

On Sound Money Series

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On Sound Money

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Abstract. An essay on the hazards of unsound money, savings behavior under unsound monetary orders, the common fallacies of modern central banking, and the prospect of digital sound money.

1 Introduction

There are two types of money: sound money and unsound money. The theoretical differences are clear, but recognizing and choosing which to utilize, in practice, is hard, and usually comes with tradeoffs and consequences. Generally, money that is costly to create has served as the more reliable form of currency; the ability to create money inexpensively destroys the wealth of savers and therefore, the incentive to save. High creation cost currencies known as hard or sound money, such as those supported by a specie standard, maintain reliable mechanisms for restricting supply growth. In contrast, money that is easily prone to supply increases (such as most government-issued money), known as unsound money, is susceptible to rapid stock increases and the wealth depreciation of its holders. The printing of unsound money has often been used to finance national spending, effectively utilizing the future wealth of its citizens to fund the perceived needs of today's citizens. Evidence from the largest civilizations in history shows that sound money is necessary for progress and growth, and the lack of a stable monetary standard is generally associated with societal and economic destruction, like the collapse of the Roman Empire through its currency debasement. Digitally sound currencies such as Bitcoin may offer a solution to the historical and current problems of unsound money. At the same time, the practical adoption of non-sovereign sound money is

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not without risk, as it is diametrically opposed to the interests of the world's largest sovereigns and central banking institutions who control their currency supply. However, history has proven time and time again that once "sound" monetary media departs from this path via debasement, it will eventually be replaced by newer forms of more sound money.

2 Unsound Money

Government-issued money, like primitive money and most commodity-based monetary bases, is susceptible to rapid supply increases compared to its existing stock, and therefore could lead to a rapid loss of salability, diminishment of purchasing power, and depreciation of wealth of its current holders. With the suspension of the gold standard during early 1900s wartime, governments expanded money beyond their limited gold-back treasuries, spreading the liability of future repayment out to the entire population. In a sound monetary regime, a government's wartime expenditures are bound by the taxes it can collect and savings it has amassed over time (in the form of hard money treasury). With an unsound monetary regime, the only constraint is how much currency a government can create before each incrementally-created unit becomes exponentially less valuable (asymptotically approaches zero) and the future income and wealth of a government is naturally reduced with a decreased value of real tax receipts. In a fiat currency regime, value can appear simply through the creation of additional money, but only for as long as the population believes this new fiat to be valuable (whether through the future creation of actual wealth or the future promise of a currency supply contraction). World War I may have ended far sooner had European nations remained on the gold standard and not been able to continue their war efforts with limited treasuries through the expansion of fiat money. The Great Depression forced nations off the gold standard, while government control and socialization of the economy under Hoover and FDR continued to exacerbate the growth of unsound money; the Executive Order 6102 signed by FDR in 1933 forbade the ownership of gold coin, bullion, and certificates and essentially allowed the federal government to confiscate its citizens' wealth.

Hyperinflation is an economic phenomenon unique to rapidly inflatable commodity and government-controlled money. Given that the cost of production of government-issued money is effectively zero, creating currency in order to satisfy short-term consumption demand is tempting and can lead to a vicious cycle of borrowing from the future to satisfy the needs of the present. This cycle of hyperinflationary government activity can cause the wealth of a nation to slowly disappear. Hyperinflation extends beyond the extreme loss of a nation's wealth; it represents a complete collapse of the economic structure, production capability, and productivity of a society. The increasing monetary supply means a continuous devaluation of the currency, expropriating value from individuals who currently own

wealth (and who have amassed it over generations of sound saving behavior) to those who are first to receive the new money. This transfer of wealth from savers to “new money” is known as the Cantillon Effect: inflationary policy creates wealth for a government at the expense of current savers and holders, and the immediate beneficiaries are those who receive it once the government spends it.² In essence, inflationary policy eliminates the temporal element of future government income and wealth derived from citizen taxation by printing money and receiving it today. Whether the Cantillon Effect is a result of general inflationary policy or national emergencies that justify increased government spending, the expansion of government money creates far more serious longer-term issues if not managed by an ever-vigilant sovereign focused on restoring the soundness of its money as quickly as possible. And, given the lack of tangible historical examples of a successful “return to sound money,” it is increasingly concerning that excessive borrowing from the future to pay for the present may result in modern societies that are incapable of breaking this cycle.

Sound money makes the creation of wealth for some through the dilution of others nearly impossible; in a sound money society, the avenues for fundamental prosperity are societal efforts like production, mutual cooperation, wealth accumulation, capital savings, and trade. The 1900s marked the transition from sound money to unsound money backed by a government decree that denied a free market choice of monetary media and forced government-issued fiat into the hands of its citizens. Sound money enables freedom from authoritarianism and despotism; a state’s ability to create infinite money can give it undue influence over its citizens. This influence, by its very nature, can be abused and attract others with suboptimal agendas.

3 Savings & Time Preference

Time preference refers to an individual’s preference for current consumption over future consumption. Sound money is a prerequisite for individual time preference choices, a critical and commonly ignored element of personal decision making. Those with higher time preference are more focused on their well-being in the present and immediate future, while those with lower time preference place more emphasis on their well-being in the longer-term future. But this concept extends far beyond the basic preference of the individual to consume; the economist Hoppe explains that once time preference of individuals drops low enough across a broad enough base of the population to allow for the production of widespread capital goods, it initiates the “process of civilization.” Per the original publication, the process of civilization is “a positive feedback loop where time preferences perpetually decrease due to the accumulation of capital, the increase of the relative value of

² Cantillon, R. (1755). *An Essay on Economic Theory (Essai sur la Nature du Commerce en Général)*. <https://doi.org/10.1215/00182702-1811397>

future goods, the further division of labor, and the lengthening of life expectancies.”³ The consequences of the converse, a situation in which time preferences increase enough across a broad enough base of the population, decreases the accumulation of capital, reduces the relative value of future goods, depresses productivity, and lowers the aggregate quality of life.

Microeconomics focus on individual decisions, and among the most important economic decisions any individual can make are the tradeoffs made today with their future selves. The better money can retain its value through time, the more individuals (all else being equal) are incentivized to postpone present consumption and instead dedicate capital and resources for future production, leading to higher capital accumulation and improved quality of life. In instances where money does not retain its value through time, individuals are incentivized to consume in the present rather than save and commit capital for the future, eventually leading to suboptimal capital allocation decisions and lower aggregate wealth levels. Unsound monetary standards have profound effects on societies in the long run: society saves less, accumulates fewer resources, and consumes its capital at a faster pace. What’s worse is that it occurs in an almost paradoxical fashion, as individuals only “see” the short-term effects of an increased ability to consume, while continuing to fuel the long-term wealth decline of the society.

Societies and economic progress thrive under a sound monetary system; this progress disintegrates when monetary systems are debased. The Roman Empire collapsed in part due to the debasement of the Roman silver currency, the denarius. Trade was vital and responsible for generating the vast majority of the wealth among Roman citizens. It also allowed the capital to pay for the administration, logistics, military, and control of its 130 million people over 1.5 million square miles. In order to finance present spending, the denarius, originally comprised of 4.5 grams of pure silver, was debased; the coin’s silver content was reduced from 90% to 50% (the economic equivalent of printing additional fiat currency today). Throughout the 2nd and 3rd century, the currency was continually inflated; eventually the silver content was reduced to just 0.5%, the equivalent of having increased the supply of the denarius by 180x. The debasement of the denarius was initially intended to increase overall prosperity via empire financing. However, citizens did not reap the benefits of the debasement and imperial expansion. With soaring logistical and administrative costs, particularly those associated with financing the Roman Empire’s military efforts, everyday commerce became increasingly challenged. Romans levied higher taxes on the citizens of the Empire, eventually leading to hyperinflation, a fractured economy, localization of trade, a financial crisis, and a return to inefficient barter methods. Similar dynamics can be studied across the fall of the Byzantine empire and the modern-day struggles of European societies.

³ Hoppe, H.-H. (2001). *Democracy, The God That Failed: The Economics and Politics of Monarchy, Democracy, and Natural Order*. Transaction Publishers. <https://doi.org/10.1111/1467-8365.12281>

Unsound money controlled by central banks, whose express task is to keep inflation positive, adds potentially (and increasingly) adverse incentives for individuals to save. Only returns that are higher than the rate of inflation of the currency are positive in real terms, which creates incentives for higher-return but higher-risk investments and accelerated spending. In the twentieth century, savings rates, on average, have declined alarmingly across developed nations, particularly after the suspension of the gold standard (Fig. 1). Meanwhile, household, municipal, and national debts have increased considerably.

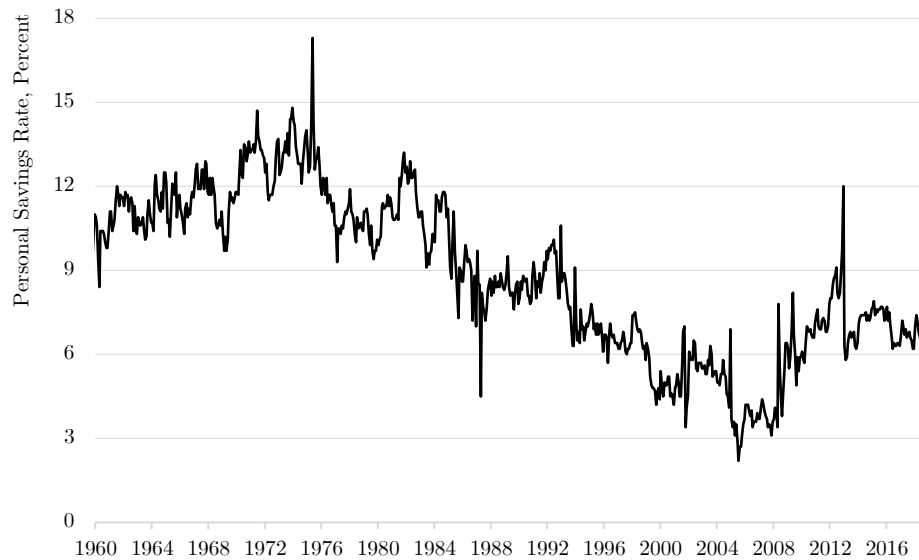


Fig. 1: US Personal Saving Rate, Seasonally Adjusted.⁴

Keynesian high time preference thinking with abstained saving and urging of consumption as the key to economic prosperity has transformed capitalism, a system originally based on saving and capital accumulation, into a system of immediate gratification and consumption. Long-term economic growth is unavoidably driven by delayed gratification, saving, and capital investment, thereby extending the production cycle and increasing productivity. The transition from sound money to unsound money has led to wealth depreciation, a significant increase in consumption, and debt as the commonplace method for funding such consumption.

⁴ Federal Reserve Bank of St. Louis. (2019). US Personal Saving Rate, Percent, Monthly, Seasonally Adjusted Annual Rate.

4 Central Banking

In *The Use of Knowledge in Society*, Hayek argues that prices are information and a communication system of economic production amongst an economy that coordinates complex processes for production in a free market system.⁵ A breakdown in the ability for prices to communicate information causes interruptions in economic activity, as the economy can no longer appropriately understand and measure resource scarcity and economic costs. Capitalist systems cannot properly function without a free market determination of the price of capital through the interaction of supply and demand, allocation of capital goods, and economic decisions driven by price signals. The adoption of the modern Keynesian capitalist structure (as opposed to traditional accumulation-based capitalism to which the authors remain fervent disciples) has led to interest rate manipulation and monetary debasement, which eliminates the incentive to accumulate capital and creates distortions in normal business cycles. Eventually, the mispriced cost of capital through interest rate manipulation and lending capital to negative net present value endeavors result in recessions and depressions.

Keynesians believe that business cycles are a result of flagging “animal spirits” and that central bankers and the government can engineer recoveries and growth through the printing of new money and higher government spending of newly minted unsound money. However, economic logic shows that such actions attempt to conceal critical economic issues with the hope that new economic activity will catch up in time. History shows that the manipulation of money and the meddling of price discovery mechanisms increase the severity of recessions, particularly under the erroneous notion that central banks can prevent or manage recessions. Central bank control of a money supply and interest rates distorts signals and incentives market participants use to manage their consumption and production, which can lead to a misallocation (sometimes to a severe degree) of capital and resources and potentially extensive failures (and layoffs) across industries. Sound money forces all market participants to be capital and resource efficient, and governments to be fiscally responsible. Without the presence of a central bank, individuals in a free market for money would likely choose reliable currencies (those with the highest stock-to-flow ratio) which fluctuate the least with changes to the demand or supply of the currency. Such a concept is not unprecedented: prior to the pervasion of Keynesian economics and the creation of floating exchange rates, individuals were able to create global business plans, denominated in any currency, without much regard for exchange rate fluctuations.

⁵ Hayek, F. (1945). *The Use of Knowledge in Society*. *The American Economic Review*. <https://doi.org/10.1017/CBO9780511817410.007>

5 Data in Review

In the last century, global central banks have printed exceptional quantities of money and, through their symbiotic and “independent” relationship with local governments, created substantial debt levels. Central banks and governments have in practice worked in concert to create and maintain business cycles through the issuance of debt by governments (fiscal policy) and the subsequent open market purchases, with self-created money, made by central banks (monetary policy). Having taken domestic money off the gold standard, central banks were free to print money, finance war efforts, and engineer business cycles. By tapping into a central bank’s money press, the government could incur as much debt as it wanted, because, as Nobel Prize laureate Krugman puts it, *we owe it to ourselves*. Over the last century, global debt has skyrocketed while fiat money is continuously debased through over-printing.

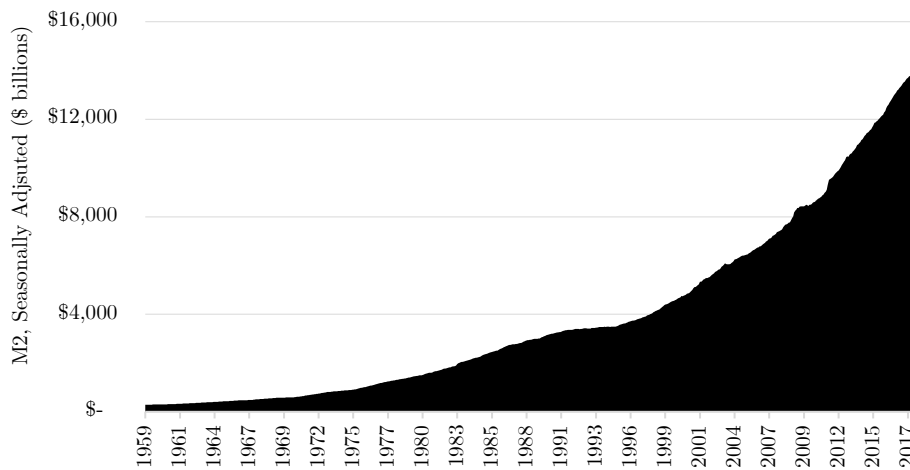


Fig. 2: United States Dollar - M2 Money Stock.⁶

Figure 2 depicts the growth of the US dollar money stock and Figure 3 shows the growth of national debt of select countries since the 1970s. Money stock and federal debt increased dramatically following the 2008 Financial Crisis as central bankers were left with the possibility of a deep global depression. The federal government spent money it raised from the sale of Treasuries to engineer growth, as the US federal debt significantly increased from \$9.2 trillion at the end of 2007 to \$20.5 trillion at the end of 2017. The M2 US money supply nearly doubled in just ten short years, increasing from \$7.5 trillion in December 2007 to an estimated \$14.3 trillion by September 2018. Similar dynamics can be seen across the world’s major governments and central banks.

⁶ Federal Reserve Bank of St. Louis. (2018). M2 Money Stock, Billions of Dollars, Monthly, Seasonally Adjusted.

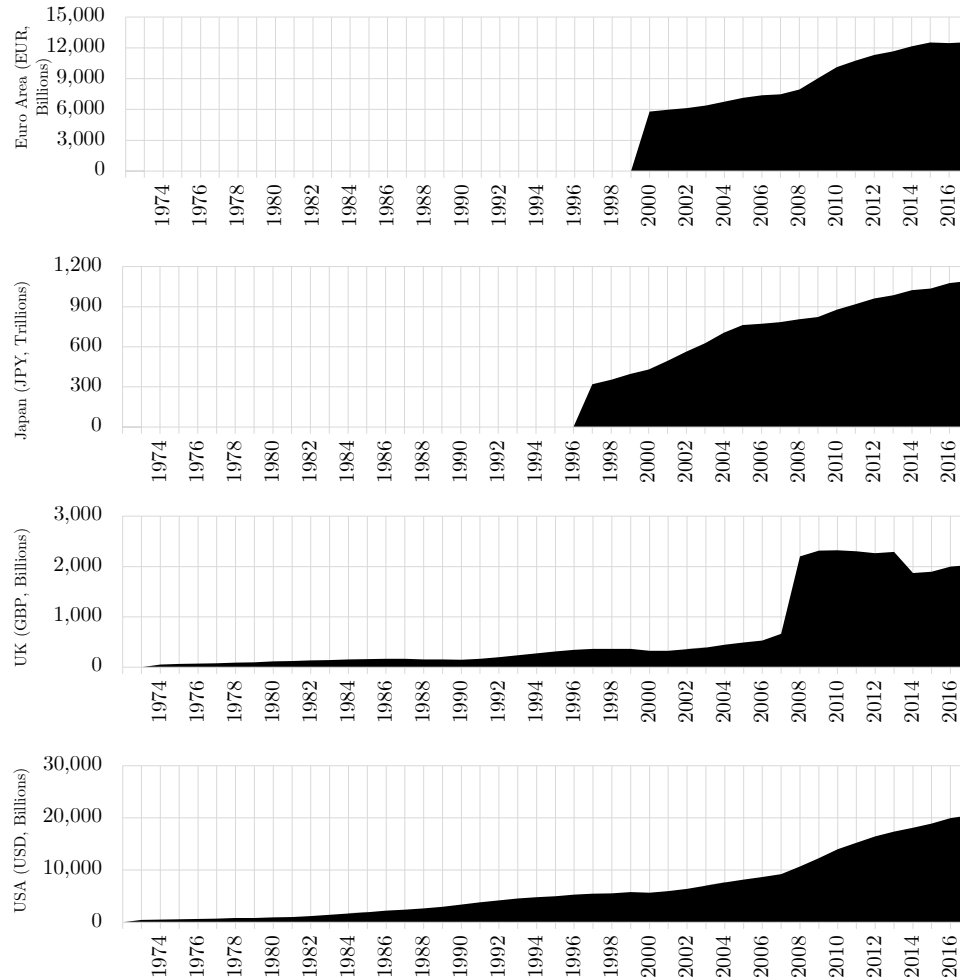


Fig. 3: Government Debt.⁷

While increased monetary debasement and government deficit spending succeeded in increasing nominal GDP and temporarily preventing a deep global depression, the actions came at a significant price: general government debt-to-GDP ratios rose as government debt rose faster than the GDP the nation created with the increased spending and federal deficits. Figure 4 shows the growth of debt-to-GDP ratios across the largest global economies.

⁷ Bloomberg L.P. (2018). Government Debt Data. Bloomberg L.P.

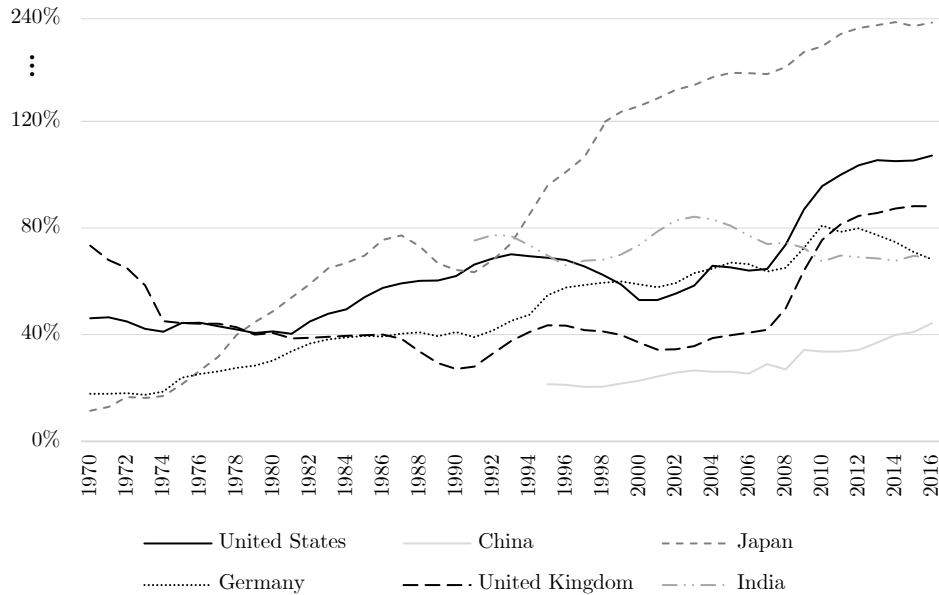


Fig. 4: General Government Debt (Percent of GDP).⁸

Since debt-to-GDP ratios are indicative of an economy's health and a key factor in government finance sustainability, rising debt-to-GDP ratios suggest untenable federal spending practices and inevitably lead to either currency collapses or long periods of financial austerity (depending, in part, on whether its debt is denominated in local or foreign currency). The spending enabled by deficits and debt accumulation will need to be paid back with periods of lower spending. Without periods of lower spending, governments will be unable to pay rising debt interest payments, which will lead to continuous printing of money to cover the nominal cost of debt, and heavier taxes. This will depress economic growth, decrease confidence in the currency, and create a deeply inflationary (and perhaps even hyperinflationary) cycle. A government's debt level, sustainability and credibility as a lender, money stock changes, and the strength of a currency are all closely linked; if any fall out of sync at any point, it can incite a monetary and financial crisis. Although it's hard to know what specifically tips the balance, and when, crashes of past imperial powers show us the severe consequences that result from a lack of government credibility as a lender, uncontrolled money debasement, or fading confidence in a currency.

⁸ OECD. (2018). General government debt. Retrieved from <https://data.oecd.org/gga/general-government-debt.htm>

6 Sound Digital Money

In the search for a digitally sound money, Bitcoin was the first digital payment system that did not rely on a trusted third-party intermediary. Bitcoin is verifiably digitally scarce with a known supply issuance in perpetuity: the total supply is limited to 21 million bitcoin and employs a variant of Milton Friedman’s k -percent rule where the annual money supply growth is fixed.⁹ Supply issuance declines every 210,000 blocks (approximately every 4 years) as the block reward halves. At its introduction in 2009, bitcoin’s block reward was 50 bitcoin per block, and halved to 25 bitcoins in 2013 and 12.5 bitcoin in 2016. In contrast to modern central banking where newly issued money is used to finance government spending and lending, newly issued bitcoins are provided as compensation to individuals who expend resources to update the distributed ledger, and more importantly are “created” under a fixed, known, and unalterable issuance schedule (Figure 5).

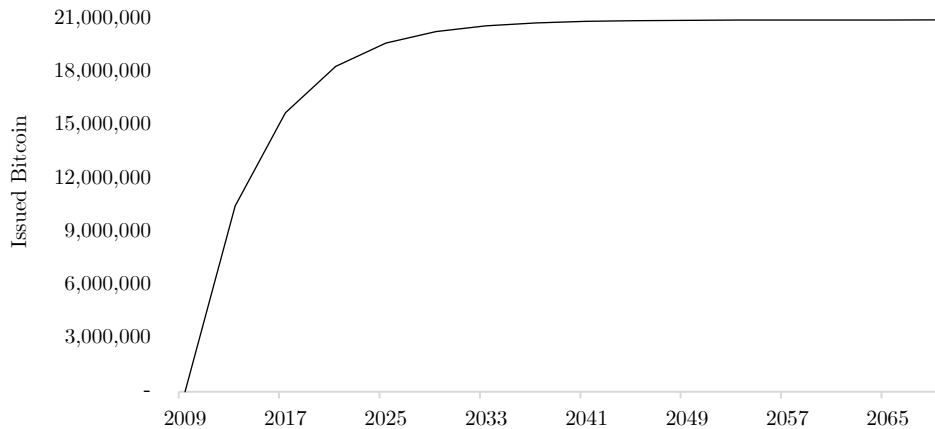


Fig. 5: *Bitcoin Supply Issuance*.¹⁰

The difficulty adjustment in Bitcoin, or the method that modulates supply creation with increased network resources acts as a reliable method for limiting the stock-to-flow ratio increases and makes bitcoin fundamentally unique from all other forms of money. Growth in bitcoin’s value cannot increase its supply, which makes it a durable hard money – the supply of the network is naturally bound by the hard-coded algorithm and the dynamically adjusted difficulty of the network. Furthermore, the asymmetric costs of performing the “proof-of-work” necessary to validate transactions and those of verifying completeness and truthfulness is inherent

⁹ Bitcoin with an uppercase B refers to the network, bitcoin with a lowercase b refers to the monetary unit in the network.

¹⁰ Blockchain Luxembourg S.A. (2018). Bitcoins in circulation. Retrieved from <https://www.blockchain.com/charts/total-bitcoins>

network security, as it is relatively difficult and expensive to perform the calculations in the first place but trivial to verify the computations are correct.

The presence of a conservative monetary policy and the difficulty adjustment theoretically allows bitcoin to succeed as a digital store of wealth and as a transferable monetary media. While many will point towards bitcoin's volatility as an insurmountable hurdle for its adoption as a store of wealth or transactional currency, its volatility today, while still early in its global adoption, is a result of its programmable, inflexible supply and predetermined growth rate; demand changes of the underlying units do not affect the creation or destruction of the units. Therefore, as bitcoin adoption increases (and bitcoin market capitalization increases given its fixed, known supply), each incremental adopter will, by definition, have a decreasing impact on the price of bitcoin, leading to lesser volatility in the long run. So, while bitcoin's volatility is natural and expected during its early stage of global adoption, it should not be confused with its expected volatility at mature adoption. Bitcoin is one of the very few assets that has strict limited scarcity and the only monetary media that is guaranteed to not be debased – properties that make it a fundamentally good store of value. In addition, bitcoin does not have any of the physical drawbacks of traditional money or stores of wealth – its cost and speed of transfer and general storage is a significant improvement over traditional media.

Bitcoin created an independent alternative mechanism for global payments that does not require a trusted third-party intermediary and can function entirely outside the existing financial system. Bitcoin combines the finality of cash settlement with the benefits of digitization, creating a fast method for large payment settlement across borders. While it may compete with central banks and large financial institutions that perform international payment settlements, Bitcoin has a distributed, verifiable ledger, cryptographic security, is practically resistant to threats, and bears no counterparty risk. If bitcoin achieves a long-term stability in value, it could be a superior alternative to unsound fiat money for global payments and serve as a truly decentralized way of storing wealth where transaction processors, developers, and users are in true equilibrium. Even if it does not become a ubiquitous alternative to central banking, it should, at the very least, provide an alternative to sound fiat money which can be leveraged by any global citizen in need of reprieve from local currency inflation.

For an asset that exhibits annualized volatility in excess of 50%, utilizing bitcoin for everyday economic transactions could be prohibitively challenging. However, it is imperative to consider a few key points. First, bitcoin's high volatility is primarily a function of high marginal demand relative to its existing stock and market capitalization (c. \$64bn as of February 2019). Should bitcoin's market capitalization grow to accommodate its demand fluctuations, its volatility should decline as marginal buying and selling are smaller relative to the outstanding value of the asset. Second, bitcoin today represents a speculative, venture-like investment for many who own the asset. Accordingly, investors should have higher expected

returns in order to compensate for the higher risk of the investment, and as a result should naturally expect higher volatility. Volatility should naturally decline as the ownership of the outstanding stock changes from speculative to more stable investors. Finally, bitcoin’s volatility is generally measured versus a fiat currency, primarily the US dollar. However, the value of sound money is not its value relative to other currencies, but rather its purchasing power versus a basket of goods and services. Bitcoin is designed to be a “stablecoin” against purchasing power, and therefore its volatility should be measured against its ability to purchase goods and services.¹¹ The vast majority of global economies experience positive inflation and have for the past century following the suspension of the gold standard. Positive inflation indicates that the value of an underlying basket of goods and services has appreciated versus the fiat currency it is tied to; conversely, it means that each unit of currency has reduced purchasing power and is marginally worse at its primary function (to pay for goods, services, and labor). Hence, the volatility of bitcoin, like other forms of money, should be measured against its purchasing power in local economies as opposed to that of other fiat currencies to account for real and not nominal volatility.

We highlight two seemingly opposing examples of purchasing power lost by unsound fiat currency to illustrate this phenomenon: the Venezuelan bolivar and the US dollar. In the first example, hyperinflationary policies in the late 2010s led to a massive depreciation of the bolivar, which led to an alarming eradication of individual wealth and extreme poverty for the vast majority of its citizens. At the end of 2018, Venezuela’s inflation rate topped 80,000% (2018-end estimates for Venezuela’s inflation rate wildly varied from 80,000% all the way to 1,000,000%), which means that each unit of local currency had effectively lost 100% of its purchasing power. Daily inflation was roughly 220%, or each \$100 was worth just \$31 a mere 24 hours later. This massive loss of purchasing power can also be observed in the United States dollar throughout the past century. From 1913 to 2018, the value of the US dollar fell over 96%. Figure 6 depicts the loss of purchasing power of \$100 US dollars since 1913. Over just the last ten years, the US dollar lost 16% of its purchasing power (\$4.70 to \$3.90 on Fig. 6’s scale). Though the loss of the US dollar’s purchasing power is more drawn out and less extreme than that of the Venezuelan bolivar, the stark conclusion is the same: fiat currencies have unarguably failed to maintain their purchasing power, perhaps money’s only core requirement and reason for existence. Despite its volatility and multiple bull-bear cycles, bitcoin has unequivocally increased its purchasing power, rising from \$0 to \$3500, in the ten years since its creation.

¹¹ Stablecoins are digital assets designed to maintain stable value against a real-world asset or basket through pegged collateralization or algorithmic adjustments. The most common stablecoins include digital representations of fiat currencies such as US dollars through collateralized deposits at a bank.

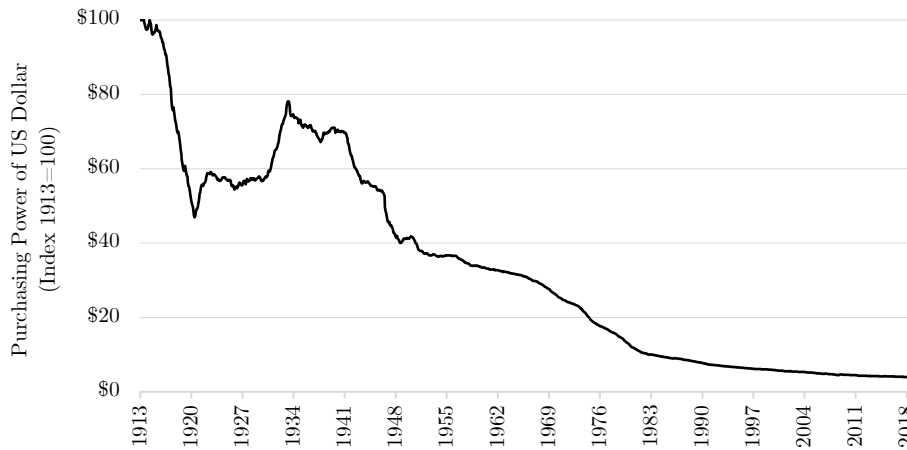


Fig. 6: Purchasing power of the US dollar, monthly.¹²

Other digital assets that exhibit characteristics of sound money with high stock-to-flow ratios, sufficient network and cryptographic attack resistance, and inflation protection can also serve as sound monies. The objective elements of a money must also be considered with its degree of social acceptance; money has value because society demands the benefit it offers in purchasing power for labor, goods, and services. Because society is willing to accept and give money as forms of payment, its value is derived in part from its social convention. It is entirely possible that bitcoin may be disrupted and lose market share to a future sound money. Sound monies with equivalent objective and social characteristics theoretically share the market for sound money, though in practice, network effects, feature sets, first mover advantages, and social convention create unequal growth rates and market shares. In this light, the search for digitally sound money begins with bitcoin, and has opened up the possibility for a more free and accessible global market for sound money.

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The authors would like to acknowledge Saifedean Ammous, PhD, author of *The Bitcoin Standard*, and Ray Dalio, founder of Bridgewater Associates and author of *Principles for Navigating Big Debt Crises*, for their influence on this essay. Ammous' book provided the initial inspiration for the authors to delve into the history, dynamics, and evolution of monetary systems; many of his views that the authors share present themselves in this work. Dalio's multi-decade study on understanding the engine of economic and financial systems, its cause-effect relationships, and models for navigating debt crises remain closely-held guiding principles for the authors.

¹² Federal Reserve Bank of St. Louis. (2019). Consumer Price Index for All Urban Consumers: Purchasing Power of the Consumer Dollar, Index 1913=100, Monthly, Not Seasonally Adjusted.

On Free Markets for Money

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Abstract. Current monetary standards have been relatively monopolistic and have caused significant wealth erosion of its holders through inflationary policies. However, the crypto asset innovations of the past decade have enabled a free market determination of the best forms of money for its users. A competitive market for money would lead to a free market determination of monetary standards and place natural disciplines on issuers to maintain the soundness of their money.

1 The Market for Monetary Standards

Similar to any good, service, or form of labor, monetary standards exist in a market, a process by which the price of money for goods and services is established. The market for monetary standards facilitates competition among competing forms of money, and the economic agents responsible for maintaining the monetary standard seek to obtain a share of a finite market chasing scarce resources. Effective usage of monetary standards enables trade and the distribution and resource allocation in societies. The market for monetary standards can emerge spontaneously or deliberately through human interactions in order to enable the exchange of ownership of services and goods.

Monetary standard markets have ranged from free markets, where the best forms of money competed and accurately signal costs and benefits, to monopolies, where monetary standards are controlled by a central agent. Some examples of “free money markets” include barter/commodity economies, free specie markets like early Mesopotamia and the Mongol empire, and even late 1800s America. In general, the common denominator for more competitive money markets have been fairly liberalized economic and political policies. In contrast, most monetary standard markets historically have existed as near monopolies in bounded economies. Whether it was an explicit government diktat or requirements for taxes due to be paid in a chosen media, monopolistic or oligopolistic conditions for monetary markets have persisted for the most part.

The history of money is well documented by many historians, particularly the monopolistic dynamics and externalities of government-issued money. Over the past two thousand years, the monopoly (whether natural or government dictated) of government-issued money has deprived societies and economies from discovering the best forms of

money through natural, free market processes. In nearly every instance of monopolistic government-issued money, governments with the ability to fully control issued money have resulted in rapid stock increases and the wealth depreciation of its holders, leading in many instances to economic collapses.

Prior to Bitcoin, the modern market for monetary standards had been monopolistic (or oligopolistic if one were to include other G20 currencies) and monetary standards were extremely similar to one another, sharing similar policies and control by centralized governments. The creation of Bitcoin and the innovations over the past decade have created an experimental testing ground for creating new forms of value and money. In our view, we believe that Pandora's box has been opened and natively digital currencies and forms of value (whether created as crypto assets or by private corporations) have borne an emerging market for monetary standards. While it is premature to say that we have a free market for money just yet, the US dollar's position as the global reserve currency is experiencing heightened competition from foreign sovereigns, crypto assets, and private corporate-issued money.

In competitive markets, open competition leads to innovation and product development, providing consumers with a wider selection and better products that serve the needs and wants of its users. In a competitive market for money, monetary standards would compete and lead to the best forms of money for its users. The requisite elements of money become the key points of competition and differentiation, leading to a free market determination of society's monetary standard.

2 Monetary Market Competition

There are three widely considered requirements for money: unit of account (ability to specifically measure value), medium of exchange (can be exchanged for good and service as an instrument and avoids the limitations of barter), store of value (ability to retain and exchange value at a future point in time). If a media satisfies these three elements, it can be considered as a form of money and does not need to be limited to what is more colloquially considered "money." Through this more macro lens, we can see that the categorization of money can extend beyond government-issued currencies, and include crypto assets designed to be money (whether they exist today or are new market entrants), new corporate-issued forms of money, and even digitized traditional assets that, due its newfound digitization and transferability, can be used to transfer value and pay for goods, services, and labor. If asset X can act as a unit of account, retain its value over time, and avoids the limitations of a barter system through market discovery of its price, it should be able to be used as money.

The first two requirements of money are no doubt critical, and hinge upon the ability for economic goods to be measured in discrete units of the media and for the media to have some sort of economic value in the present, a measurement of an asset's direct or indirect utility. Money has value because society demands the indirect benefit it offers in purchasing power for goods and services. Because society is willing to accept and give money as forms

of payment, its value is derived more so from a social convention as opposed to a government mandate. Money has ascribed value ultimately because of supply limitations and resource scarcity. If money was available in unlimited supply, it would be effectively free. Non-zero prices serve as a rationing mechanism whereby consumption is limited to the available supply.

We will focus our discussion on the 3rd requirement of money: store of value, perhaps the hardest requirement for money to achieve and retain. The focal determinant of money's ability to retain value is 1) high stock to flow ratios (thereby preventing the rapid increase in stock and loss of salability) and 2) lasting social conventions to accept the money. Government-issued money has historically been susceptible to losses in value, as the effectively zero cost of production and printing of unsound money to finance national spending creates a vicious cycle of borrowing from the future to satisfy the needs of the present and alarming devaluation of money. This phenomenon of irresponsible money stock management persists because there are no currently imposed disciplines on government issuers to control the quantity of money in an appropriate manner. The lack of monetary standard competition prevents the market determination of these natural disciplines, and furthermore changes the primary goal of an issuer from providing its citizens with good money to creating a system by which a government can tap into a money supply by owning its manufacturing process.

It is particularly peculiar that fiscally irresponsible governments exist in capitalist economies—capitalist economic participants such as corporations are required by the market to remain fiscally responsible to maintain and grow the value of their currency (i.e. their “stock”) through long-term growth, driven by responsible capital investment, the extension of the production cycle, and increased productivity. Natural market forces also place determinants on how a corporation manages its currency, preventing a company from grossly diluting current holders of their currency with market checks and balances. It becomes quite apparent that the stocks of many corporations could actually serve as better forms of money than many of the government-issued fiat currencies.

Monetary Policy

Monetary policy's impact and influence is unquestionably an important element in modern economies. Policymakers seek to achieve inflation, growth, interest rate, and employment objectives. Central banks use various tools, including open market operations, lending to banks, and bank reserve requirements, to achieve these objectives. It can be used in conjunction or as an alternative to fiscal policy, which federal governments use to manage the economy through a combination of taxes, government borrowing, and federal spending. Using its levers, central banks play a critical role in managing the rates of inflation, growth, and unemployment by increasing or decreasing the money supply and changing consumption and spending propensities through interest rate manipulation.

Productivity is a critical factor in the long-term wealth and health of societies. Improvements in economic productivity over time (increased aggregate outputs for the same aggregate inputs) causes a relative decrease in broad price levels if the money supply

remains constant: if the amount of goods produced in an economy are doubled but the amount of money stays the same, the cost of the goods are halved. Increases in economic productivity generally lead to increases in nominal labor income, as some of the profits generated by businesses flow to its labor. The relative changes in productivity and nominal labor income affect the ultimate inflation in an economy: if wage inflation is higher than productivity (holding consumption propensity and savings rate constant), there is “more money chasing fewer goods” and hence overall price inflation (the rise in the nominal cost of goods). Conversely, if productivity is higher than wage inflation, the cost of goods in an economy falls, or creates deflation.

Central banks play a deeply influential role in managing these dynamics of price level changes. It would stand to reason that with such influence, there should be express or market-driven disciplines that enforce a policymaker’s fiscal responsibility with how a nation’s money supply is managed to promote price stability, enduring purchasing power, and long-term prosperity. Yet, quantitative evidence shows the severe longer-term consequences of monopolistic control and the printing of money when gone unchecked. In particular, the US dollar has emerged as the primary reserve currency of the world over the last two hundred years. However, using core CPI inflation figures, the US dollar has lost 96% of its purchasing power over the century. In the aftermath of the 2008 Global Financial Crisis, the USD M2 money stock doubled to \$17t leading to a 16% decline in the USD’s purchasing power and a 31% increase in the US’ debt-to-GDP ratio in just ten years.

Inflation & Purchasing Power

While these data points may seem alarming, many have argued that developed market inflation has been relatively low in the last decade, on average sitting below the 2% stated inflation target by policymakers. Monetary printing simply has not surfaced into inflation. Some policymakers have even expressly stated that the phenomenon of low inflation despite the aggressive monetary stimulus has left them confused. In part, increased globalization and automation have led to a weakening of domestic firms’ pricing power and the passing along of rising costs into wages and ultimately goods’ prices. Furthermore, there are a multitude of innovations that are not captured in inflation measures that have improved the aggregate quality life for the average citizen; the basket itself and hedonic quality adjustments in CPI do not capture these innovations and could even suggest there has been price deflation in goods.¹

However, the historical inflexible dependence on traditional inflation metrics severely understate the broader pricing dynamics that have occurred in the past ten years. Consumption and goods are just one outlet for monetary stimulus. The capital flow dynamics into other ultimate outlets of the newly minted money paints an inflation reality that is actually far worse than many imagine: real and financial asset inflation have grown substantially and have been the primary beneficiaries of the Fed’s stimulus (see Figure 1).

¹ The hedonic quality adjustments in CPI do not include many of the innovations and goods present in the 21st century, particularly digital goods and services. <https://www.bls.gov/cpi/quality-adjustment/home.htm>

Overall inflation of goods and assets, when adjusted for these monetary outlets, is far higher than the reported sub-2% inflation.

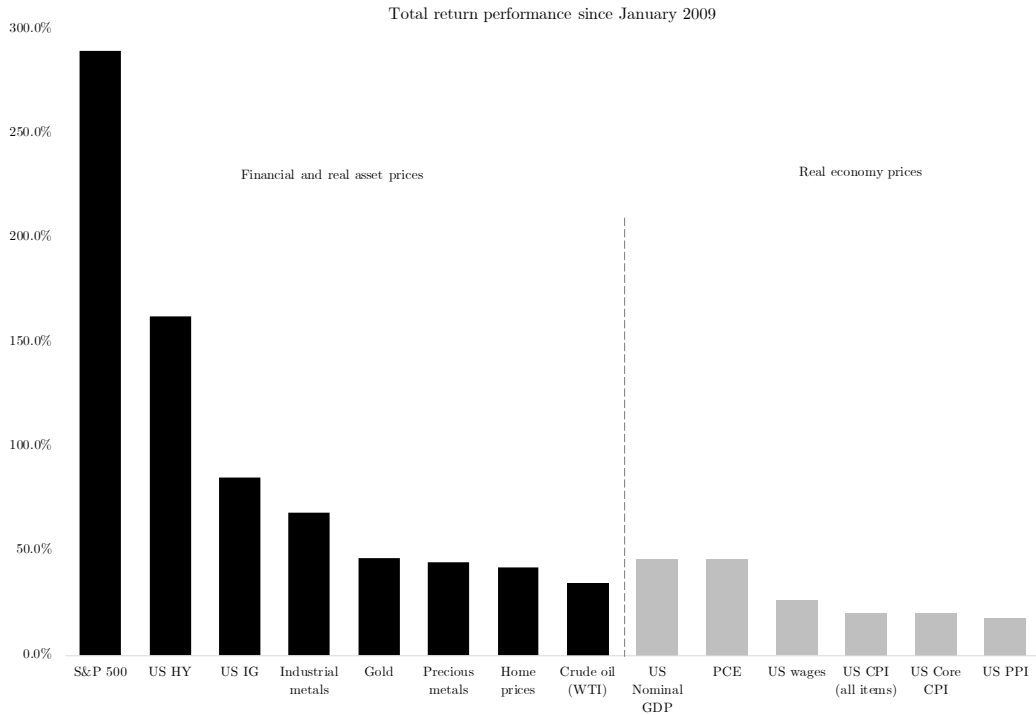


Fig. 1: Total return performance, financial & real asset inflation versus real economy inflation.²

Real and financial asset inflation is a predictable phenomenon of monetary stimulus given the mechanics of monetary open market operations and flow of capital. While the Treasury is responsible for printing paper currency and minted coin, the Fed can “print” money by extending credit to banks and charging an appropriate interest rate. The Fed also purchases Treasury notes and mortgage-backed securities from banks and adds credit to the banks’ reserves. Since 2008, the size of the Federal Reserve’s balance sheet has grown substantially; open market operations have led to a 4x increase in the Fed’s balance sheet from \$1t to roughly \$4t (see Figure 2).

² Source: Bloomberg, Federal Reserve Bank of St. Louis, Economic Research, June 2019. Selected indices: S&P 500 Total Return, iBoxx High Yield Total Return Index, iBoxx Investment Grade Total Return Index, S&P CoreLogic Case-Shiller 20-City Composite Home Price Index, S&P GSCI Total Return Index, S&P GSCI Precious Metal Index, S&P GSCI Industrial Metal Index.

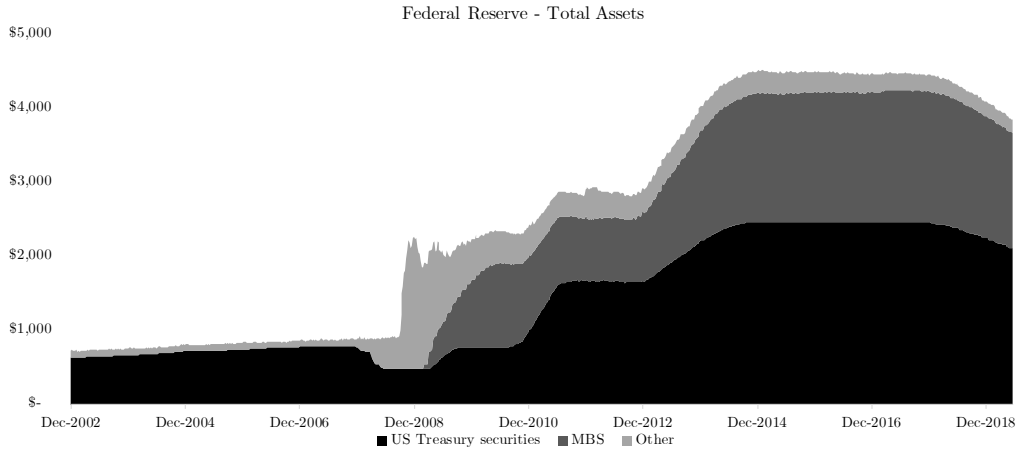


Fig. 2: Total assets, Fed's balance sheet.³

The Fed can also tweak bank reserve requirements and the overnight Federal funds rate, thereby influencing credit extension and its cost in the market. Once banks receive credit from the Fed, they can turn to the market and lend it out to market participants. These market participants tend to be large corporate institutions, who in theory can use corporate loans and debt for increased investment and expansion. This dynamic can be viewed in historical balance sheet data: the total debt-to-equity ratio from the S&P 500 rose from 101% to 112% between December of 2013 to 2018 (see Figure 3). As of March 31, 2019, this ratio stood at 117%.

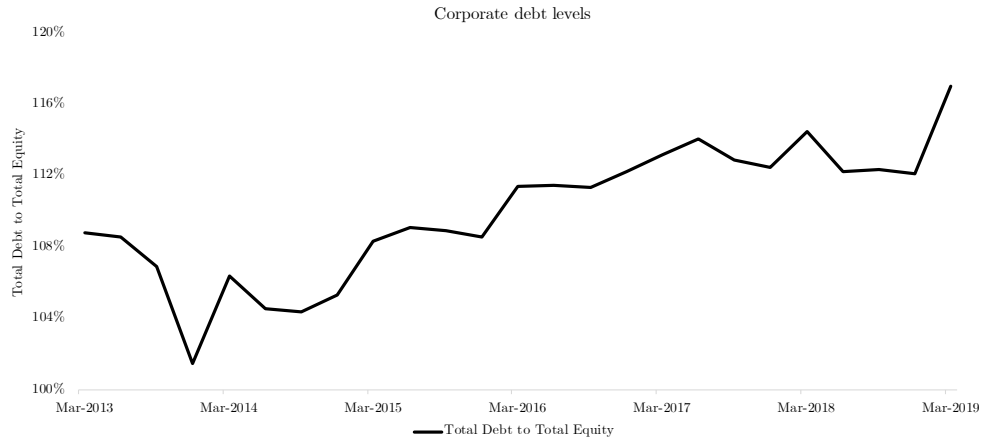


Fig. 3: Corporate debt levels.⁴

The increased debt levels of corporations, both on an absolute and relative basis, has led to significant increases in share buybacks and dividends relative to capital investment. Between 2013 and 2018, companies increased dividends and share buybacks from \$787b to

³ Source: Federal Reserve Bank of St. Louis, Economic Research, June 2019.

⁴ Source: Bloomberg, S&P, June 2019.

\$1.26t, representing a 60% increase (see Figure 4). In comparison, total aggregate spending for capex, R&D, and cash M&A increased just 36% from \$1.03t to \$1.40t.

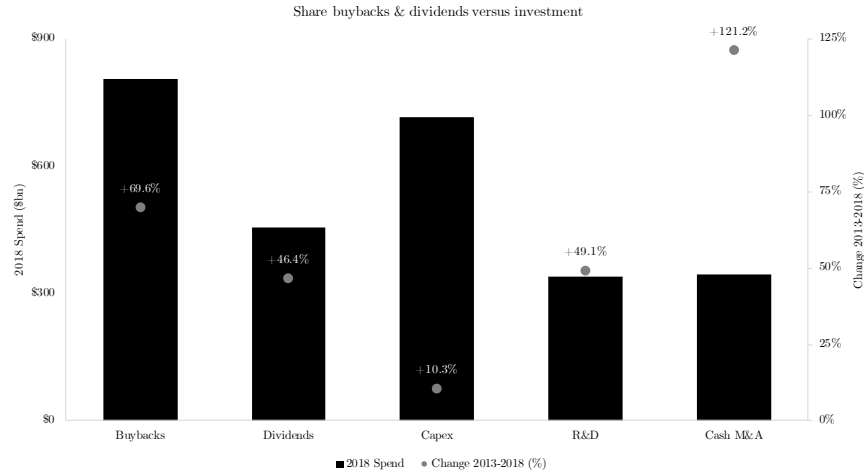


Fig. 4: S&P 500 cash spending.⁵

Conceptually, buybacks and dividends provide many benefits for shareholders and long-term economic productivity, releasing underutilized “trapped” capital from companies, prevents suboptimal capital investment, and putting capital toward more productive uses that drive growth, productivity, and innovation. While growth investment in aggregate accounts for a larger share of cash spending and growth investment has risen considerably in recent years, the accelerated share buybacks accounting for the single largest source of US equity demand over the past five years suggest that corporate buyback spending has resulted in elevated equity price levels. Considering this dynamic has occurred on the back of rising corporate debt levels spurred by easy and cheap liquidity from the Fed, we can see that a portion of the considerable monetary stimulus and printing has led to equity asset inflation.⁶

Category	2014	2015	2016	2017	2018
Corporations	\$442	\$508	\$697	\$296	\$509
Households	95	-138	-151	226	191
Life Insurance	-5	31	98	-45	-18
Foreign Investors	114	-191	-188	125	-94
Mutual Funds	95	58	-112	-134	-124
Pension Funds	-272	-7	-217	-162	-243
Other	12	-7	-12	-17	9
<i>less</i>					
Foreign equities by US	432	197	22	167	128
US Credit ETFs	50	57	96	123	100
Included among holders above are:					
Equity ETF purchases	\$191	\$174	\$188	\$347	\$210

Table 1: Net US equity demand (\$ billions).⁷

⁵ Source: S&P, Goldman Sachs Global Investment Research, Compustat, June 2019.

⁶ Source: Goldman Sachs Global Investment Research, <https://www.goldmansachs.com/insights/pages/top-of-mind/buyback-realities/report.pdf>.

⁷ Source: Goldman Sachs Global Investment Research, Federal Reserve Board, June 2019.

Competitive Markets for Money

The crypto asset innovations over the past decade have created an experimental sandbox for creating new forms of money. We break down these new types of money into three broad buckets:

- Permissionless crypto asset money networks such as Bitcoin
- Corporate or foundation-issued money and payments networks such as Facebook, Telegram, and fiat-backed stablecoin networks
- Digitized (“tokenized”) traditional assets such as equities, real estate, LP interests, etc.

Permissionless crypto money. Permissionless digital assets that exhibit characteristics of sound money with high stock-to-flow ratios, sufficient network and cryptographic attack resistance, and inflation protection can serve as money. In our view, Bitcoin remains the market leader and will continue to grow its moat through its network effects, feature sets, first mover advantages, and social convention. However, we do see the possibility for other forms of permissionless money to take a smaller market share for more targeted use cases and applications, such as privacy-oriented money.

Corporate-issued money. The desire to transfer dollar-equivalents between exchanges and speculators during closed banking hours led to advent of fiat-backed “stablecoins.” Permissionless asset-backed money like Dai and other algorithmic soon followed with the intention to create a more useable money for everyday use, but have mostly struggled with monetary management issues and expanding beyond speculative use cases. Perhaps the first formidable movements into creating a generalized digital money has come from messenger-oriented companies like Facebook, Telegram, Signal, and even Samsung who are in various stages of development for creating a general crypto money. Since the actual architecture and degree of permission for these platforms is unknown by the general public, we categorize them as “corporate-issued money.” The wide user bases of these applications and deep relationships between the issuer and Fortune 1000 companies can potentially lead to widespread adoption and usage of digital money, competing with legacy payment methods and networks.

General digitized value. Perhaps the furthest from fruition and actual practicality, the move to create smart digital securities for both currently digitized securities like publicly traded equities and previously non-digitized assets like real estate and LP interests creates an interesting potential for new forms of value transfer. The digitization of traditional assets coupled with seamless financial markets creates an opportunity for the full monetization of one’s portfolio and wealth. Imagine for instance a retiree who wishes to pay for a dinner. Today, the retiree must have previously sold a small portion of their retirement portfolio, wait until the trade was settled, then transfer the cash to a primary bank account. Along the way, the brokerage, market makers, payment networks, and banks all take economic rents as intermediaries. In a world in which one’s portfolio is fully digitized and the market infrastructure has evolved, the retiree can instead pay for the dinner using a small fraction of their portfolio (say a share of Apple or a fraction of an LP interest),

remitting the due balance as a fraction of a traditional asset which is met with an automatic selling and settlement by the recipient. While there are many barriers associated with such a system (requires a common-denominated value to avoid barter limitations, selection of which shares to sell, and hyper-efficient market and payment infrastructure), there is certainly an interesting potential for financial assets with enduring value into edge case money.

3 Competitive Forces & Darwinism

The proliferation of monopolistically managed money has deprived users with the ability to find the best money (or monies), despite the lack of evidence that government issuers can responsibly and effectively manage the money supply in the long run. As Nobel Prize winning economist F.A. Hayek explains, “There is no justification in history for the existing position of a government monopoly of issuing money. It has never been proposed on the ground that government will give us better money than anybody else could.”⁸

The history of civilization and dead money suggests that despite attempts by empires and imperial powers to maintain lasting political and economic influence, weakened money backed by fragile empires eventually succumb to Darwinian dynamics and are replaced by money with stronger monetary characteristics (Figure 5).

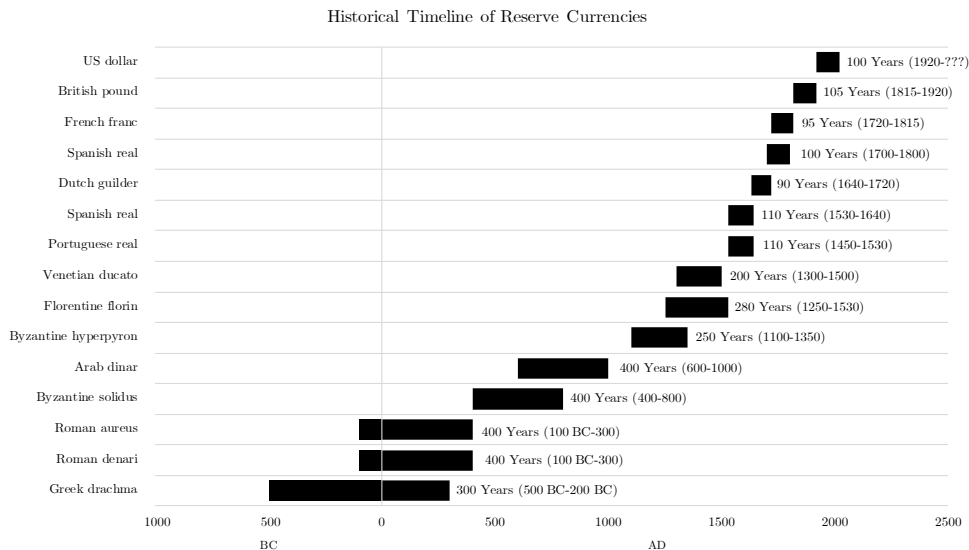


Fig. 5: Historical timeline of reserve currencies, estimates, various sources

A transition from a monopolistic to competitive market does not spell ruin for the US dollar; in fact, it provides the central bank with the opportunity to return the US dollar to a state of “soundness” and make the currency more competitive in an open field of

⁸ F.A. Hayek, Denationalization of Money, 2nd edition (London: Institute of Economic Affairs, 1978 [1974]), p. 7.

competitors. Market competition for monetary standards would not only open the market to new entrants and innovation, but also force current issuers to remain disciplined with how they manage their money supply, remaining ever-vigilant on maintaining the soundness of its money and providing the best form of money for its users. Rather than establish the default currency by royal or government decrees, monetary standards can exist in an open, competitive market, lead to a free market determination of our monetary standards, and improve monetary standard optionality for the global citizen.

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On Incentives & Scarcity

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Abstract. Tepid developed market growth projections, the proliferation of negative yielding debt, and political motivations create a moral hazard and incentivize the continued monetary and fiscal stimulus that has underpinned much of post-global financial crisis economic expansion. As signs of macroeconomic uncertainty begin to emerge and many of the traditional strategies employed by policymakers are no longer effective, the probability of a global system breakdown rises with already weakened economies and the overextension of sovereign debt and easy money policies. While traditional safe haven assets benefit from increased demand during periods of market instability, they do not offer true scarcity as their relatively elastic supply responds to increases in price. In contrast, bitcoin provides a fixed-quantity, supply-inelastic alternative to today's safe haven assets and could potentially serve as a better instrument during periods of macroeconomic turmoil.

1 Incentives

Today's macroeconomic landscape is littered with uncertainty and conflict. Central banks have become less effective at the tail end of a long-term debt cycle with limited ability to stimulate growth and are contemplating so-called "makeup" strategies to combat low real economy inflation. Non-debt pension obligations continue to soar and outstrip the assets required to sustain them, threatening key sources of income for current and future generations. Wealth gaps are widening, and political polarity across ideological, political, and economic factions are producing increased levels of domestic conflicts. Externally, the continued rise of China threatens the US' incumbent position as the premier global superpower and issuer of the world's reserve currency, and points toward a potential change in the world order. This backdrop provides fertile ground for the continuation of debt monetization and emergence of deeply consequential externalities, as the incentives to monetize debt driven by low growth outlooks, negative yielding debt, and political motives remain all too alluring for policymakers. The consequences of prolonged debt monetization set up a "house of cards" scenario in which too much capital chases too few NPV-positive endeavors, confidence in our global financial systems falters, and the probability of a global system failure catalyzed by some unknown contagion increases.

Growth & Negative Yielding Debt

Growth rebounded sharply post-global financial crisis on the back of quantitative easing and increased fiscal stimulus but has slowed in recent years across both developed and emerging economies. Growth forecasts paint a bland future: growth in key global economies such as the US, China, and the Euro area is expected to decline over the next five years. Inflation remains low and below most central bank targets, and while unemployment rates have likely reached their nadir and there is seemingly little slack in labor markets, lukewarm wage gains persist. Many domestic governments have attempted to combat the slowing growth and low inflation with continued fiscal stimulus, monetizing debt at a historic pace and increasing sovereign debt to previously unimaginable levels.

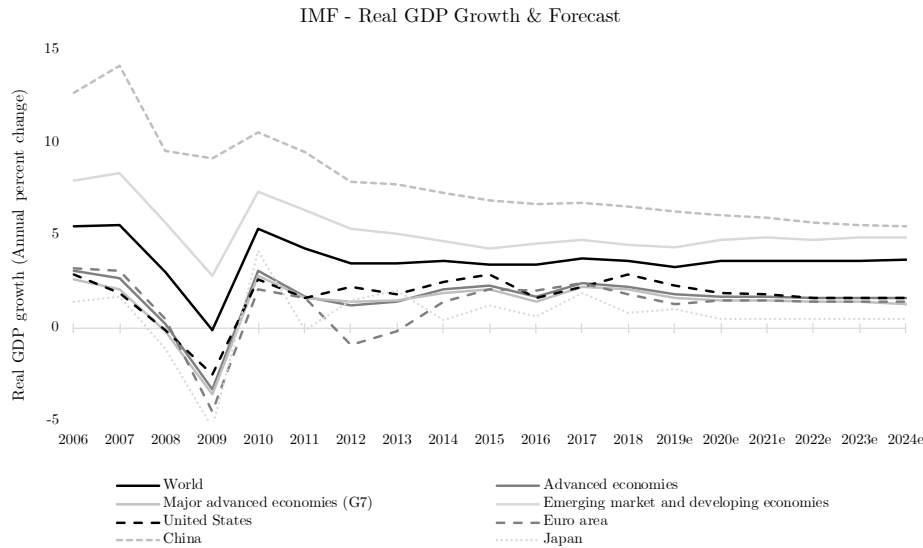


Fig. 1: Real GDP historical growth & forecast, IMF.¹

Region	GDP (bn, USD)	GDP (%YoY)	Surplus/Def (% GDP)	CPI (%YoY)	Jobless Rate (%)
<i>Americas</i>					
United States	\$20,494	2.0/Sep-19	-4.6%/Sep-19	1.7/Aug-19	3.6/Oct-19
Brazil	\$1,869	1.0/Jun-19	-6.4%/Sep-19	3.4/Aug-19	8.2/Feb-19
Canada	\$1,713	1.3/Aug-19	-0.4%/Dec-18	1.9/Aug-19	5.5/Oct-19
Mexico	\$1,224	-0.5/Sep-19	-1.4%/Sep-19	3.2/Aug-19	3.8/Sep-19
<i>Europe</i>					
Eurozone	\$13,676	1.1/Sep-19	-0.5%/Dec-18	1.0/Aug-19	7.5/Sep-19
Germany	\$3,997	0.4/Jun-19	1.7%/Dec-18	1.4/Aug-19	5.0/Oct-19
United Kingdom	\$2,825	1.0/Sep-19	-1.5%/Dec-18	1.7/Aug-19	3.8/Sep-19
France	\$2,778	1.3/Sep-19	-2.5%/Dec-18	1.0/Aug-19	8.5/Jun-19
Italy	\$2,074	0.4/Sep-19	-2.1%/Dec-18	0.4/Aug-19	9.9/Jun-19
<i>Asia/Pacific</i>					
China	\$13,608	6.0/Sep-19	-4.2%/Dec-18	2.8/Aug-19	3.6/Sep-19
Japan	\$4,971	1.0/Jun-19	-2.0%/Dec-18	0.3/Aug-19	2.4/Sep-19
India	\$2,726	5.0/Jun-19	-3.9%/Dec-17	3.2/Aug-19	8.5/Dec-17

Table 1: Global economy watch, selected countries and regions.²

¹ Source: IMF, World Economic Outlook, DataMapper, as of April 2019.

² Source: Bloomberg, November 13 2019.

Meanwhile, central banks continue to ease, cutting interest rates, buying up sovereign debt, and pushing more stimulus into the global financial system. The increased printing and monetary stimulus has not manifested itself in real economy prices or inflation; rather, asset inflation has manifested amidst cheap debt, particularly as the trail of breadcrumbs shows rising corporate debt levels, increased corporate expenditures on dividends and share buybacks, and higher proportions of overall equity demand stemming from corporate buybacks.³ Macroeconomic uncertainty and global tensions have increased the demand for developed market sovereign bonds driven by a flight to (relative) safety, and alongside the continued decline in interest rates have resulted in trillions of dollars of negative yielding debt.



*Fig. 2: Market capitalization, outstanding negative yielding debt, trillions of dollars.*⁴

Historically, institutions and investors have flocked to sovereign bonds for safety and income, but negative yielding debt creates a mechanism where institutions are buying under the hope of capital gains rather than yield and not holding the bonds to maturity. Much of the world's developed market sovereign rates are now negative across the curve, with an estimated \$12t of negative yielding debt outstanding. The ramifications of negative yielding debt are plenty: the specter of a bond bubble looms, pension funds lose critical sources of income while their asset-liability imbalances grow, and investors may be incentivized to make riskier investments that they may not be compensated for in search of positive returns. The benefits of negative yielding debt lie solely with the issuers, who effectively have a zero dollar cost to print and carry their debt, while the holders of the debt shoulder significant risks.

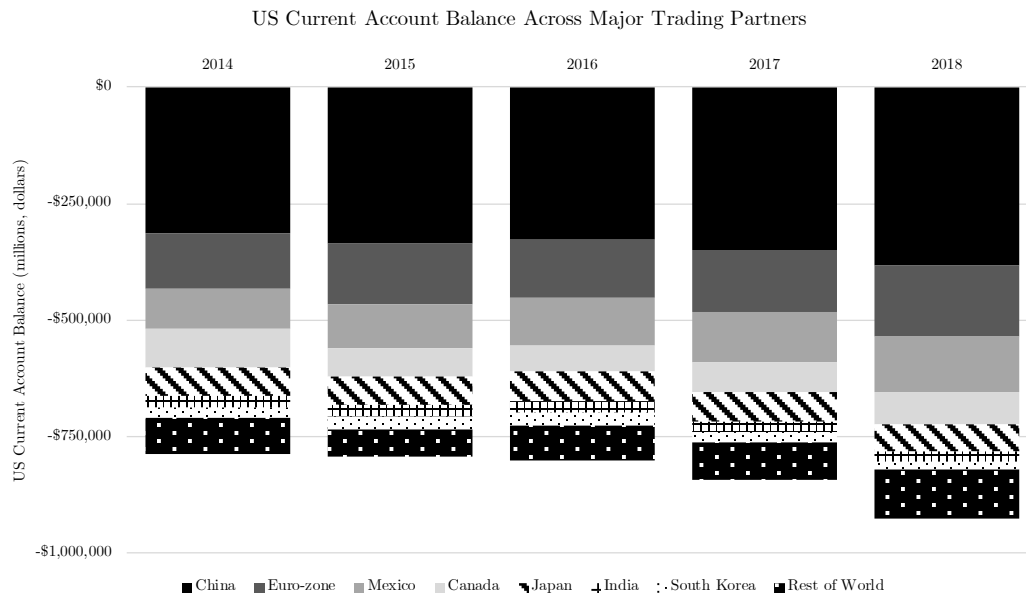
³ For further reading, see Galaxy Digital Research's *On Free Markets for Money*.

⁴ Source: Bloomberg, BNYDMVU Index, weekly, November 13 2019.

Trade Imbalances, MMT, and Political Motivations

Waning growth, trade imbalances, and political motivations from both sides of the aisle further point toward fiscal expansion. Economic growth, stability, and prosperity are unquestionably among the goals of the global policymakers, but perhaps becomes more relevant during key political elections. Particularly if the incumbent candidate has presided over a period of economic expansion, he or she has a clear incentive to maintain that growth in the year leading into an election year. In the US, President Trump has laid many claims to the successes of the economic expansion and stock market and has become a key point for his 2020 campaign.

Much of President Trump's economic policy has focused on perceived trade imbalances, as the US continues to expand its current account deficit. Less expensive imports have hurt domestic exporters, and President Trump has engaged in multiple trade negotiations (or wars) with China, Japan, and the US' NAFTA counterparts. The US' current account deficit has grown 18% from \$787b in 2014 to over \$926b in 2018, as a strengthening dollar and cheap imports from improvements in global productivity increased the domestic consumption of foreign goods. Roughly half of the current account deficit growth has come from increased Chinese imports. The global balance of trade and US dollar strength has made it difficult for domestic exporters, adding an additional incentive to engage in strategies to weaken the dollar and make US exports more competitive on a global scale, a desire that President Trump has verbalized on multiple occasions.



*Fig. 3: US net exports across major trading partners, millions of dollars.*⁵

⁵ Source: Bloomberg, November 13 2019.

Challengers to President Trump's seat in the White House have pointed to continued debt monetization: many leading US progressives, some of who are vying for the Democratic presidential nomination, have presented ambitious, expensive policy proposals including the Green New Deal and Medicare for All. These potential nominees advocate running a deeper deficit to fund extensive new social programs, particularly with current low inflation and interest rates, and a relatively unorthodox strain of economics called modern monetary theory (MMT) has worked its way into the mainstream political debate.

In a nutshell, MMT argues that a country borrowing in its own fiat currency can finance fiscal stimulus by issuing debt and printing money to purchase its own debt. It is a theory of full employment and price stability that argues that the government is the monopoly supplier of money, and because it issues its own money, it can always afford to spend in nominal terms. It rejects the traditional idea that the government needs money before it spends, and therefore the government's spending is not limited to its tax revenues. MMT proposes to resolve unemployment through a job guarantee program that would provide full employment to everyone willing to work. The job guarantee portion is essential to the school of thought because it supposedly solves the problem of full employment and price stability. MMT doesn't say deficits don't matter or that the government's spending is unconstrained; in reality the government does have a real budget constraint (inflation).

According to MMT, when inflation is low there's room for bigger government deficits. By extension, MMT would allow the government to control inflation through tax policy. Instead of asking the Fed to stabilize prices through monetary policy, the government could raise taxes when prices get too high and cut taxes when prices get too low. The idea that traditional fiscal-policy needs to be rethought in eras of low real interest rates has validity to it, but the idea has been warped into claims that massive spending on job guarantees can be financed by central banks without any burden on the economy. During the current era of economic and political frustration, some are jumping on the possibility of politically attractive ways out of economic difficulty.

MMT has several potential issues. First, it is false that governments can create new money to pay all due liabilities and avoid default. MMT argues that the government can pay for as much as it wants with an endless supply of money that it creates to boost employment and promote price stability. However, there is a limitation of real resources. Eventually, if the government and an artificially buoyed workforce keeps paying for more things, the economy inevitably runs up against real supply constraints, whether it's offices and factories, natural resources, or production capacity, thereby causing rapid inflation. Naturally, inflation arises when money is created in excess of the capacity of the supply side of the economy to produce additional goods and more money ends up chasing a limited supply of goods. As evidenced by several emerging markets, this strategy and its practiced variants inevitably leads to hyperinflation. MMT also leads to the collapsing of an exchange rate, causing increased inflation, capital fleeing the country, and lower real wages as exchange rate collapses and the price of imports rises.

It is also important to note that not all debt and spending are created equal. Debt that creates enough economic benefit to pay for itself is a good thing. Too little debt growth

can create as bad or worse economic problems as having too much, particularly with the cost of foregone opportunities. Whether more debt is necessary depends on whether the debt is used productively enough to generate enough economic benefit to service the overall cost of the debt. If that is the case, the resources will have been well-allocated, the capital was appropriately used toward positive NPV projects, and both the lender and the borrower will benefit economically. Sometimes these trade-offs are hard to see (such as when monetary income does not cover the cost of debt but the project leads to an overall positive economic benefit). If lending standards are too tight that they require a near certainty of being paid back, it may lead to fewer debt problems but too little development. If the lending standards are too loose, that could lead to more development but could also create serious debt problems down the road that erase the benefits. While MMT has a small faction of supporters, it is unlikely that MMT will gain full traction in the United States. However, the broad social, healthcare, and environmental programs proposed by Democratic candidates do not have requisite revenue or budgetary sources, which suggests continued fiscal expansion and debt monetization regardless of which party controls the White House or Congress.

Deficits & Debt Maintenance

Negative yielding sovereign debt and a desire for stimulus set up an open invitation to run deeper deficits and monetize debt: when growth slows and turns negative, there is an incentive for federal government to spend more to combat a flagging economy and negative yielding debt creates an infinite incentive to print money because the cost to issue and carry is \$0. Over the past twenty years, the cumulative federal budget deficit has ballooned to roughly \$11.4t; notably, the rate at which the deficit (and by extension the federal government's total debt outstanding) grew at a faster pace following the GFC as policymakers stimulated the economy through increased government expenditures.

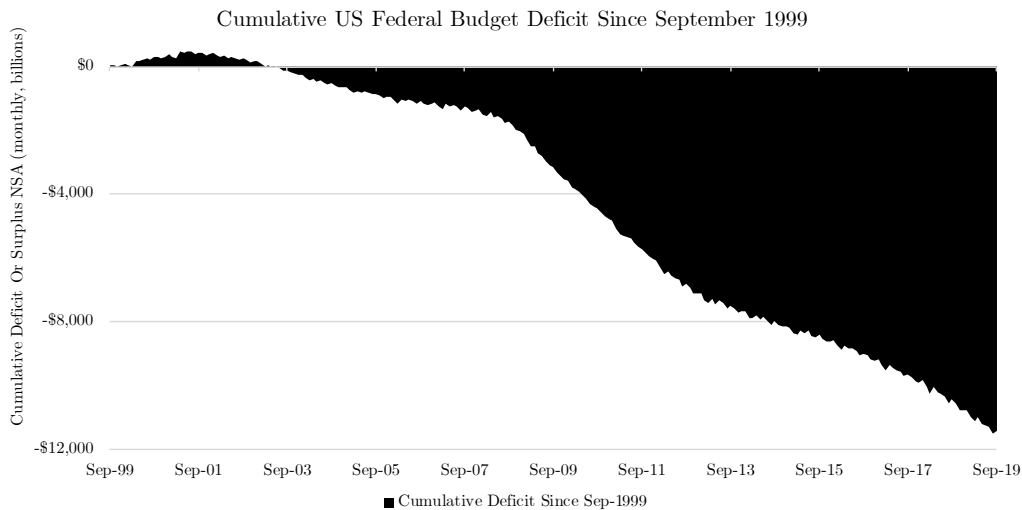
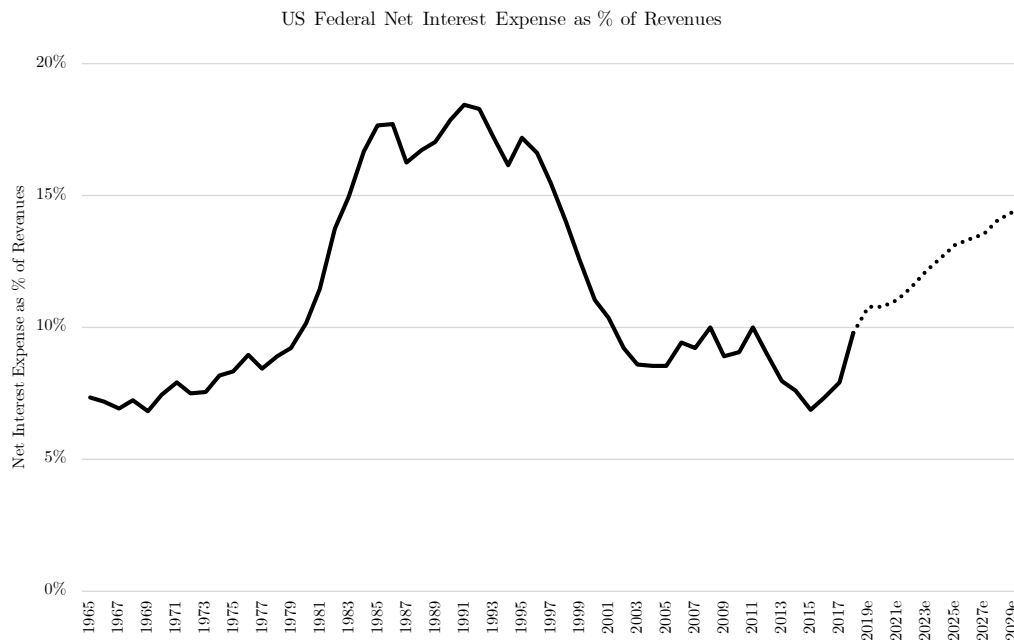


Fig. 4: Cumulative US federal budget deficit summary since September 1999, dollars.⁶

⁶ Source: Bloomberg, November 13 2019.

Servicing the growing federal government outstanding debt has become increasingly expensive as deficits and debt loads grew: federal net interest expense has risen to 10% of its total revenue and is expected to increase to nearly 15% over the next decade according to CBO projections. Market demand for these Treasuries is also effectively limitless: the Federal Reserve can print money and purchase this debt in open market operations, thereby monetizing federal debt. While there is no concept of interest coverage ratios or margins for governments, in comparison the S&P 500's aggregate interest expense margin as a percent of sales was just 2.1% in 2018.⁷



*Fig. 5: US federal net interest expense as % of revenues, historical and projected estimates.*⁸

House of Cards

Growth projections, negative yielding debt, and political motivations incentivize debt monetization and create a house of cards situation that misprices risk and assets. The unwind of this inflated risky asset bubble would be a broad system failure with some trigger spreading a global contagion into interconnected economies and financial markets. It could lower negative real return breakpoint that cause sovereign debt holders to finally capitulate, a trade imbalance that causes a deeper trade war and catalyzes inflation amidst a retrenchment from globalization, or the addition of capital controls that restrict the creation, flow, and ownership of capital. It is unclear what or when this trigger will be, or how the house of cards will unwind, but we can see from posterior economic and financial crises that the probability that it does occur is heightened significantly.

⁷ Source: Factset, FY 2018, Retrieved November 2019.

⁸ Source: Congressional Budget Office, historical and projected estimates, Retrieved October 2019.

2 Scarcity

A global risky asset unwind predictably has outlets, much like the breaking of a dam forces water into old and new tributaries. As a crisis of confidence in our financial and economic system spreads, value will flow out of liquid, non-sovereign financial assets such as equities or corporate bonds as well as relatively riskier currencies and sovereign bonds and push capital into safe haven assets. Though its apparent that even the “safest” global reserve currency and sovereign bonds, the dollar and Treasuries, have clear systemic risks in an absolute sense, on a relative basis the dollar and Treasuries are faring far better than other developed market sovereign assets. Paradoxically, value that flows out of non-sovereign financial assets will likely partially flow into US sovereign assets, thereby sustaining the untenable house of cards situation. However, the systemic risks that continue to grow behind these sovereign assets remain, and other real assets will likely serve as better safe haven assets.

The traditional stores of value outside of Treasuries and the dollar are gold, real estate, art, and the yen. While on the surface these assets may seem like attractive stores of value, in reality they all have elastic supply functions that modulate price increases and limit the benefit it can have on one’s portfolio during periods of uncertainty or crisis. If gold prices increase, existing miners with excess capacity and miners who were not profitable at prior prices may find themselves suddenly profitable at current prices will turn on production; the supply of gold will rise from the new mining production and naturally dampen price. Similarly, if the supply of current homes is constrained and home prices were to rise, homebuilders will start building more houses; the increase in home supply will lead to a decrease the price of the homes in aggregate. From a scarcity and “hardness” perspective, art is comparatively better, but art has an inherent subjectivity in its value interpretation, non-fungibility, illiquidity, and limited capacity to hold value. The yen carries similar systematic risks as other sovereign financial assets (particularly as Japan’s debt-to-GDP is among the highest in the world) and has a similar value modulation: a stronger yen makes exports comparatively more expensive, hurting domestic producers of global goods and incentivizing the subsequent weakening of the yen to restore trade imbalances.

Bitcoin offers the only verifiably scarce, immutable, and capped supply asset in the world. Importantly, bitcoin has a price-inelastic supply, where bitcoin’s value cannot change its supply issuance: bitcoin’s supply issuance is strictly bound and algorithmically hard-coded as the transaction validation difficulty of the Bitcoin network modulates supply creation. If bitcoin’s price rises, more miners will deploy resources to mining bitcoin, speeding up the block times to under the targeted ten minutes per block and temporarily increasing the supply issuance. However, an algorithmic regulation occurs every 2016 blocks (approximately every two weeks) that dynamically adjusts the complexity of the mining algorithm, re-targeting the block time and periodic issuance back to ten minutes despite the new resources vying to mint new bitcoin at higher prices. A similar process occurs if the price of bitcoin falls and resources are taken off the network, thereby increasing the block time and slowing issuance: the difficulty is lowered and block times are decreased back to roughly ten minutes. This dynamic process, alongside the issuance halving every

four years and capped supply, creates the only transparent and trustless stock-to-flow schedule for any asset.⁹ Due to the design of bitcoin, its stock-to-flow ratio rises over time, as the annual issuance of bitcoin decreases relative to the outstanding supply. Bitcoin already has a higher stock-to-flow ratio than US notes & bonds and silver, and is expected to surpass that of the yen by 2021 and that of gold by 2025.

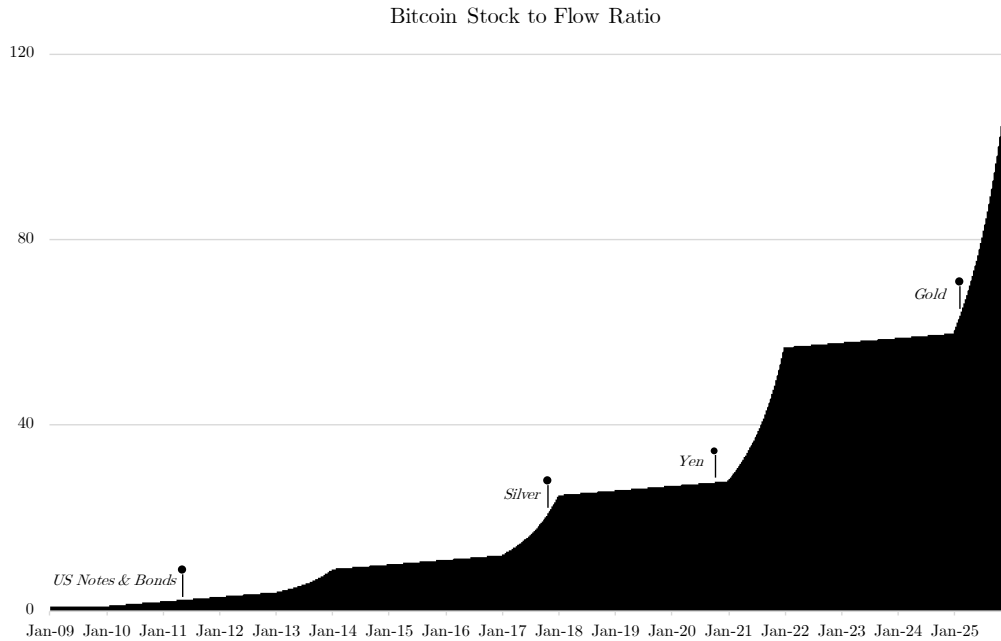


Fig. 6: Bitcoin stock-to-flow schedule and selected assets.¹⁰

Contrary to popular belief, the value proposition of a safe haven asset is not about its low volatility; rather, it's about its stock and flow assurances, or predictable and high stock-to-flow ratios through time. Stock-to-flow assurances are what gives things staying value but not necessarily constant value. Bitcoin's volatility is a function of its 1) high marginal buyers and sellers relative to existing liquidity (the incentive and high propensity to hold bitcoin makes its liquidity low by design), and 2) the current holder base is mostly retail and more susceptible to behavioral biases. Over time, as the value of bitcoin grows alongside its stock-to-flow ratio, liquidity should follow with a higher market capitalization and more institutional, liquidity venues. The market should naturally be able to absorb the impact of marginal trading better, but it's important to note that assets with high stock-to-flow ratios and deflationary issuance will have high volatility by design due to high incentive and propensity to hold, *ceteris paribus*.

⁹ Stock-to-flow is a measure of an asset's scarcity. It is defined as the ratio between the current stock supply and new production over some time period). Assets with high stock-to-flow ratios have low issuance or creation relative to the existing supply.

¹⁰ Source: Galaxy Digital Research, Bitcoin, various sources.

3 Final remarks

The premise that somehow a government can always print enough money to cover its debts is plainly imprudent. It is foolish to assume that current conditions will last, or to ignore the real risks faced by countries with high and rising debt burdens. The federal government's ability to print money is a privilege, but a printing press is not a panacea for its problems. Particularly with the backdrop of low global growth, cheap debt, and political motives that point to continued stimulus and debt monetization, it seems that the status quo will continue for as long as the market can stomach the gluttony of debt and money printing. With less effective tools at the disposal of central banks and federal governments to stimulate, influence prices, and maintain employment in a potential downturn, real assets will become necessary for investor portfolios amidst a broader slide in risky assets. Existing safe haven assets may provide marginal portfolio diversification during these periods of uncertainty and crisis, but their elastic supply responses limit the benefits these assets can provide. In contrast, bitcoin's design provides supply-elasticity resistance that could potentially provide better diversification for an investor's portfolio.

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