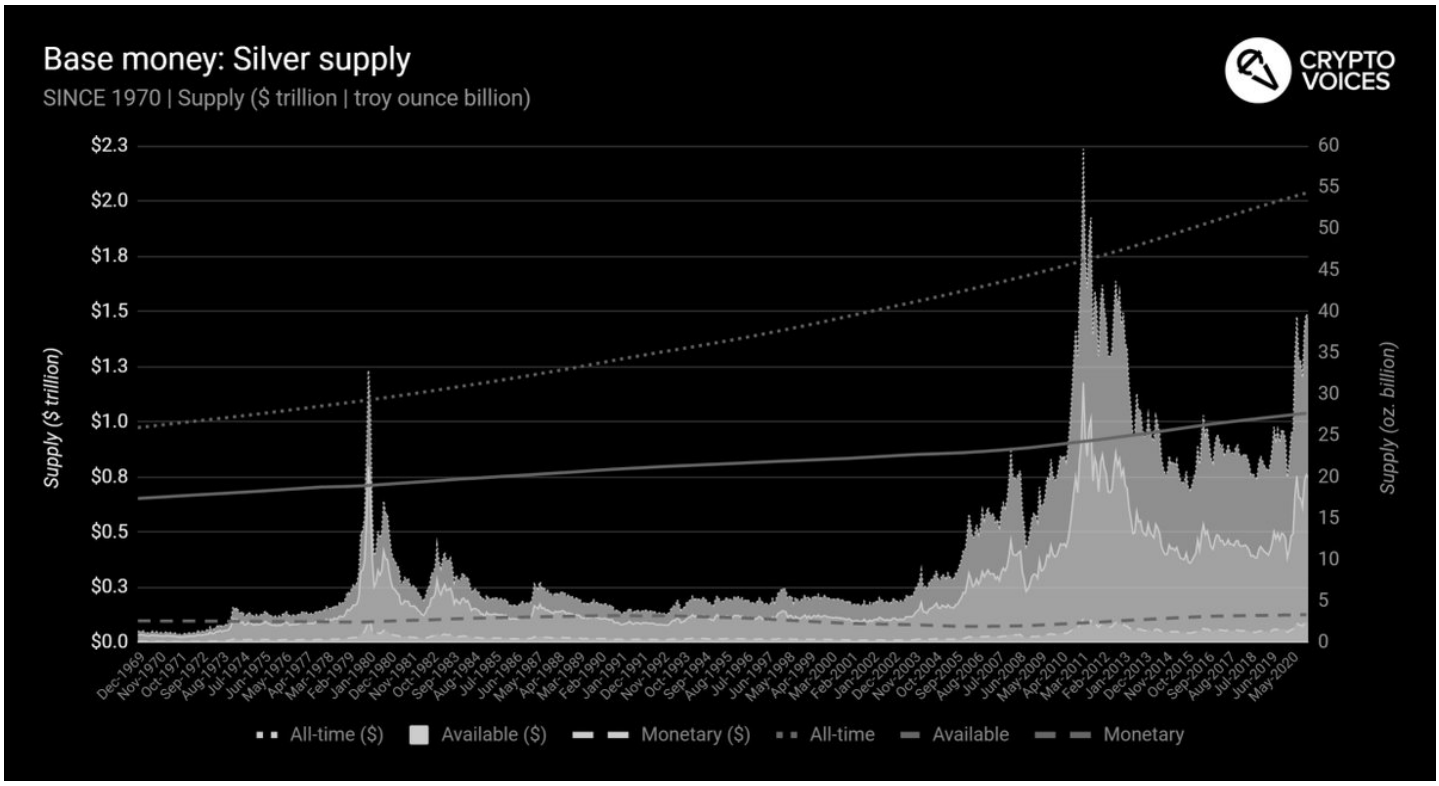
17/ True, many emerging market central banks are net buyers of gold these days. But actually central banks hold less gold collectively than in 1965. Notice how high the proportion of gold reserves-to-issued base money was in 1980 (both valued in US$). Today, it's only 6.4%.

18/ In other words, central banks collectively have issued $25.25 trillion in base money *above* the value of their gold holdings (again, both marked to market in USD). This is an important fact that has implications for central bank money printing, for gold, and for bitcoin.

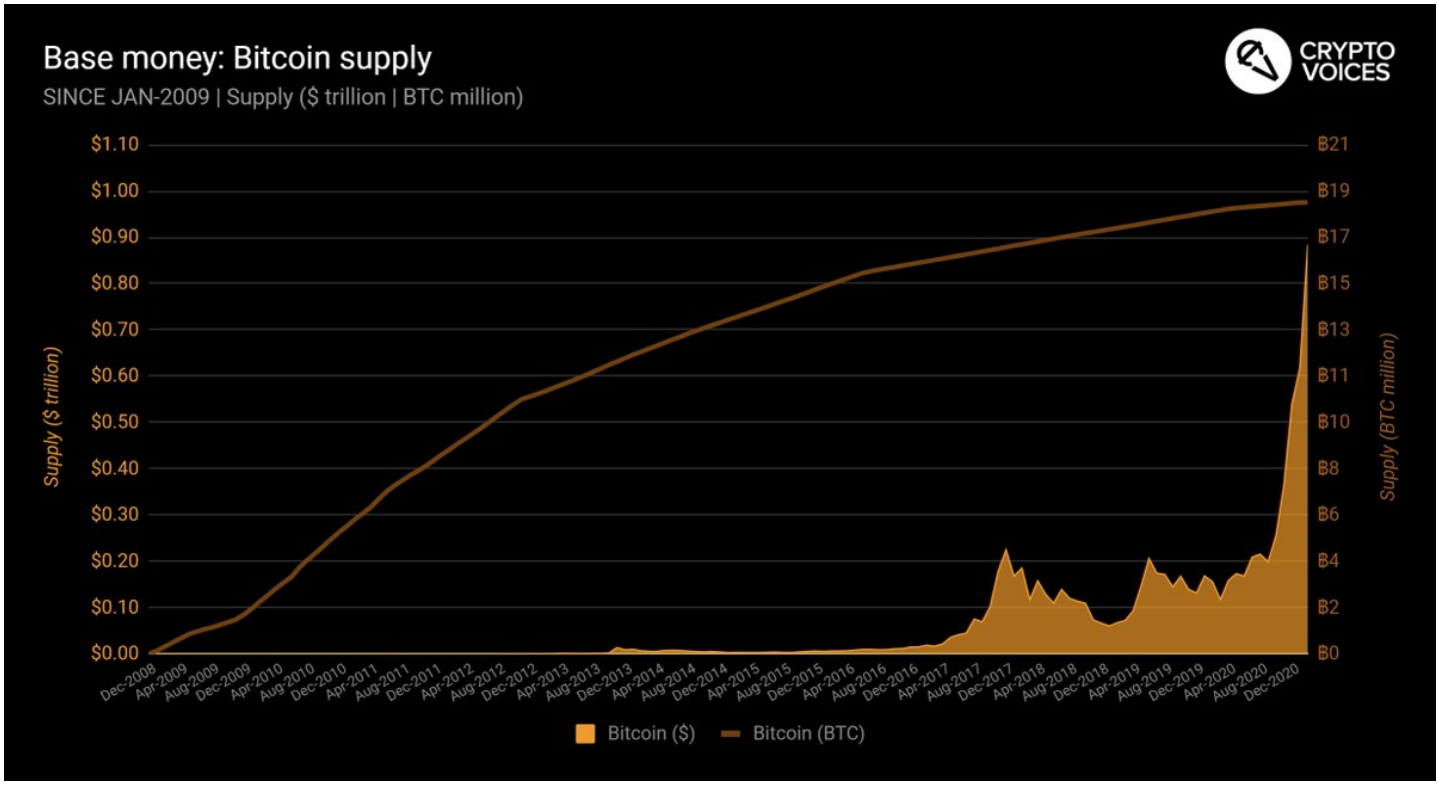
19/ What is that implication? So far, the money monopoly "works" for central banks, and for their governments. It's virtually costless: fiat has proven to be nearly "unconstrained" by the market value of gold. Some claim CBs manipulate the gold price; we won't address that here.

20/ As for #bitcoin, if and when it becomes large enough to be on that chart, and held by central banks, only then will know what bitcoin "costs" central banks. For now, bitcoin "costs" central banks nothing in seigniorage; it's a rounding error. But it's growing. Quickly.

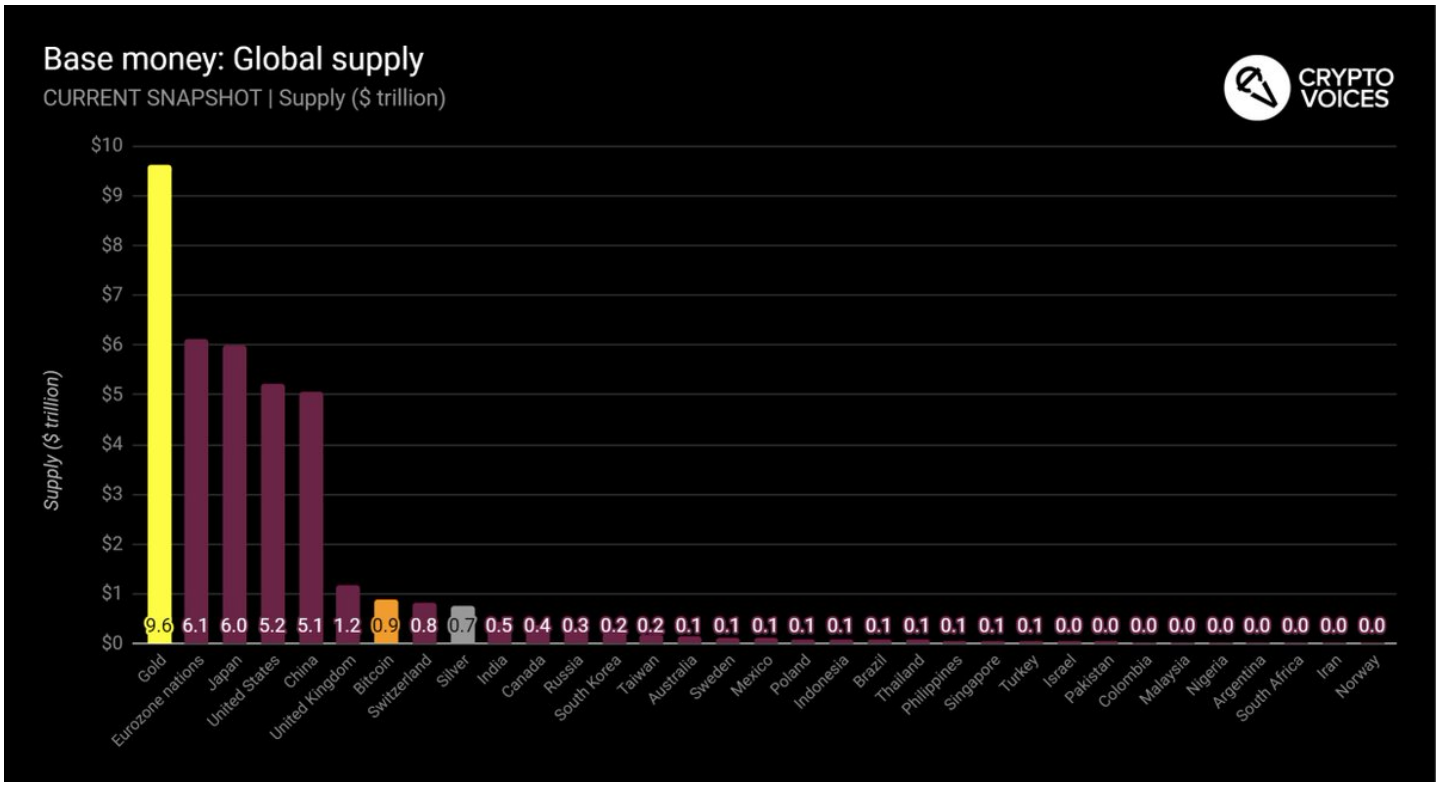
21/ Now silver. 54 billion ounces of the stuff has been mined throughout humanity. Note, we include 3 categories for both gold & silver: "all-time" mine production, "available" estimates (i.e. not lost to industry), and "monetary" estimates (bullion). Since 1970, this is silver.



22/ And finally Bitcoin. Bitcoins are limited by the protocol to an eventual 21 million in supply by 2141, and each day it seems more likely that bitcoins could circulate as base money of the future: a deep & balanced final settlement money supply. Here's its global supply curve.



23/ And now we'll put them altogether - global fiat, "available" gold, "available" silver, and bitcoin - today. Without further commentary, note that the Bitcoin system is now the 6th largest money in the world, and the 7th largest money if gold included.



24/ And for a broad, historical ranking in table format, a progression of all major money for the entirety of #Bitcoin's history since 2009, that information is here.

PROGRESSION OF THE GLOBAL MONETARY BASE
US$ trillion equivalent

~ Gold & silver | Base money of the past ~
~ Top 5 fiat currencies | Base money of the present ~
~ Bitcoin | Possible base money of the future ~

CRYPTO VOICES

Period End	AU gold	EUR euro	JPY yen	USD dollar	CNY yuan	GBP sterling	BTC bitcoin	AG silver
Dec-2009	#1 $4.74	#4 $1.75	#5 $1.14	#3 $2.03	#2 $2.11	#7 $0.33	n/a $0.00	#6 $0.40
Dec-2010	#1 $6.25	#4 $1.56	#5 $1.34	#3 $2.02	#2 $2.81	#7 $0.31	n/a $0.00	#6 $0.75
Dec-2011	#1 $6.98	#4 $2.01	#5 $1.62	#3 $2.62	#2 $3.57	#7 $0.35	n/a $0.00	#6 $0.68
Dec-2012	#1 $7.66	#4 $2.19	#5 $1.60	#3 $2.68	#2 $4.05	#7 $0.56	n/a $0.00	#6 $0.75
Dec-2013	#1 $5.65	#5 $1.86	#4 $1.92	#3 $3.72	#2 $4.48	#6 $0.61	n/a $0.01	#7 $0.49
Dec-2014	#1 $5.71	#5 $1.70	#4 $2.30	#3 $3.93	#2 $4.74	#6 $0.58	n/a $0.00	#8 $0.40
Dec-2015	#1 $5.17	#5 $2.04	#4 $2.96	#3 $3.84	#2 $4.27	#6 $0.56	n/a $0.01	#8 $0.36
Dec-2016	#1 $5.71	#5 $2.60	#3 $3.75	#4 $3.53	#2 $4.45	#6 $0.56	#31 $0.02	#8 $0.42
Dec-2017	#1 $6.58	#5 $3.70	#3 $4.26	#4 $3.85	#2 $4.95	#6 $0.74	#11 $0.22	#8 $0.46
Dec-2018	#1 $6.61	#4 $3.64	#3 $4.60	#5 $3.40	#2 $4.81	#6 $0.73	#19 $0.07	#8 $0.42
Dec-2019	#1 $7.98	#4 $3.56	#2 $4.77	#5 $3.43	#3 $4.66	#6 $0.75	#13 $0.13	#8 $0.49
Dec-2020	#1 $9.63	#2 $6.11	#3 $5.99	#4 $5.21	#5 $5.06	#6 $1.18	#7 $0.88	#9 $0.75

All figures in $US trillion; ranked at displayed period end, according to market exchange rates with US$.

Note on last row: All fiat currencies' value reflects the latest quarter displayed; however, gold, silver, and bitcoin's latest value is ranked as of 12-Feb-2021.

Bitcoin ranked once broken into top-30 fiat currencies' monetary base value.

25/ And for those that wish to see that progression against the remaining fiat currencies, and how quickly (if) #Bitcoin passed each one, that chart is here. Note that as of this posting, #Bitcoin has passed the Swiss franc in value for the first time ever.

PROGRESSION OF BITCOIN'S VALUE
VERSUS GLOBAL FIAT CURRENCIES' MONETARY BASE VALUES

CRYPTO VOICES

Sovereign	Fiat currency	Exchange rate regime	Current fiat rank	Date when BTC first surpassed	Fiat value when BTC first surpassed (US$ trillion)	Fiat monetary base value now (US$ trillion)	BTC still surpassed?
Eurozone nations	euro	Free floating	1	n/a	n/a	$6.11	No
Japan	yen	Free floating	2	n/a	n/a	$5.99	No
United States	dollar	Free floating	3	n/a	n/a	$5.21	No
China	yuan	Other managed arrangement	4	n/a	n/a	$5.06	No
United Kingdom	pound sterling	Free floating	5	n/a	n/a	$1.18	No
Switzerland	franc*	Floating	6	Jan-2021	$0.81	$0.81	Yes
India	rupee	Floating	7	Dec-2020	$0.45	$0.45	Yes
Canada	dollar	Free floating	8	Aug-2017	$0.07	$0.36	Yes
Russia	ruble	Free floating	9	Oct-2020	$0.23	$0.25	Yes
South Korea	won	Floating	10	Nov-2017	$0.14	$0.21	Yes
Taiwan	NT dollar	Free floating	11	Nov-2017	$0.13	$0.17	Yes
Australia	dollar	Free floating	12	Oct-2017	$0.08	$0.14	Yes
Sweden	krona	Free floating	13	Aug-2017	$0.06	$0.11	Yes
Mexico	peso	Free floating	14	Oct-2017	$0.07	$0.11	Yes
Poland	złoty	Free floating	15	Aug-2017	$0.06	$0.10	Yes
Indonesia	rupiah	Floating	16	Aug-2017	$0.08	$0.08	Yes
Brazil	real	Floating	17	Oct-2017	$0.08	$0.08	Yes
Thailand	baht	Floating	18	Aug-2017	$0.05	$0.08	Yes
Philippines	peso	Floating	19	Aug-2017	$0.06	$0.07	Yes
Singapore	dollar	Crawl-like arrangement	20	Aug-2017	$0.05	$0.06	Yes
Turkey	lira	Floating	21	Jul-2017	$0.04	$0.05	Yes
Israel	new shekel	Floating	22	May-2017	$0.03	$0.05	Yes
Pakistan	rupee	Other managed arrangement	23	Jul-2017	$0.04	$0.05	Yes
Colombia	peso	Floating	24	May-2017	$0.03	$0.04	Yes
Malaysia	ringgit	Floating	25	May-2017	$0.04	$0.04	Yes
Nigeria	naira	Stabilized arrangement	26	Oct-2016	$0.01	$0.03	Yes
Argentina	peso	Floating	27	Aug-2017	$0.05	$0.03	Yes
South Africa	rand	Floating	28	Feb-2017	$0.02	$0.02	Yes
Iran	rial	Free floating	29	Aug-2017	$0.05	$0.02	Yes
Norway	krone	Free floating	30	Jul-2016	$0.01	$0.01	Yes
						$26.98	

Fiat currencies' current values reflect latest quarter ending 31-Dec-2020.

Bitcoin's current comparison value reflected in last column is as of 12-Feb-2021.

**Switzerland's monetary base has not yet technically "closed" a month behind Bitcoin in value.*

26/ Now for the main event of this analysis: Inflation. Inflation today means "price increases." It's usually measured by the central bank and usually wrong. There is no way all prices can ever be measured in a simple index. The input variables are changed all the time to boot.

27/ When we analyze inflation, we are using the classical definition, which is "monetary inflation." In other words, "money growth," or "money production." Understanding this rate of increase can be very helpful when trying to understand money.

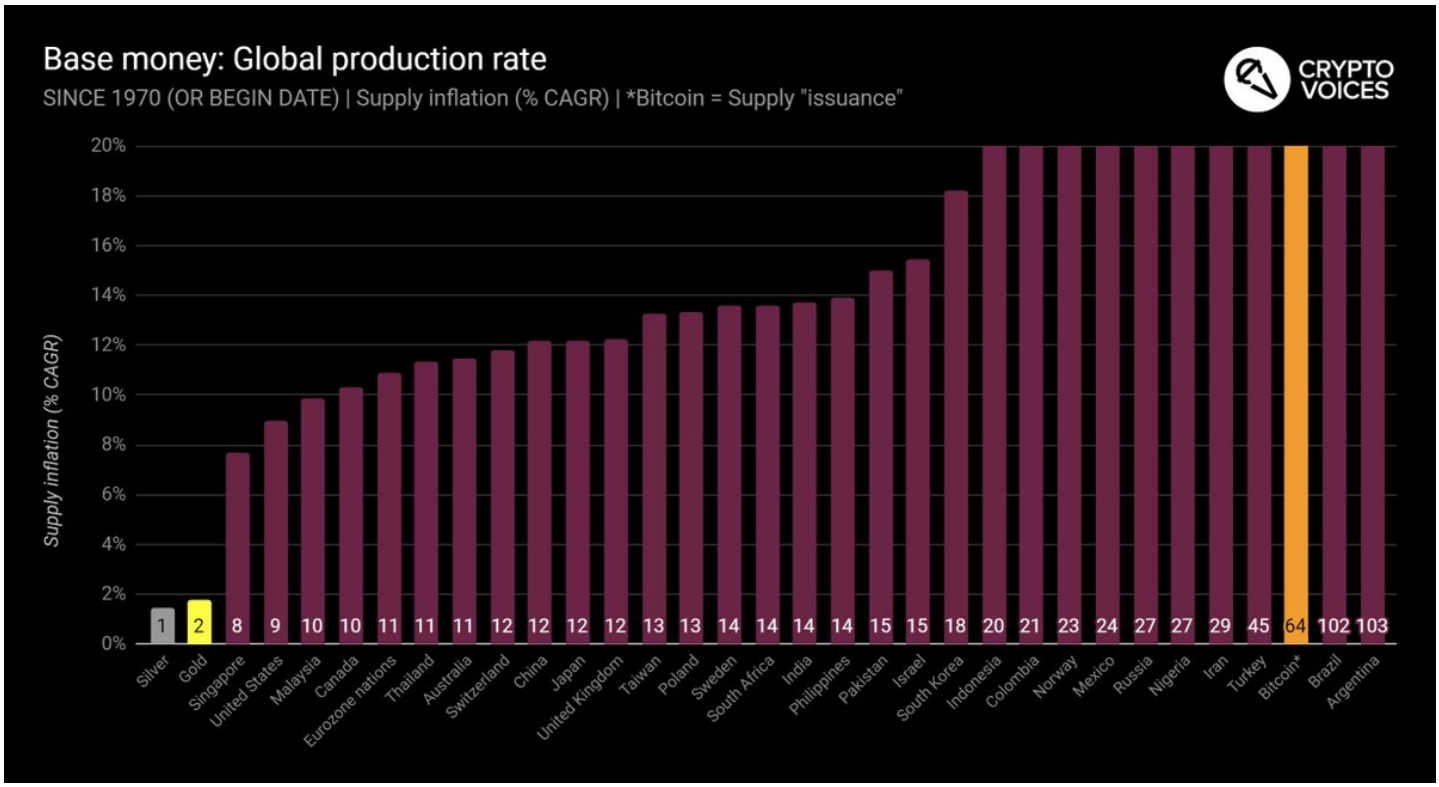
28/ Inflation is one of the most important things to understand about money, in fact. Money growth inflation reflects scarcity, and dilution, relative to other goods. But to be clear... ■ The charts that follow have nothing to do with price growth, or prices, at all. ■

29/ Let's jump to it. This is the last 12 months of all base money growth. Remember, this is "unit" growth. % changes in dollars, euros, or yen, ounces of gold, or bitcoins. Big… big... numbers.

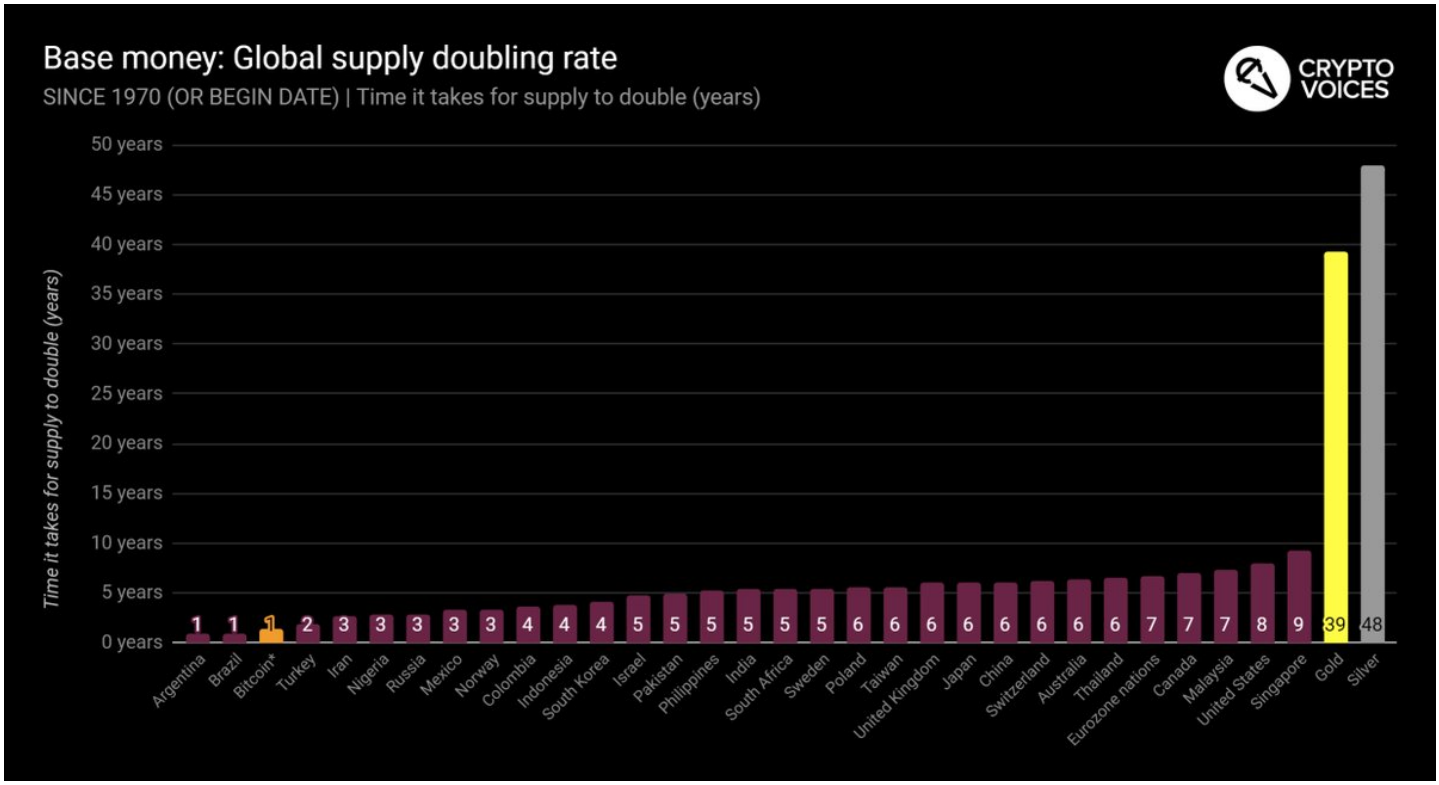
30/ But we need to look deeper. It helps to look long-term. Remember the global fiat supply curve? ■ In 1970, the US$ equivalent of global base money was $200 billion. Today: $27 trillion. What does this mean? To understand it, you need to understand compound annual growth.

31/ Compound annual growth is an extremely important metric. It's "stronger" than a simple, annual rate (https://t.co/iT7h6UZZdZ). We can use this rate to understand investment returns, or long-term trends like population growth. We can also derive doubling time from this figure.

32/ So let's start with the compound annual growth rates for the global monetary base since 1970. 50 years of data. About half the countries' data goes back this far. For the rest, % displayed is since their start date. For bitcoin, the start date is Jan-2009.

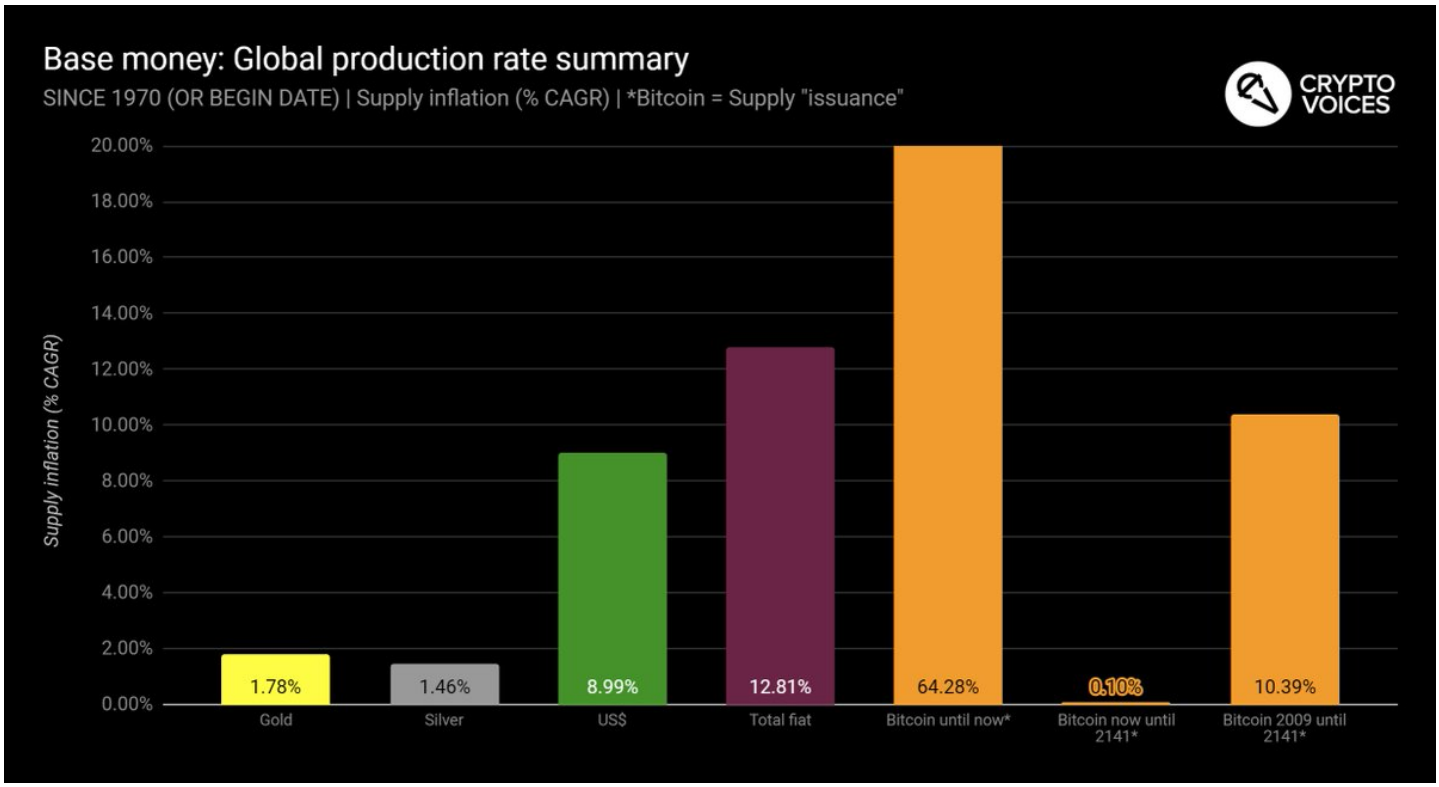


33/ Doubling time also helps. From compound growth %, we can determine exactly how long it takes for an asset's supply to double. Here is the exact same chart as just shown, since 1970 (and since 2009 in Bitcoin's case), but displaying doubling time instead of compound growth.

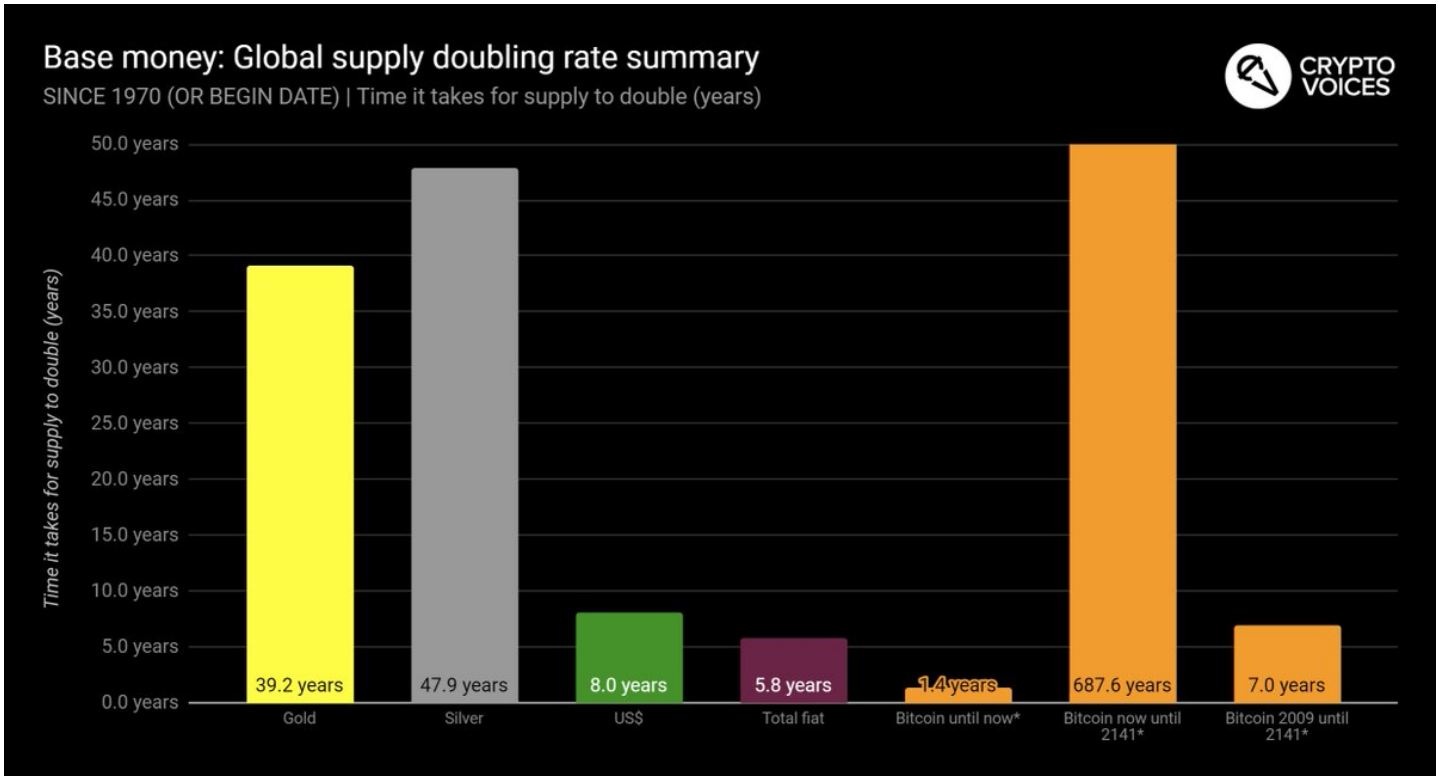


34/ It should be clear why gold and silver arose as past base money. 'Twas difficult to inflate them, and thus with low inflation rates they had long supply-doubling times (scarcity). Fiat base money has typically been much quicker to double. Bitcoin... needs more explanation.

35/ These next 2 charts will make it easier to understand how Bitcoin's supply works. From 2009 until now, yes, 50 bitcoins grew to 18.6 million. That's a ~64% compound annual growth rate, or doubling every 1.4 years. But, from now until 2141… that's when things get interesting.



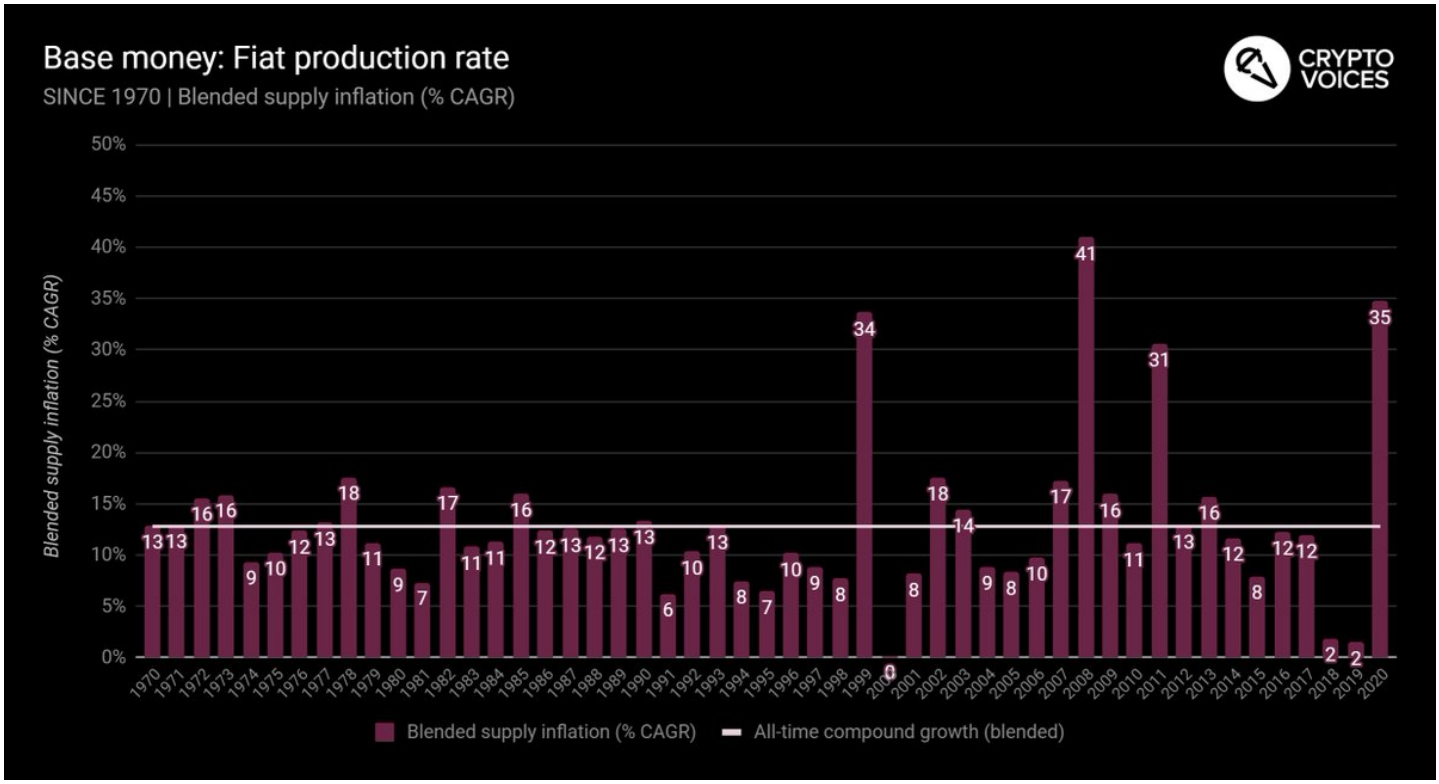
36/ Notice how the supply of bitcoins will only grow at 0.1% per year, or double every *688 years*. And it gets even more unique, as the Bitcoin protocol won't allow that doubling to happen, as it's supply will cap at 21 million in 2141. No money in history has worked like this.



37/ To clarify, this is the long-term compounding of past, present, & possibly future base money, since 1970:

Gold: 1.8% (39 yr-doubling)
Silver: 1.5% (48 yr-doubling)
US$: 9% (8 yr-doubling)
Global fiat: 12.8% (6 yr-doubling)
Bitcoin: From now until 2141: 0.1%... compounded.

38/ Back to the 50 year time series again, and this is the big one. Here is the inflation rate of the global monetary base, weighted averaged by each base money's equivalent in US$. Notice it matches the overall 12.8% CAGR (6 year doubling time) we've already seen.



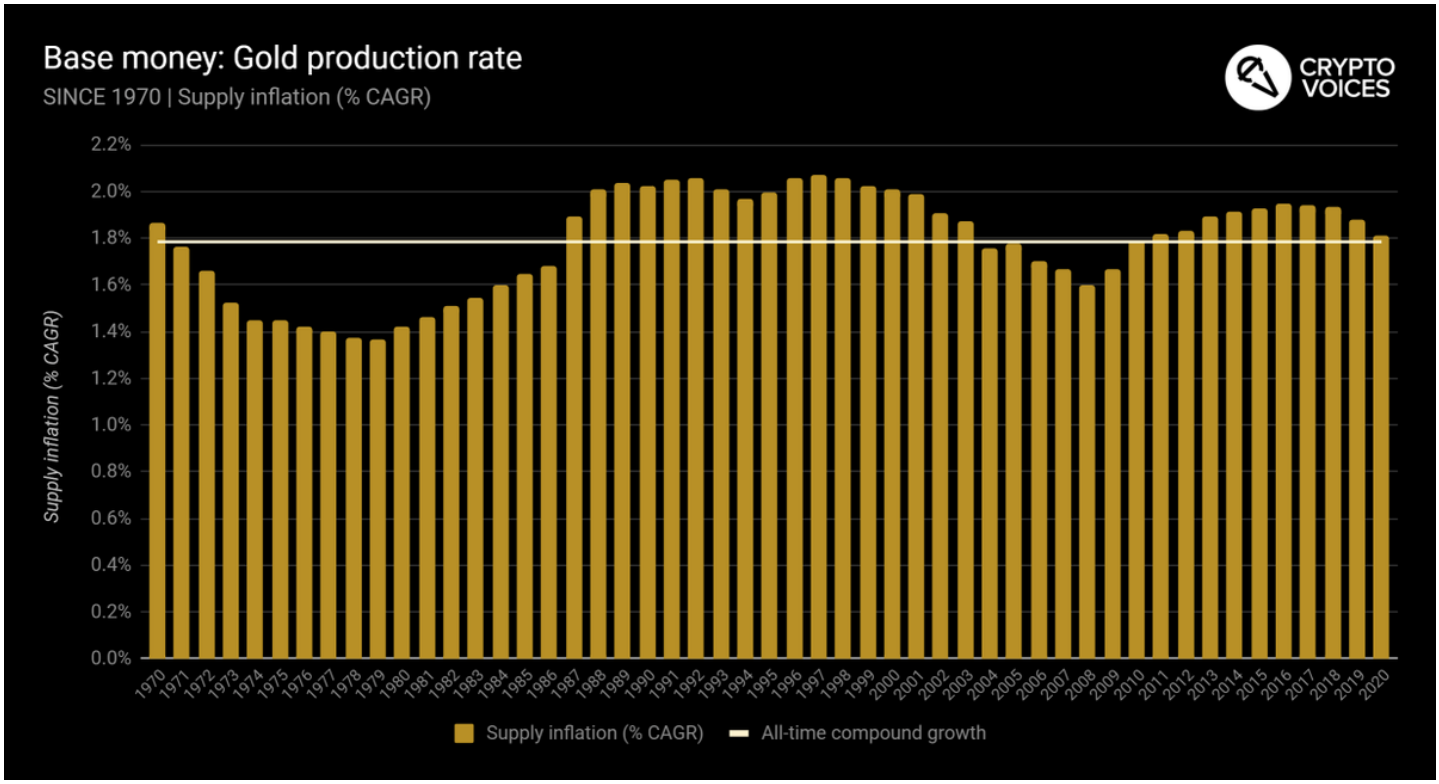
39/ Quick note on prior slide. What happened in 1999? People were taking cash out like mad before Y2K. Interesting to note, 2018 and 2019's inflation rates were in fact the lowest rates of growth of basic money ever, besides 1999. And we should say a few more words on this…

40/ For all 2019, central banks were actually on track to *deflate* their currencies. This would have been a first in the modern fiat era. So interestingly, no matter "why" one argues for money printing, 2019 still did finish off with positive inflation, weighted at 1.5%.

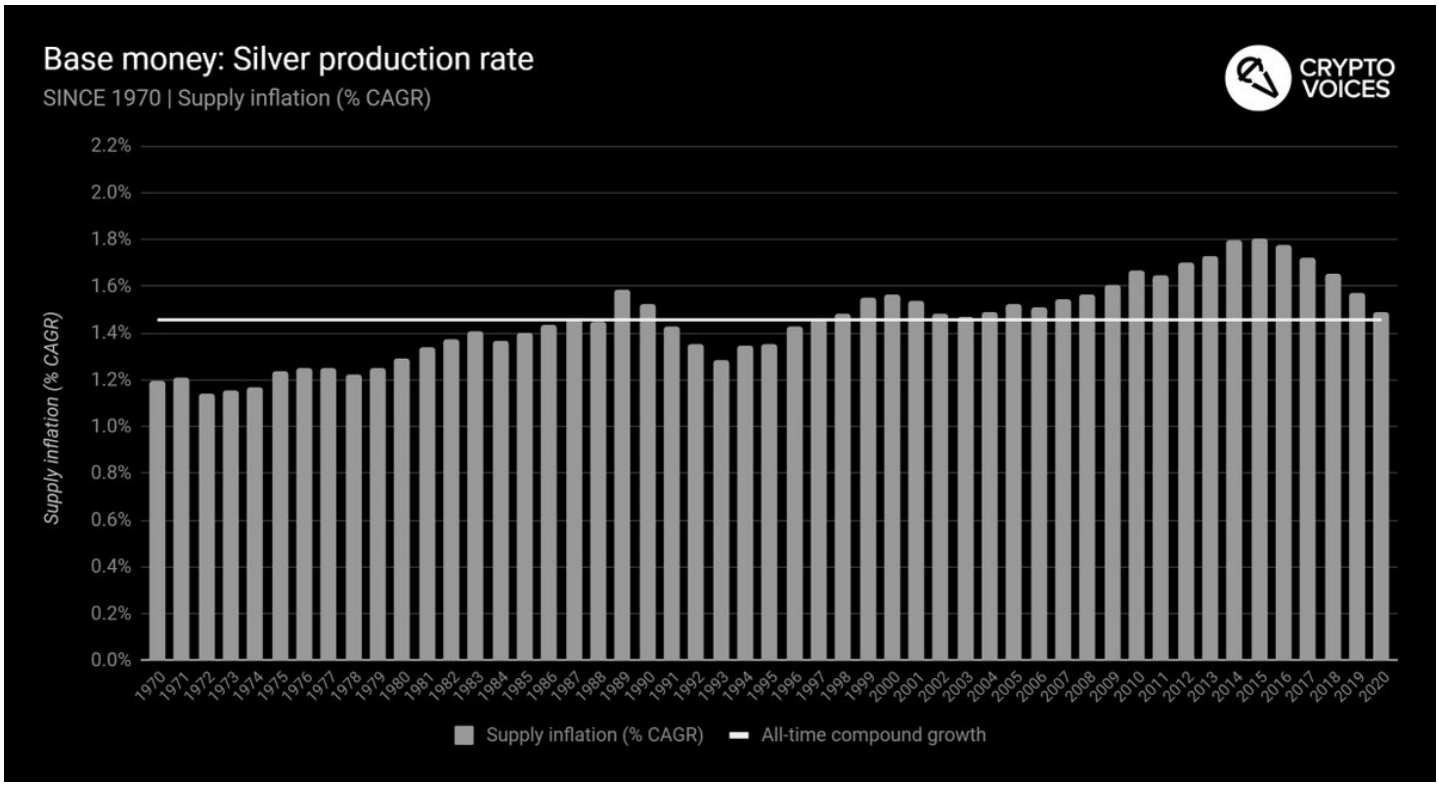
41/ Now perspective on the big one. How much money is actually printed around the world? That exhibit answers that question: 2020 was historical. Central banks expanded the money supply by 35%. ■ This is second only to the global crisis in 2008.

Not a good thing, by the way.

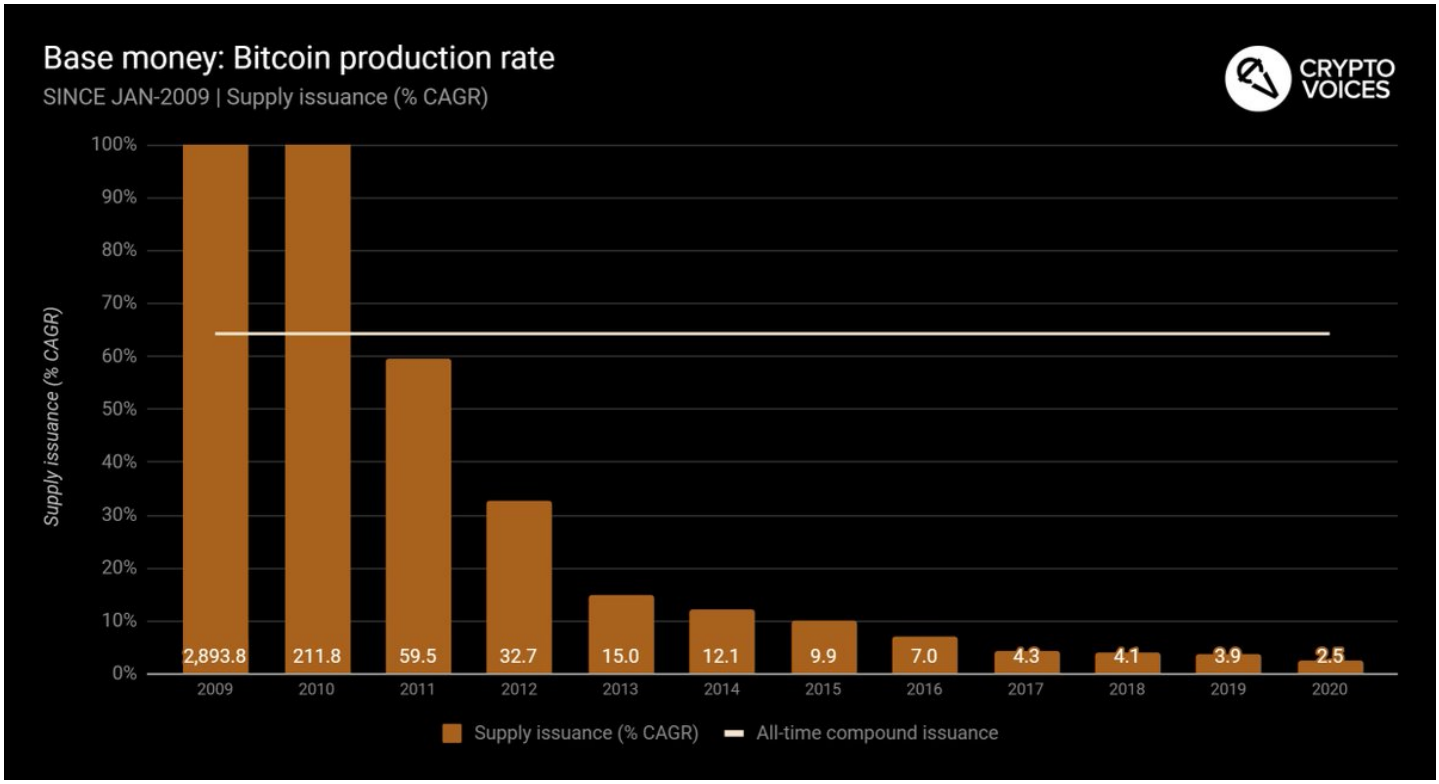
42/ Here's gold. Same concept. Notice again the overall series compounding will match the summaries we've already seen. Gold's rate of growth has, in fact, been around 1.8% per annum for the last 170 years.



43/ And here's silver. Same deal. We're going to say some more on silver below, it's almost as politicized as its bigger brother gold.



44/ And now Bitcoin. Remember why the overall compound growth, thus far, is so high, and why it will never be that high again. And now is about the time for a clarification note on the Bitcoin system's compound annual growth rate, specifically.



45/ Also notice the phrase "supply issuance" for Bitcoin's chart titles, and not "inflation." Bitcoin's "inflation," economically, is already baked in. Everyone knows its max supply. As already demonstrated, its growth rate is known until 2141, per the protocol.

46/ So when it comes to #bitcoins, "inflation" is not the best term. "Coin issuance" is more apropos, as its overall supply is fixed & known. As monetary expert George Selgin said on our show, "We know it's 21 million, and that's that." This is uniquely unlike fiat, or even gold.

47/ Lets take another detour on supply growth, also on the concept of "stock to flow." The attached exhibits cover all the main stock categories: all-time production, "available" supply, and "monetary metal" supply. These categories are often quoted inconsistently.

EXHIBIT 1

ALL-TIME UNITS (long-term horizon)

COMPOUND ANNUAL GROWTH	Gold	Silver	US dollar	Global fiat	Bitcoin	Formula	Description
Stocks below represent	*All-time production*	*All-time production*	*Monetary base*	*Monetary base*	*All-time issuance*		*Gold & silver: all-time, cumulative metal mined; US$ and global fiat: Total monetary base (physical currency + commercial bank reserves); Bitcoin: all-time, cumulative bitcoins mined.*
Begin date	31-Dec-1969	31-Dec-1969	31-Dec-1969	31-Dec-1969	3-Jan-2009		Bitcoin: Genesis block; all others: Start of 1970s (approximate closing of gold window).
Begin "all-time" stock	2.5 billion oz.	25.9 billion oz.	$0.1 trillion	$19.8 trillion	฿50		
Latest date	31-Dec-2020	31-Dec-2019	31-Dec-2020	31-Dec-2020	11-Feb-2021		Latest date analyzed.
Latest "all-time" stock	6.2 billion oz.	53.4 billion oz.	$5.2 trillion	$27.0 trillion	฿18.6 million		Latest stock analyzed.
Compound annual growth rate	**1.8%**	**1.5%**	**9.0%**	**12.8%**	**64.3%**	= ((1+r)^12)-1	Where r is average monthly growth rate since "Begin date." This is the "strongest" and most useful figure of an asset's long-term growth. Note with Bitcoin, we know the protocol's coin issuance will never again be as fast as it was in early years.
Compound stock to flow	**56.0**	**68.7**	**11.1**	**7.8**	**1.6**	= 1 / Compound annual growth rate	This is, in fact, the "strongest" stock to flow figure, as it reflects cumulative, annualized, long-term growth since "Begin date" (Genesis block with Bitcoin; Dec-1969 for all others). It truly represents how many years it took the all-time supply to double. Note again Bitcoin is unique here, as we know the protocol's issuance will never again be as fast as it was in early years.

Source: Gold & silver from industry expert Nick Laird; US$ from Federal Reserve; Global fiat from remaining central banks; Bitcoin from Coin Metrics.

EXHIBIT 2

ALL-TIME UNITS (1-year horizon)

LATEST ANNUAL GROWTH	Gold	Silver	US dollar	Global fiat	Bitcoin	Formula	Description
Stocks below represent	*All-time production*	*All-time production*	*Monetary base*	*Monetary base*	*All-time issuance*		*Gold & silver: all-time, cumulative metal mined; US$ and global fiat: Total monetary base (physical currency + commercial bank reserves); Bitcoin: all-time, cumulative bitcoins mined.*
TTM date	31-Dec-2019	31-Dec-2018	31-Dec-2019	31-Dec-2019	11-Feb-2020		Means date "trailing twelve months" before Latest date.
TTM "all-time" stock	6.0 billion oz.	52.6 billion oz.	$3.4 trillion	$19.8 trillion	฿18.2 million		Means stock "trailing twelve months" before Latest stock.
Latest date	31-Dec-2020	31-Dec-2019	31-Dec-2020	31-Dec-2020	11-Feb-2021		Latest date analyzed.
Latest "all-time" stock	6.2 billion oz.	53.4 billion oz.	$5.2 trillion	$27.0 trillion	฿18.6 million		Latest stock analyzed.
Latest annual "new" flow	**0.11 billion oz.**	**0.83 billion oz.**	**$1.78 trillion**	**$7.18 trillion**	**฿0.41 million**	= Latest stock - TTM stock	The latest, estimated (actual in Bitcoin's case), gross annual supply change for all use cases of metal (industrial, jewelry, coins & bars), fiat currency, and bitcoin. With gold, silver, & Bitcoin, this figure is analogous to annual mine production.
Latest annual growth rate	**1.8%**	**1.6%**	**52.0%**	**37.8%**	**2.3%**	= Latest stock / TTM stock - 1	Latest annual growth rate of all-time supply since TTM date. Most useful figure when comparing assets across short-term data. Note how both gold & silver's Latest annual growth rates are quite consistent with their long-term CAGRs (Exhibit 1). Note again with Bitcoin, as we know the protocol's issuance will never again be as fast as it was in early years, this figure is arguably more important than its long-term CAGR (again, Exhibit 1).
Latest stock to flow	**55.3**	**63.5**	**1.9**	**2.6**	**44.0**	= 1 / Latest annual growth rate (or TTM stock / Latest annual flow)	Simply inverse of above formula. This is the only stock to flow methodology consistent with the Latest annual growth rate calculation directly above.

Source: Gold & silver from industry expert Nick Laird; US$ from Federal Reserve; Global fiat from remaining central banks; Bitcoin from Coin Metrics.

EXHIBIT 3

"AVAILABLE" UNITS (1-year horizon)

LATEST ANNUAL GROWTH	Gold	Silver	US dollar	Global fiat	Bitcoin	Formula	Description
Stocks below represent	*Jewelry, coins, & bars*	*Jewelry, coins, & bars*	*N/A*	*N/A*	*Bitcoins not lost / burned*		*Gold & silver: all-time, cumulative metal mined, less industrial metal and metal presumed lost; US$ and global fiat: Not applicable; Bitcoin: all-time, cumulative bitcoins mined, less bitcoins (constant 20%) presumed lost.*
TTM date	31-Dec-2019	31-Dec-2018			11-Feb-2020		Means date "trailing twelve months" before Latest date.
TTM "available" stock	5.3 billion oz.	27.0 billion oz.			฿14.6 million		Means stock "trailing twelve months" before Latest stock.
Latest date	31-Dec-2020	31-Dec-2019			11-Feb-2021		Latest date analyzed.
Latest "available" stock	5.4 billion oz.	27.4 billion oz.			฿14.9 million		Latest stock analyzed.
Latest annual "available" flow	**0.09 billion oz.**	**0.31 billion oz.**			**฿0.33 million**	= Latest stock - TTM stock	The latest, estimated, net annual supply change of "available" metal (jewelry, coins & bars) and bitcoin. Note that with gold & silver, particular supply and demand factors must be included in this calculation, such as recycled metal (scrap), treasury sales, and fabrication demand. With bitcoin, the loss rate assumed is a constant 20% discount from all-time figures. Category not applicable to fiat currency.
Latest annual growth rate	**1.8%**	**1.1%**			**2.3%**	= Latest stock / TTM stock - 1	Latest annual growth rate of "available" supply since TTM date. Most useful figure when comparing assets across short-term data. Note how both gold & silver's Latest annual growth rates are quite consistent with their long-term CAGRs (Exhibit 1). Note again with Bitcoin, as we know the protocol's issuance will never again be as fast as it was in early years, this figure is arguably more important than its long-term CAGR (again, Exhibit 1).
Latest stock to flow	**55.7**	**87.6**			**44.0**	= 1 / Latest annual growth rate (or TTM stock / Latest annual flow)	Simply inverse of above formula. This is the only stock to flow methodology consistent with the Latest annual growth rate calculation directly above.
"Discounted" stock to "New" flow	**48.1**	**32.6**			**35.2**	= TTM stock / Latest annual "new" flow from mine production (Exhibit 2)	Here we arrive at an alternate stock to flow calculation. This formula does not have any basis in the economic reality of supply and demand **in this particular category of "available" supply**. The formula takes the same "discounted" stock of available supply as directly above, but instead of using the corresponding net change (net available flow) in the denominator, the formula uses the "full flow" of new metal and bitcoin (in other words, mine production, used in Exhibit 2).

Source: Gold & silver from industry expert Nick Laird; US$ from Federal Reserve; Global fiat from remaining central banks; Bitcoin from Coin Metrics.

EXHIBIT 4

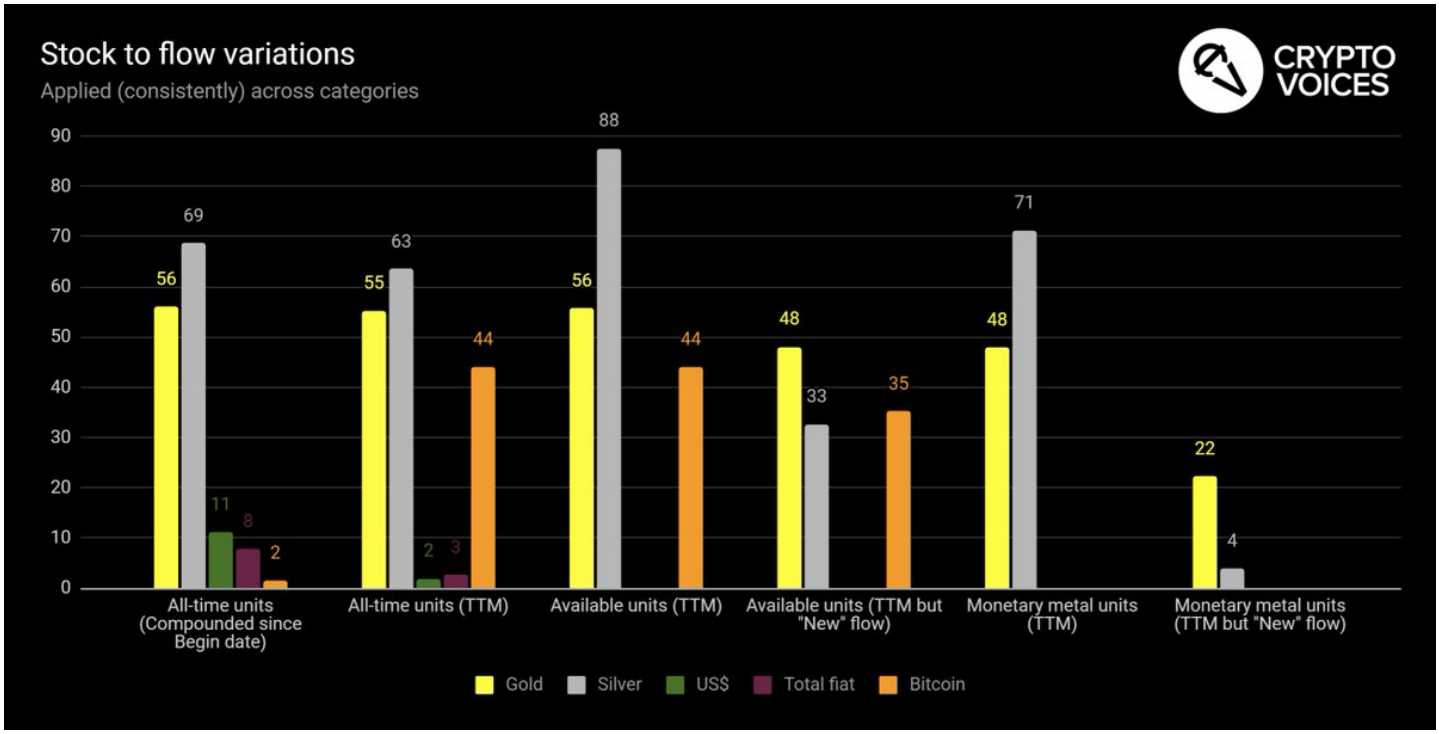
"MONETARY METAL" UNITS (1-year horizon)

LATEST ANNUAL GROWTH	Gold	Silver	US dollar	Global fiat	Bitcoin	Formula	Description
Stocks below represent	*Coins & Bars*	*Coins & Bars*	*N/A*	*N/A*	*N/A*		*Gold & silver: estimated metal in bullion (coins & bars) form; US$ and global fiat: Not applicable; Bitcoin: Not applicable.*
TTM date	31-Dec-2019	31-Dec-2018					TTM means "trailing twelve month(s)."
TTM stock	2.4 billion oz.	3.2 billion oz.					TTM means "trailing twelve month(s)."
Latest date	31-Dec-2020	31-Dec-2019					Latest date analyzed.
Latest stock	2.5 billion oz.	3.3 billion oz.					Latest stock analyzed.
Latest annual "monetary" flow	**0.05 billion oz.**	**0.05 billion oz.**				= Latest stock - TTM stock	The latest, estimated, net annual supply change of "monetary" metal (coins & bars). Note that particular supply and demand factors must be included in this calculation, such as recycled metal (scrap), treasury sales, and fabrication demand. Category not applicable to fiat currency and Bitcoin.
Latest annual growth rate	**2.1%**	**1.4%**				= Latest stock / TTM stock - 1	Latest annual growth rate of "monetary" supply since TTM date. Most useful figure when comparing assets across short-term data. Note how both gold & silver's Latest annual growth rates are quite consistent with their long-term CAGRs (Exhibit 1).
Latest stock to flow	**47.9**	**71.3**				= 1 / Latest annual growth rate (or TTM stock / Latest annual flow)	Simply inverse of above formula. This is the only stock to flow methodology consistent with the Latest annual growth rate calculation directly above.
"Discounted" stock to "New" flow	**22.3**	**3.9**				= TTM stock / Latest annual "new" flow from mine production (Exhibit 2)	Here we arrive at an alternate stock to flow calculation. This formula does not have any basis in the economic reality of supply and demand **in this particular category of "monetary" supply**. The formula takes the same "discounted" stock of monetary supply as directly above, but instead of using the corresponding net change (monetary flow) in the denominator, the formula uses the "full flow" of new metal (in other words, mine production, used in Exhibit 2).

Source: Gold & silver from industry expert Nick Laird; US$ from Federal Reserve; Global fiat from remaining central banks; Bitcoin from Coin Metrics.

48/ Remember, consistency. Gold bugs first: They often claim silver's S2F is 3 or 4, so... bad. If you're a gold bug and really want to disparage silver with this (closer to 4) ratio, then you should in the same breath quote gold's comparable S2F in this

(spurious) category: 22.

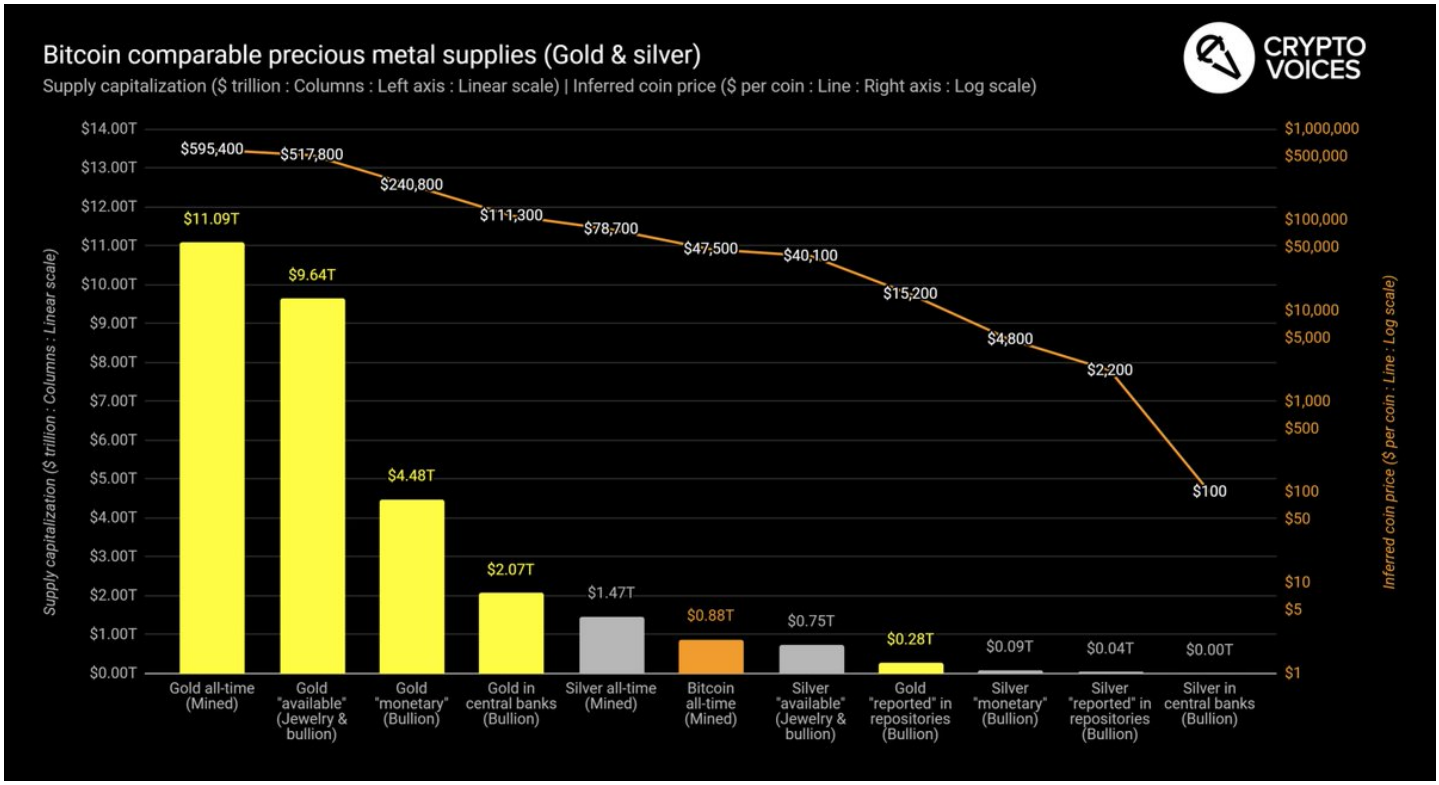


49/ Now, for silver bugs. For years, as gold's price is 70-100X silver's, they've claimed silver's price is due for at least a 5X move, to bring it back in line with the historical, natural ratio to gold (about 16 to 1). There are a few problems with this.

50/ First, it's impossible to predict price based on historical supply and demand ratios. Second, even if we assumed that historical ratio of 16 to 1 was gospel, silver is *already* at that level. You just need to view it through the correct lens…

51/ The all-time gold *stock* is $11.1T; silver is $1.5T. Ratio of 8X. Holding gold constant, silver's price needs to *fall* 53% to get to the 16x ratio! Repeat this process across "available" metal ($10T gold and $1T silver), then it's a -31% move in silver price. Done.

52/ One more thing. Let's look bird's eye across all gold & silver groups. Of all the "transparent," reported repositories of bullion (sourced from Nick Laird) - all ETFs, even @PeterSchiff's GoldMoney, #Bitcoin has passed gold & silver in these vaults COMBINED.



53/ Oh yeah, and in case you forgot, last quarter #Bitcoin also passed the entire "available" (not lost to industry) supply of #silver value in the world.

54/ Alright. Now that we've seen all the data, let's finally take a quick look at some price chat, because even though I told you none of the above covers prices, I know you're thinking about how all of this monetary inflation has affected or will affect prices.

55/ Milton Friedman said, "Inflation is always and everywhere a monetary phenomenon." He meant price inflation (not graphed above) always and everywhere follows money inflation (very much graphed above).

56/ The rub is it is impossible to predict how and when price inflation will happen. Impossible to predict. Hyperinflations (of prices) or otherwise. The best we can do is measure the money supply and its growth, as we've done here.

57/ But we can say this: If the supply of base money increases, and if there is no or a lesser increase in the demand for that money, then ceteris paribus, prices will rise. Ceteris paribus, a growing base money supply will always undermine that money's purchasing power.

58/ These are some of the reasons why the market chose hard money like gold & silver. Always emergent in human action, unless there is monopoly intervention (fiat), the market will decide the best money. If aliens in a one-off whisked away our gold, we'd choose the next best...

59/ Let's take one more detour back to the dollar and the USA specifically, to see why it matters to track the growth of the monetary base (the *money* ■), versus the growth of other economic stuff. Focus on the green box first. Let's keep in mind the lessons we've learned…

UNITED STATES: LONG RUN COMPARISONS OF ECONOMIC HEALTH FACTORS & VALUE STORES

VERSUS GROWTH OF MONETARY BASE	Monetary base	Annual GDP	$1 of base money will get you $X of GDP:	Broad unemployment rate (U-6)	Base money printed per 1% of unemployment	Government debt	Gold cap (available gold)	S&P 500 Index (w/ dividends reinvested)*	Bloomberg Barclays US Aggregate Total Return Bond Index
31-Dec-2000	$0.6 trillion	$10.3 trillion	*$17.14*	6.9%	$87 billion	$5.7 trillion	$1.0 trillion	1,320	931
31-Dec-2020	$5.2 trillion	$21.0 trillion	*$4.02*	11.7%	$445 billion	$26.9 trillion	$10.1 trillion	5,559	2,392
Compound annual growth rate	*11.4%*	*3.6%*			*8.5%*	*8.1%*	*12.2%*	*7.5%*	*4.8%*
Doubling rate	*6.4 years*	*19.4 years*			*8.5 years*	*8.9 years*	*6.0 years*	*9.6 years*	*14.7 years*

**Latest value of S&P 500 Index includes initial investment ("1 share") plus additional shares purchased with dividends.*

60/ First, in the last 20 years the supply of basic money grew 11.4% per year, or doubled every 6.4 years. The Fed's mandate is to control inflation and keep people employed. GDP would be one way to measure economic health. How fast did it grow? Only 3.6% per year.

61/ In 2000, $1 of basic money printed got you $17 of GDP. Now? $1 gets you only $4 in GDP. In 2000, 1% of unemployment would cost you $87 billion in printed dollars. Now? $445 billion for the same 1%. Oh yeah, government debt grew 8.1% per year as well, doubling every 9 years.

62/ And continuing, we can start to see why measuring "price inflation" is hopeless. Gold valued in dollars? Grew 12.2% per year. Stocks? 7.5% per year. Bonds? Only 4.8% per year. Bonds (specifically the gov't variety) are return-free risk, not the colloquial opposite.

63/ A few notes before the final summary. Almost done! Remember these are the top 30 currencies in the world over the past 50 years. Zimbabwe & Belarus don't make the cut; as their monetary base is so tiny, their hyperinflations would barely move the needle on what's presented.

64/ For the euro, its accounting creation began in 1999, and it started circulating in 2002. Prior to 2002, we are building a blended monetary base for the euro back to 1970, and as of now, include 3 of the very largest: the Deutsch mark, the French franc, and the Italian lira.

65/ To be absolutely clear on the global fiat blended inflation rate: it's calculated using a weighted factor of each country's base money supply, based on how large their US$ equivalent actually is, during that month. This weight evolves as more currencies are added.

66/ As we look back in time, for those currencies that weren't established, they didn't factor into that period's global inflation. For example, the US dollar's weight itself was 40% of the pie in 1970, and only 19% today, as (among others), data on China begins only in Dec-1999.

67/ Regarding compound annual growth rates: they're always calculated from monthly fiat unit growth, then compounded to annual (to the 12th exponent). This is necessary due to cases like Brazil and Argentina, which had 6 and 4 different currencies respectively, since 1970 alone.

68/ Continuing, a compound annual growth rate from a 1970 currency to 2020 currency doesn't make sense for Brazil. So the *monthly* rate must be taken across time and then compounded, ignoring those 6 months when the central bank reset (slashed zeroes) from the old currency.

69/ And finally, the mechanics of this method (compounding monthly growth rates to annual) were of course repeated across gold, silver, & bitcoin's supply curves, for consistency. The only exception is the TTM column in the summary (coming). There it's simple year-on-year growth.

70/ On our podcast @crypto_voices, we explore the varying economic nuances of #Bitcoin as a contender for the global monetary base, for global money, for the prospect of it achieving ultimate settlement status.

71/ To sum up, this graphic includes all items. Print it out if you like. The base money of 113 nations is reflected inside the top 30 currencies, and it summarizes gold, silver, and the supply of bitcoins. It is a supply-side summary of essentially all basic money in the world.

The Crypto Voices *Global Monetary Base*

The *MONETARY BASE* is also known as Base Money, High-Powered Money, Outside Money, and Reserve Money, among other names.
The *MONETARY BASE* is the ultimate asset of settlement. It is the most irreducible form of "Money" in the system.
It is presented here, globally, across three basic time periods: Past, present, and future.

This table summarizes present base money; namely, the global fiat supply:

Fiat production	Fiat unit	Exchange rate regime	*Present* base money: Fiat supply				GDP rank	Compound annualized growth rates			Doubling rate since begin date	Begin date	Latest date
			Fiat trillion	US$ trillion	Fiat weight	Global rank		Latest month (more noise)	TTM (less noise)	Since begin date (least noise)			
United States	dollar	Free floating	$5.21	$5.21	19.3%	4	1	30%	52.0%	9.0%	8.0 years	Dec-1969	Dec-2020
China	yuan	Other managed arrangement	¥33.04	$5.06	18.8%	5	2	81%	1.9%	12.2%	6.0 years	Dec-1999	Dec-2020
Eurozone nations	euro	Free floating	€5.00	$6.11	22.7%	2	3	14%	57.7%	10.9%	6.7 years	Dec-1969	Dec-2020
Japan	yen	Free floating	¥617.61	$5.99	22.2%	3	4	26%	19.2%	12.2%	6.0 years	Jan-1970	Dec-2020
United Kingdom	pound sterling	Free floating	£0.86	$1.18	4.4%	6	5	7%	55.0%	12.2%	6.0 years	Dec-1969	Dec-2020
India	rupee	Floating	₹33.14	$0.45	1.7%	10	6	0%	14.9%	13.7%	5.4 years	Jun-2001	Dec-2020
Canada	dollar	Free floating	$0.46	$0.36	1.3%	11	7	73%	377.9%	10.3%	7.1 years	Dec-1969	Dec-2020
South Korea	won	Floating	₩233.30	$0.21	0.8%	13	8	13%	18.3%	18.2%	4.1 years	Dec-1969	Nov-2020
Russia	ruble	Free floating	18.47 ₽	$0.25	0.9%	12	9	-10%	9.8%	26.9%	2.9 years	Dec-1994	Dec-2020
Brazil	real	Floating	R$0.41	$0.08	0.3%	20	10	26%	29.6%	101.8%	1.0 years	Dec-1969	Dec-2020
Australia	dollar	Free floating	$0.18	$0.14	0.5%	15	11	-38%	59.0%	11.5%	6.4 years	Dec-1969	Dec-2020
Indonesia	rupiah	Floating	Rp1,147.20	$0.08	0.3%	19	12	510%	3.2%	20.1%	3.8 years	Jan-1990	Dec-2020
Mexico	peso	Free floating	$2.12	$0.11	0.4%	17	13	111%	21.6%	23.8%	3.2 years	Dec-1985	Dec-2020
Switzerland	franc	Floating	CHF0.72	$0.81	3.0%	8	14	-17%	21.5%	11.8%	6.2 years	Dec-1969	Dec-2020
Turkey	lira	Floating	₺0.38	$0.05	0.2%	24	15	133%	87.6%	44.5%	1.9 years	Dec-1980	Dec-2020
Taiwan	NT dollar	Free floating	NT$4.84	$0.17	0.6%	14	16	18%	12.5%	13.3%	5.6 years	Dec-1969	Dec-2020
Iran	rial	Free floating	Rial4,075.40	$0.02	0.1%	32	17	33%	29.7%	28.6%	2.8 years	Apr-1973	Dec-2020
Poland	złoty	Free floating	0.38 zł	$0.10	0.4%	18	18	189%	26.4%	13.3%	5.5 years	Dec-1996	Dec-2020
Sweden	krona	Free floating	0.94 kr	$0.11	0.4%	16	19	-42%	88.9%	13.6%	5.5 years	Dec-1969	Dec-2020
Thailand	baht	Floating	฿2.33	$0.08	0.3%	21	20	119%	12.6%	11.3%	6.5 years	Dec-1970	Dec-2020
Nigeria	naira	Stabilized arrangement	₦13.10	$0.03	0.1%	29	21	-85%	51.1%	27.1%	2.9 years	Dec-1969	Dec-2020
Israel	new shekel	Floating	₪0.16	$0.05	0.2%	25	22	5%	22.0%	15.4%	4.8 years	Jan-1995	Nov-2020
Argentina	peso	Floating	$2.23	$0.03	0.1%	30	23	1%	33.2%	103.0%	1.0 years	Dec-1969	Nov-2020
Philippines	peso	Floating	₱3.40	$0.07	0.3%	22	24	95%	5.1%	13.9%	5.3 years	Jul-1993	Dec-2020
Norway	krone	Free floating	0.08 kr	$0.01	0.0%	33	25	103%	5.6%	23.3%	3.3 years	Dec-1969	Nov-2020
Singapore	dollar	Crawl-like arrangement	$0.09	$0.06	0.2%	23	26	21%	15.6%	7.7%	9.3 years	Jan-1991	Dec-2020
Malaysia	ringgit	Floating	RM0.15	$0.04	0.1%	28	27	26%	-15.6%	9.9%	7.4 years	Dec-1975	Dec-2020
South Africa	rand	Floating	R0.30	$0.02	0.1%	31	28	-11%	3.6%	13.6%	5.4 years	Dec-1969	Dec-2020
Colombia	peso	Floating	$132.67	$0.04	0.1%	27	29	325%	21.6%	20.7%	3.7 years	Jan-1982	Dec-2020
Pakistan	rupee	Other managed arrangement	Rs7.65	$0.05	0.2%	26	30	12%	14.1%	15.0%	5.0 years	Dec-2004	Dec-2020
Global fiat supply				**$26.98**	**100%**			**31%**	**34.7%**	**12.8%**	**5.8 years**	**Dec-1969**	**Dec-2020**

*Fiat base money means, "**Physical currency in circulation**, plus **commercial bank reserves** deposited at the central bank." Both are **monopoly** privileges of a nation's central bank, and exist as **liabilities** on its balance sheet.*
*Fiat base money is thus **debt-based**, or **liability-based**.*
Any other fiat money supply (M1/M2/M3/shadow banking) is comprised of claims on base money, and thus is simply incomparable to gold, silver, and bitcoin. To be clear, the author does not imply that claims on base money are fraudulent nor economically problematic.
The above stock of fiat base money is sourced from central bank balance sheets. It is reflective of the following country & currency breakdown; all except for the line "Remaining FX regimes":
Displayed supply, growth rates, and pricing (FX) data is as of "latest date" on right.

Note per euro: The euro's fixed rate accounting introduction began in 1999 and is included since then; before 1999, the currencies thus far compiled here are three of its largest components (German mark, French franc, and Italian lira).

*Currency exchange rate regime**	*Countries*	*Currencies*	*% of global GDP*	*% of global population*	*Further notes*
As defined in above fiat table	**48**	**30**	**90.6%**	**73.0%**	***Actually included in above table***
No separate legal tender	*13*	*n/a*	*0.2%*	*0.4%*	*De facto included in above table*
Currency board	*11*	*6*	*0.5%*	*0.3%*	*De facto included in above table*
Conventional peg	*41*	*28*	*2.8%*	*4.7%*	*De facto included in above table*
De facto subtotal above fiat table	***113***	***64***	***94.2%***	***78.3%***	
Remaining FX regimes	*78*	*78*	*5.8%*	*21.7%*	*Mostly "managed" FX regimes*
Global fiat supply total	***191***	***142***	***100%***	***100%***	

**These categorizations of currency regimes are according to the IMF's "Annual Report on Exchange Arrangements and Exchange Restrictions 2019."*

This table summarizes past base money; namely, the global gold & silver supply:

Gold & silver production	Metal unit	Exchange rate regime	Past base money: Gold & silver supply				Fiat multiple	Compound annualized growth rates			Doubling rate since begin date	Begin date	Latest date
			Troy ounce billion	US$ trillion	% of fiat	Global rank		Latest month	TTM	Since begin date			
Global gold supply	**troy ounce**	**Market**	**5.35 oz.**	**$9.63**	**35.7%**	**1**	**2.8x**	**1.8%**	**1.8%**	**1.8%**	**39.2 years**	**Dec-1969**	**Dec-2020**
Global silver supply	troy ounce	Market	27.66 oz.	$0.75	2.8%	9	36.1x	1.1%	1.1%	1.5%	47.9 years	Dec-1969	Dec-2020

Note this stock reflects the "realistically available" supply of gold & silver ounces above ground; these are own estimates, cross-referenced with other research such as from CPM Group. The supply values presume all metal that is "not lost" to industry.
*Gold & silver are demanded naturally in the market. They are thus **asset-based**.*
Displayed growth rates are as of "latest date" on right.
Displayed supply data is updated annually upon year end, estimated quarterly thereafter.
Displayed pricing (FX) data is as of "release date" below.
Gold & silver supply data sourced from industry expert Nick Laird.

$1,800 = ***Market** gold price per ounce reflected in this summary.*
$5,042 = ***Theoretical** gold price per ounce **if total absorption of fiat** (total fiat value divided by gold supply). **Calculation, not prediction**.*
$27 = ***Market** silver price per ounce reflected in this summary.*
$975 = ***Theoretical** silver price per ounce **if total absorption of fiat** (total fiat value divided by silver supply). **Calculation, not prediction**.*

This table summarizes "possible," future base money; namely, the global bitcoin supply:

Bitcoin production	Digital unit	Exchange rate regime	*Future* base money: Bitcoin supply				Fiat multiple	Compound annualized growth rates			Doubling rate since begin date	Begin date	Latest date
			BTC million	US$ trillion	% of fiat	Global rank		Latest month	TTM	Since begin date			
Global bitcoin supply	**bitcoin**	**Market**	**฿18.63**	**$0.88**	**3.3%**	**7**	**30.5x**	**1.8%**	**2.3%**	**64.3%**	**1.4 years**	**Jan-2009**	**Feb-2021**

Note this stock reflects the "all-time, cumulative" supply of bitcoins mined (latest UTXO set); however, many studies have been conducted on Bitcoin's "spendable" supply, some suggesting as many as 4 million bitcoins may have been permanently lost, frozen, or burned.
If Bitcoin does indeed become base money of the future, the author envisions converting the "unit of account" in these tables, from US$, to BTC; though this future "date" is not known nor guaranteed, it will occur as bitcoin's "Fiat multiple" converges on 1.0x (and beyond).
*Bitcoin is demanded naturally in the market. It is thus **asset-based**.*
Displayed supply, growth rates, and pricing (FX) data is as of "release date" below.
Bitcoin supply data sourced from Coin Metrics.

$47,500 = ***Market** price per bitcoin reflected in this summary.*
$40,097 = ***Theoretical** price per bitcoin **if total absorption of silver** (total silver value divided by bitcoin supply). **Calculation, not prediction**.*
$517,036 = ***Theoretical** price per bitcoin **if total absorption of gold** (total gold value divided by bitcoin supply). **Calculation, not prediction**.*
$1,448,262 = ***Theoretical** price per bitcoin **if total absorption of fiat** (total fiat value divided by bitcoin supply). **Calculation, not prediction**.*

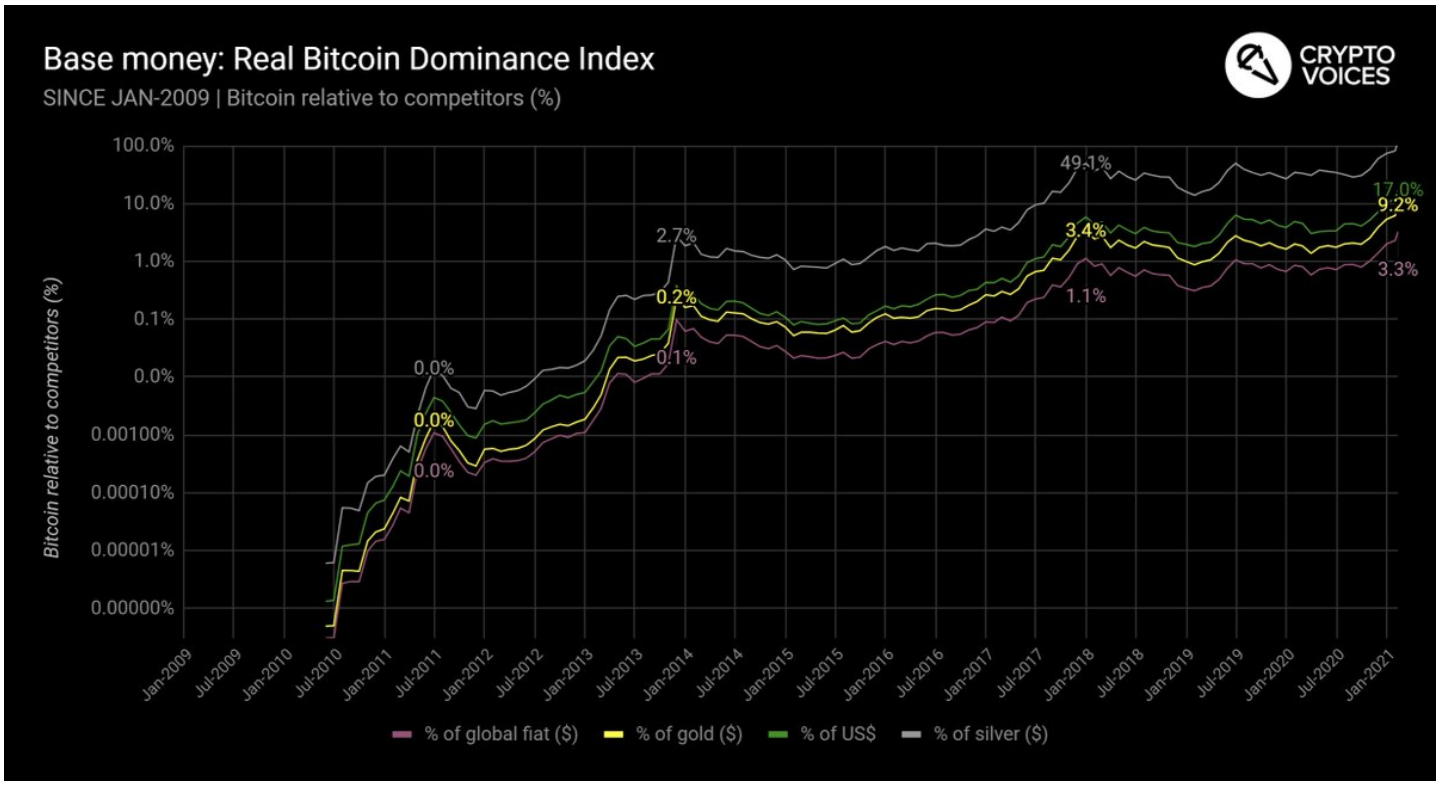
Table release date: 12-Feb-2021
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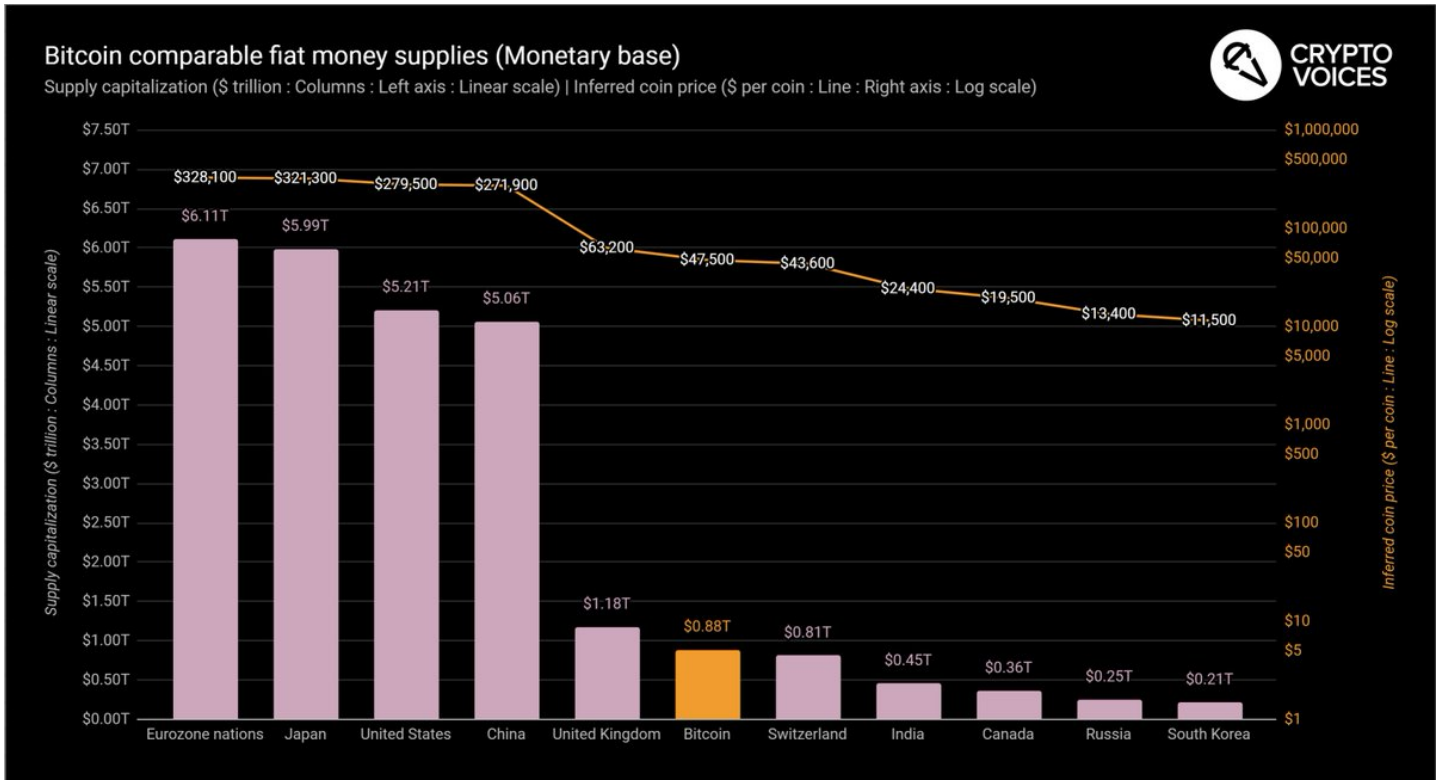
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72/ Head over to https://t.co/I5lXV9vbUy or https://t.co/UgTHz0dfAt to learn more. Fiat base money is sourced from central bank balance sheets, wonderful gold and silver history from industry expert Nick Laird, and bitcoin from @coinmetrics.

73/ These penultimate graphics illustrate how Bitcoin's supply (US$ equivalent) compares across all other basic money, past and present. Bitcoin sits at 3%. Highest ever. The #RealBitcoinDominanceIndex.



74/ And finally, let's show again what it takes for #Bitcoin to surpass the Big 4 currencies' monetary base values. Again, with the definite caveat that these are calculations, not predictions… that chart is here.



75/ More to come in the future. We are continuing to work on this topic. Any sats you might spare to contribute are very much appreciated, and will help keep up the research. Donations in $BTC may be made here: https://t.co/xyvl2bjKIs

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