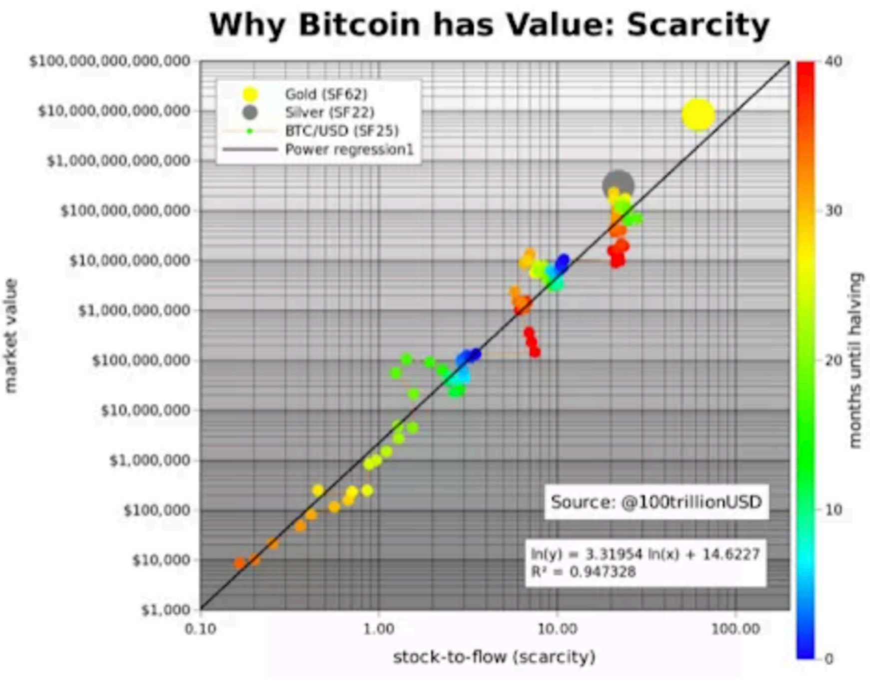
Finance

1. *Write a 500-word explanation of Bitcoin stock-to-flow model and make an argument for why it is a bad model?*

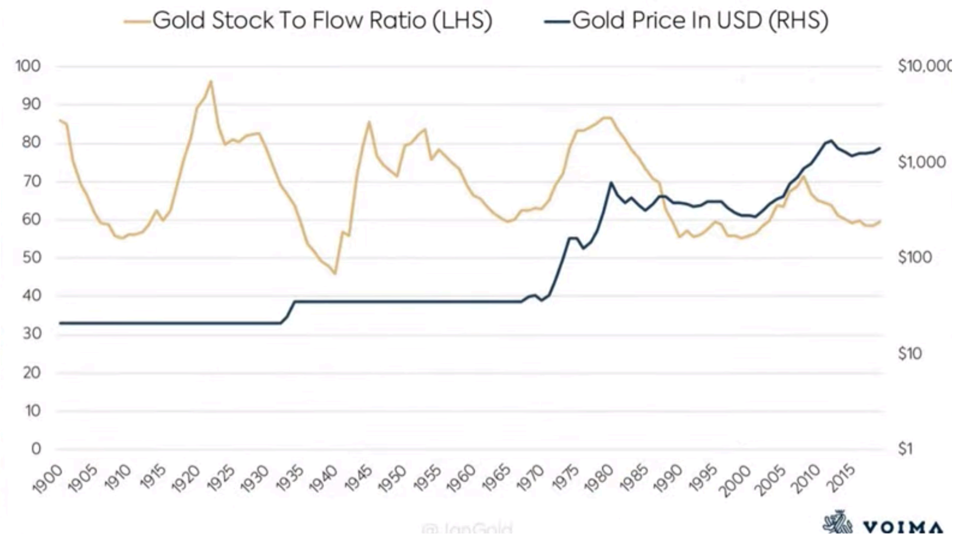
The bitcoin stock-to-flow model essentially assumes that bitcoin behaves like commodities such as gold and silver. These commodities maintain their value over long periods because of how hard it is to increase their supply significantly over a short period(i.e., searching, finding, and then mining gold is costly and takes a lot of time). Bitcoin has the same scarcity, as it takes a lot of electricity and computing effort to produce.

Stock-to-flow ratios can be used to explain the effect of scarcity on the commodity on its value. The stock-flow ratio compares the current stock of a commodity to the flow of new production. For any consumable commodity, doubling supplies will crash the price, implying a lower stock-to-flow ratio for said commodity. Gold, however, has a high stock-to-flow ratio, indicating its scarcity and its value, and the SF model assumes that the same is the case for bitcoin. This model then assumes that scarcity, as measured by stock-to-flow, directly drives value. This model then plots the USD Market cap of bitcoin against its stock-to-flow ratio and places two arbitrary chosen stock-to-flow points for gold and silver.



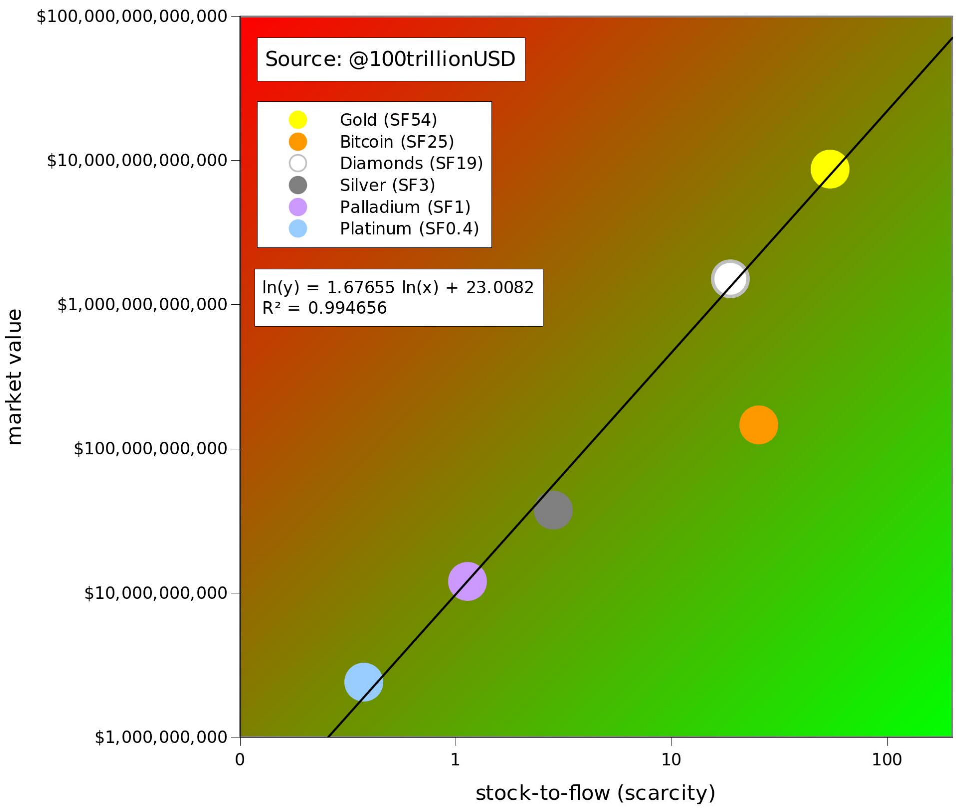
Source: "*Modeling Bitcoin value with scarcity*", by PlanB

There are many problems with this model. We could start with how bitcoin's SF is graphed over time and gets higher progressively, but it assumes gold's SF to be fixed, when in reality, over time, gold's SF over the last 120 years has been far from stable, going as low as 45 and as high as 90. Also, if we assume that the stock-flow-ratio directly drives prices, then over the last 120 years, we should expect gold prices to move in the same fluctuating wave-like pattern as its stock flow-ratio, but this is not the case.



Source: *Voimagold*

The stock-to-flow model makes no mention of demand, which is a fundamental part of economics. It completely assumes demand and relies solely on supply to estimate value, which is a bit of an oversimplification of things, as both demand and supply influence prices.
Also, if we assume that stock-flow ratio directly drives the commodity price, then by that logic, gold should be worth more than palladium since gold's SF is significantly higher than palladium's; however this is not the case.



The price of palladium per oz. is greater than that of gold even though gold's SF is significantly greater than palladium.

Also, the stock-to-flow model is not able to predict the value of other cryptocurrencies with higher stock-to-flow ratios.
If we follow the stock-flow-model, then we assume that bitcoin's price will exponentially increase until infinity, which is not a realistic assumption.
Most of the assumptions made in this model are very well known to be false, and so the model can be rejected based on the fact that it already contradicts what we know to be true, and it cannot be relied upon to accurately predict the price of bitcoin. Even though it the price has followed its SF in the past, it is highly unlikely that this trend will continue.

2. *Yara Inc is listed on the NYSE with a stock price of $40 - the company is not known to pay dividends. We need to price a call option with a strike of $45 maturing in 4 months. The continuously-compounded risk-free rate is 3%/year, the mean return on the stock is 7%/year, and the standard deviation of the stock return is 40%/year. What is the Black-Scholes call price?*

<u>Solution</u>

Black-Scholes formula

$$C = S_t N(d_1) - Ke^{-rt} N(d_2)$$

$$d_1 = \frac{\ln\left(\frac{S_t}{K}\right) + \left(r + \frac{\sigma_v^2}{2}\right)t}{\sigma_s \sqrt{t}}$$

$$d_2 = d_1 - \sigma_s \sqrt{t}$$

Stock price= $40
Strike price=$45
Risk-free rate=3%
Mean return=7%
Standard deviation=40%

$$d_1 = \frac{\ln\left(\frac{40}{45}\right) + \left(0.03 + \frac{(0.4)^2}{2}\right)0.33}{0.4\sqrt{0.33}}$$

$$d_1 = \frac{-0.1178 + 0.0363}{0.23} = -0.354 \approx -0.35$$

$$d_2 = -0.354 - \left(0.4 * \sqrt{0.33}\right) = -0.584 \approx -0.58$$

Transforming d_1 and d_2 into their corresponding z values on a standard normal distribution table.

$$Z = \frac{X - \mu}{\sigma}$$

For d_1,

$$Z = \frac{-0.35 - 0.07}{0.4} = -1.05$$

For d_2,

$$Z = \frac{-0.58 - 0.07}{0.4} = -1.625 \approx -1.63$$

From a table for the cumulative area under the standard normal distribution table, we obtain

$$N(1.05) = 0.1469$$

$$N(-1.63) = 0.05155 \approx 0.0516$$

$$C = S_t N(d_1) - Ke^{-rt} N(d_2)$$

$$C = (40 * 0.1469) - ((45e^{-0.03*0.33}) * 0.0516)$$

$$C = 5.876 - 2.3 = 3.576$$

Black-Scholes call price is \$3.576