DARKMATTER

A revolution in wealth management

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Dark Matter (XDM):
A revolution in wealth management

1.0 Abstract

Dark Matter (XDM) is a specialized token on the ION blockchain optimized to excel as a store of value (SoV) through deflationary monetary policy embedded in the token's code. As a cryptographically secure token, XDM provides holders with direct control of the asset through a decentralized network. As with other blockchain tokens, XDM ownership and utilization are free of the burdens and vagaries of central banks and government regulations, resulting in fewer barriers to entry for those who wish to use XDM without restriction. Dark Matter's deflationary policy, which reduces total token supply by 80%of every transaction fee, drives scarcity and amplifies intrinsic value. The transaction fee starts at 0.1 XDM, and gradually declines as net transaction volume increases, making Dark Matter the first hyperdeflationary asset. XDM employs a simple, elegant, and predictable mechanism that constitutes a significant innovation in multiple fields at once: cryptocurrency, economy, and finance. As an accessible, purpose-built SoV, Dark Matter democratizes wealth management and adds a new tool for balancing portfolios, particularly as a hedge against inflation and other structural vulnerabilities that plague traditional stores of value.

> Inflation is as violent as a mugger,
> as frightening as an armed robber,
> and as deadly as a hit man.
>
> — Ronald Reagan

2.0 Introduction

Profound economic disturbances and ongoing uncertainty have left vast populations worried about the financial systems in which they are so deeply embedded and invested (Lewis, 2010). If the 2009 bailouts of major US banking institutions hadn't happened, the financial crisis could have triggered a terrifying economic collapse instead of the folding of a few banks and a painful recession. Private individuals want to control transfers of their wealth, independent of central banks, erosive fees, government regulations, and the devastating effects of inflation (Lewis, 2010). Bitcoin (BTC) solves some of these problems but stops short of incorporating a truly deflationary. As Bitcoin once disrupted our sense of what money is, Dark Matter now redefines our expectations for stores of value.

Existing SoVs are constrained by structural properties that make them unsuitable for savings. The capacity to design currency with custom properties is a market disruptor that changes the cryptocurrency landscape. Compared to gold, stocks, USD, or real estate, Dark Matter's resilience stands out in sharp relief against the vulnerabilities and limitations of those assets. Although the code is robust, secure, and ingenious, the rules can be written on one side of an index card:

- Only 71,000 XDM will be created.
- A scheduled portion of the network transaction fee is removed from circulation.
- The fee decreases as the total number of transactions increases.

That's it. Dark Matter structurally combines scarcity, security, and simplicity to provide a store of value that reduces risk and cultivates value, all in one asset. All the while, the XDM holder maintains complete autonomy.

The innovative Dark Matter token is built upon the ION blockchain. Since ION is an open-source community-based project, anyone can review the code, contribute new ideas using the powerful ION Improvement Proposal (IIP) protocol and directly contribute. The XDM public ledger can be audited and independently verified by everyone. There are no secrets. Direct control of the asset and any transactions means that middlemen are no longer needed. All the transaction costs that accompany traditional stores of value are reduced to the simple dynamic fee structure built into XDM.

Dark Matter is limited to a maximum of 71,000 XDM tokens, compared to 21 million for Bitcoin. Furthermore, the quantity of XDM tokens *diminishes* from the initial maximum supply with each transaction by means of a deflationary fee mechanism. The transaction fee starts at 0.1 XDM and *declines* as the number of transactions increases over time. Every time Dark Matter is sent from one address to another, 80% of each fee is verifiably destroyed and removed from circulation.

The result of this simple formula is a blockchain network token that serves as an asset with a built-in mechanism to encourage increased value, regardless of external conditions. Dark Matter's deflationary policy ensures the token's predictable and provable scarcity, enhancing its utility as an instrument for preserving and increasing wealth.

The following analysis begins by addressing current financial conditions which present a need for a “new gold” to protect value more effectively. A detailed analysis of several traditional and popular SoVs follows, showing the innovation and utility of XDM. The comparison addresses benefits and problems for each SoV with regard to key attributes including mobility, liquidity, resistance to regulation, predictability of supply, forgery resistance, and scarcity. That discussion is followed by a parallel description of what XDM provides in connection with each attribute.

The comparison reveals that across these traditional indices, XDM offers an unprecedented matrix of benefits, excelling in nearly every category, making it a highly preferable SoV asset. XDM’s characteristics reduce its structural vulnerability to value loss.

As much as it puts Dark Matter in a favorable light, the comparison also exposes the limitations of traditional stores of value. For example, existing SoVs are vulnerable to inflation, or they lack mobility, or they are not fungible, or they have very high transaction costs, or they have some combination of these limitations and others. In light of Dark Matter as a new point of comparison, the metrics for assessment of financial risk and safety must be recalibrated. Traditional SoV assets that have been generally regarded as “safe” will be shown to have limitations and vulnerabilities that are taken for granted (Divine, 2018; Borzykowski, 2006).

These deficiencies can no longer be ignored, or regarded as inevitable. Indeed, they no longer need to be accepted at all. With the arrival of an asset with improved structural properties comes an expansion of options for people interested in protecting their wealth — and for wealth managers everywhere dedicated to increasing wealth for their clients.

Because XDM offers a store of value for those with a low time preference (e.g., seeking a long-term savings vehicle rather than immediate spending), Dark Matter has tremendous potential for broad adoption for mid- to long-term wealth preservation. Dark Matter not only enhances balance in portfolios, it also recalibrates the metrics for assessment of balance and financial risk.

3.0 Purpose

The development of Dark Matter was inspired by the following challenge:

> Is there a way to harness the benefits of blockchain technology to *neutralize the devastating effects of inflation* and *reduce barriers to entry*, so that genuine asset control can be enjoyed by a broad spectrum of society regardless of socioeconomic status?

The answer is yes. The answer is Dark Matter.

Every asset has distinctive characteristics that make the asset more or less useful for particular purposes. The US Dollar, for example, makes a more convenient spending currency than gold; Bitcoin has properties that make it a more reliable long-term store of value than USD. With the advent of cryptocurrency, society now has the ability to create purpose-built currencies. Dark Matter has been optimized to function as a superior store of value.

4.0 Existing Conditions

The US Dollar dominates the global economy. Unfortunately, USD has unequivocally shown itself to be a depreciating asset (one that loses buying power over time). Global commerce depends on the US government's propensity to leverage the world's confidence in America's seemingly unlimited creditworthiness. All the while, the mechanism for taking on more debt involves printing money that drives down the value of the dollar. This has been happening for a century, to the tune of 94% devaluation of USD (Durden, 2009).

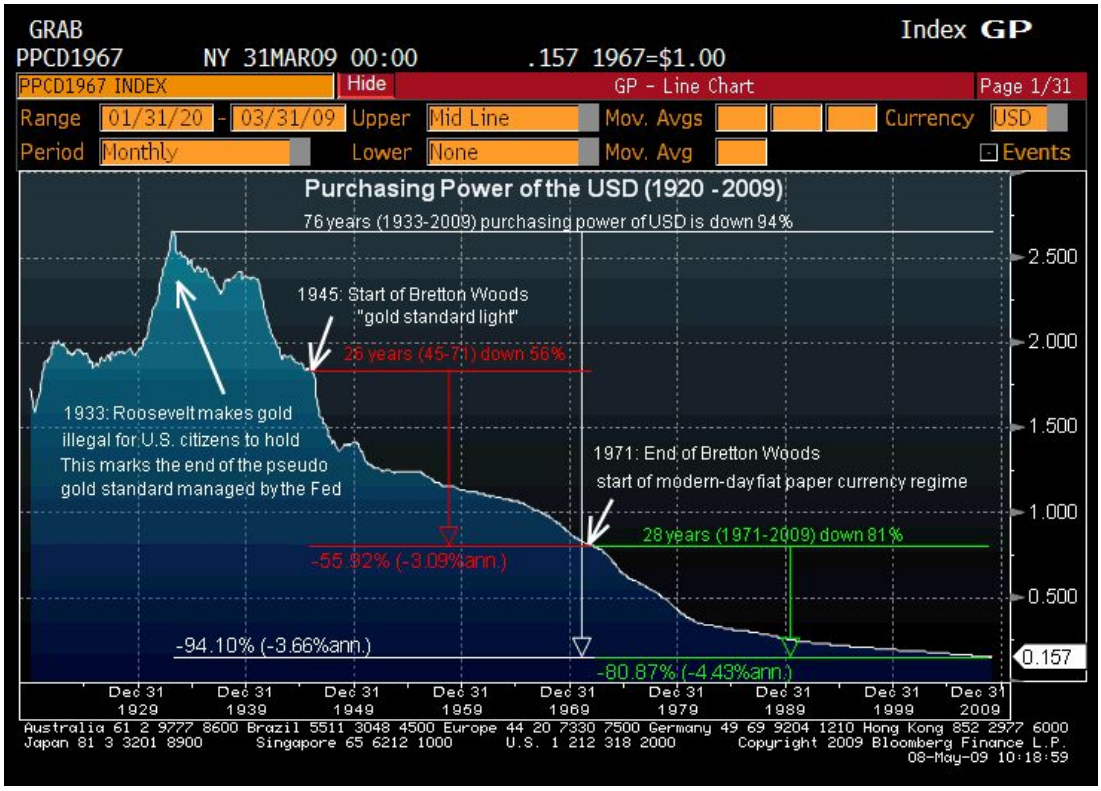


Chart: Purchasing power of USD (Durden, 2009)

This chronic devaluation proceeds insidiously, almost invisibly, through policies implemented in bureaucracies beyond our control. The effects of supply inflation are gradual, subtle, and inexorably harmful, not only to ordinary people who hold USD (and steadily lose value over time), but also to all the institutions, governments, and people potentially affected by a collapse in the credibility of the USD and creditworthiness of the US economy. That is, if there is a widespread belief that the US cannot repay its debts, there will be a massive and terrifying collapse.

An individual or business holding massive amounts of USD could lose all of that value in an instant. Even in a diversified portfolio, where USD is not the only asset, the effects will be devastating. Government bonds would immediately follow the collapse of USD, and stocks would approach book value (current liquidation value). Real Estate prices are susceptible to

factors like global climate change and marked changes in the housing market. Gold presents an interesting possibility as a sturdy SoV that could survive a USD collapse, but its supply, despite perceived scarcity, continues to *increase* over time. Gold has no predictable scarcity, leaving its market price vulnerable to supply increases.

Before looking at each of the alternative SoVs in more detail, it is first necessary to consider more detail about the dire risks that put world economies at risk and the conditions that created those risks.

4.1 Confiscation through Inflation

> By a continuing process of inflation, government can confiscate, secretly and unobserved, an important part of the wealth of their citizens
>
> — John Maynard Keynes

If the government came into your home and arbitrarily seized a portion of your assets, you would take up arms in revolt. Yet, when the government does the same thing by means of a monetary policy that causes inflation, most people just lament that “you can’t fight city hall.” Dark Matter is a way to fight back.

Dark Matter’s single most important element is its focus on inflation. Fiat currency incorporates an inherent, systemic risk of oversupply. Even under ideal economic conditions, governments can, both theoretically and practically, print money without limit. Central banks like the United States Federal Reserve (“the Fed”) are not literally speeding up the printing presses; they don’t have to. Electronic versions of USD can be created simply by policy.

In an effort to stimulate the economy, the Fed lowers interest rates and encourages borrowing to promote investment and consumption. The hope is to stimulate the economy and improve the flow of money. If the cost of servicing interest on the debt outpaces the growth of the gross domestic product (GDP), the debt can snowball. A default on repayment obligations harms the government’s credit rating, slowing the economy. The contraction of the economy (reduced flow of money, reduced spending, reduced borrowing, corporate layoffs and closures) makes it harder for the government to get out of debt. This is happening at precisely the time it is most urgent to generate enough revenue to make payments needed to recover. Continued failure to recover could then lead to a total loss of confidence in the government and its currency. Rather than fixing the problem, the Fed is seeking to keep a lid on the panic and spends approximately $5 billion of taxpayer money annually to do so (US Federal Reserve 2016).

There’s nothing wrong with optimism. But when the optimism is imbued with a misplaced faith that the future growth rate of national GDP will outpace the growth in debt and interest, the result can be cataclysmic.

Nobody wants to be robbed. Nobody wants to be conned. Nobody wants to lose something of value. Nobody wants their labor to be devalued just because they didn't spend their money, just because they tried to save. It's brutal. The losses incurred as a result of inflation are largely because we store what we've earned in vehicles that are fundamentally flawed. The flaws of most stores of value are baked in. There are vulnerabilities and limitations that are fundamental characteristics of the assets. USD is vulnerable to inflation. Not only is government issued currency vulnerable, the negative consequences of excessive inflation have already been happening: the government bloats the money supply, diluting the value of each dollar (Vogt, et al., 2010).

Shared perception is a crucial component that gives any asset value. When there is a crisis of confidence which fully undermines that perception, the ensuing catastrophe can decimate an economy suddenly. Between 1921 and 1923, Germans stopped believing that the German government could maintain the value of the Deutschmark, The national currency's value collapsed in a spiral of hyperinflation (Taylor, 2013; Kresblach, n.d.).

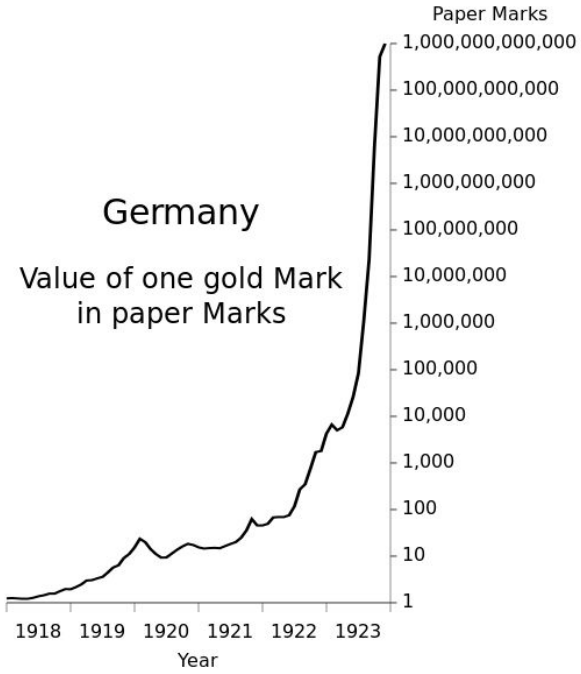


Chart: Hyperinflation of Deutsche Mark (Kresblach, n.d.)

In the 1980's Argentina had to replace its currency with a new peso, equaling 100 billion of the old pesos (Sørensen, M. 2001). In 2007, Zimbabwe had to print a 500 million dollar bill to keep up with 11,000% inflation (The Source, 2017).

Figure: Banknote for 500,000,000 Zimbabwe Dollars

In 2018,Turkey had to accept a massive bailout from Qatar to temporarily subdue spiraling inflation (Inman, P. et al., 2018). In the same year, Venezuelans fled the country as the rate of inflation exceeded 32,000% (Casey, 2018). That staggering number is expected to climb to 1,000,000% by the end of the year (McArdle, 2018).

Dark Matter is simply not subject to supply inflation. The supply cannot grow, it can only decrease. XDM's supply decreases by design, resulting in predictable supply deflation proportional to utilization. Dark Matter is not just a refuge from inflation, and theft; it is an asset network that rewards patience. Former Chairman of the Federal Reserve, Alan Greenspan (1967), has stated that, "In the absence of the gold standard, there is no way to protect savings from confiscation through inflation. There is no safe store of value." Dark Matter changes that.

4.2 Credit and Debt

Our world, and in particular the United States, has firmly adopted upside-down versions of 'credit' and 'debt.' With regard to credit, it has become a stand-in for wealth where buying power replaces the aggregate value of all owned assets. With regard to debt, the popular trend is simply to pretend that it does not matter. Both of these subversions are consistent with a "high time preference" for assets, meaning the asset holders are inclined to spend the funds in the short term without due regard for the long term. This high time preference pumps demand, fueling economies. On the other hand, the unchecked deferral of consequences also pushes world economies to the brink as borrowers, including the U.S. government, increasingly act as if they will never have to pay their debts (The Center for Microeconomic Data, 2018).

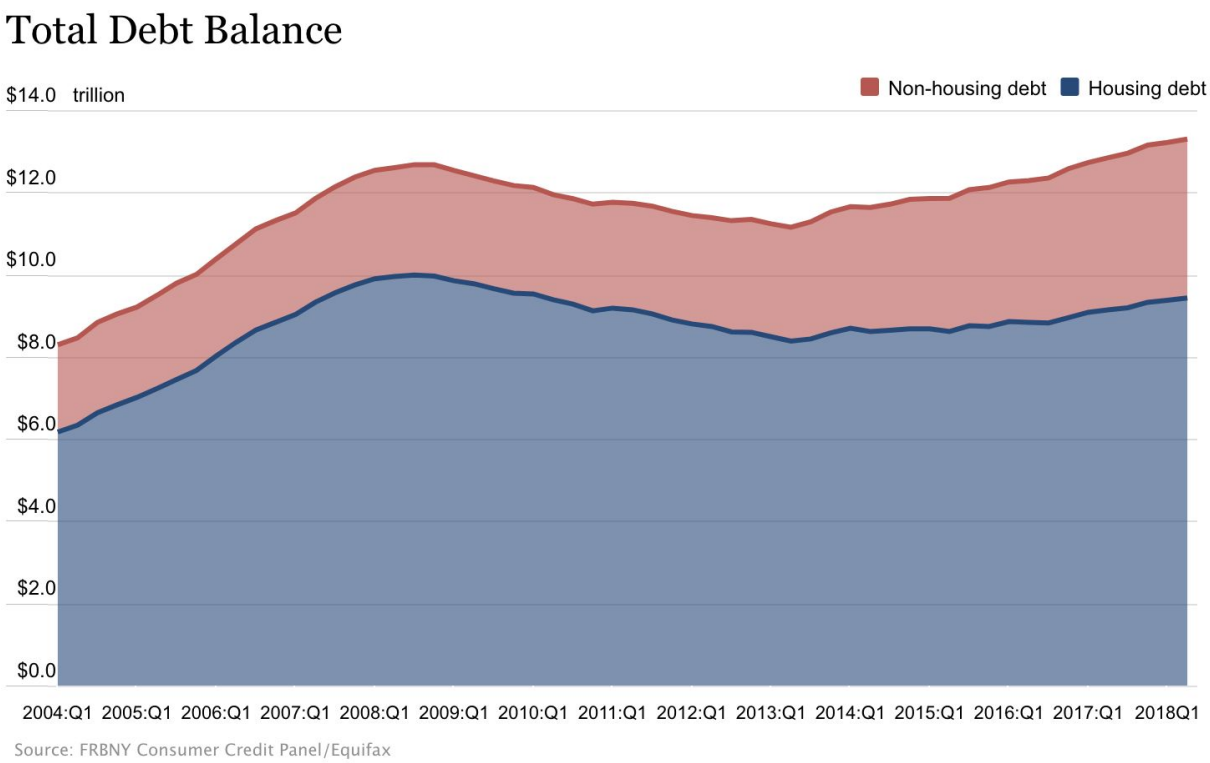


Chart: Total US debt balance (The Center for Microeconomic Data, 2018).

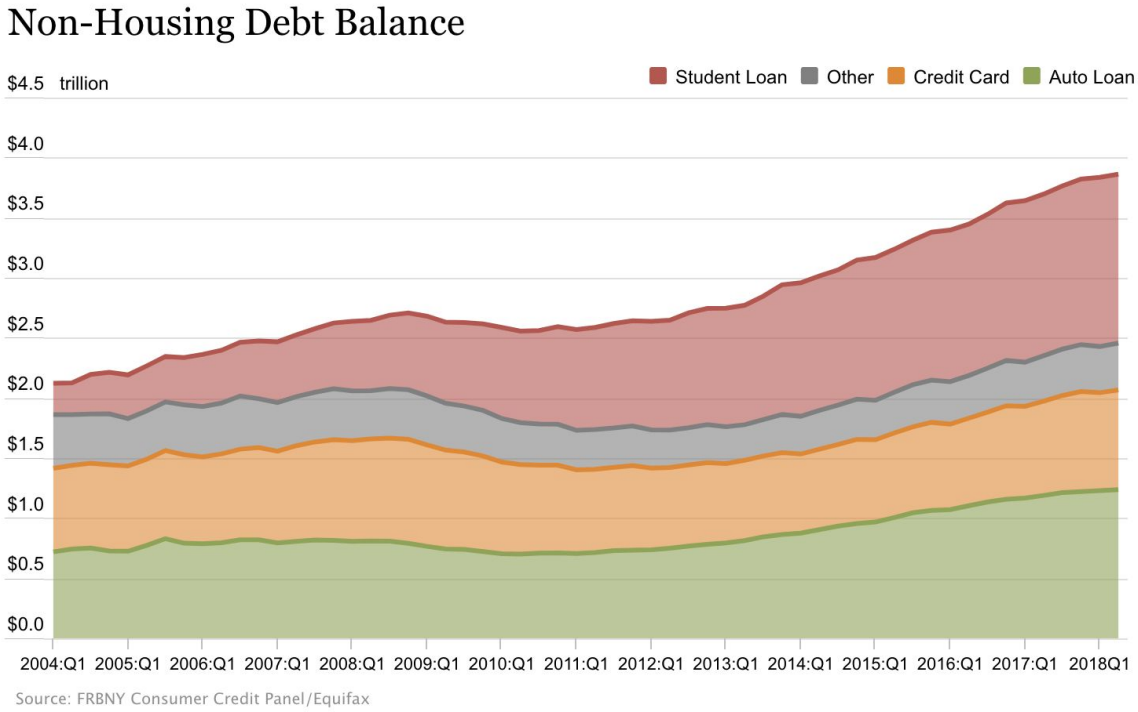


Chart: (The Center for Microeconomic Data, 2018).

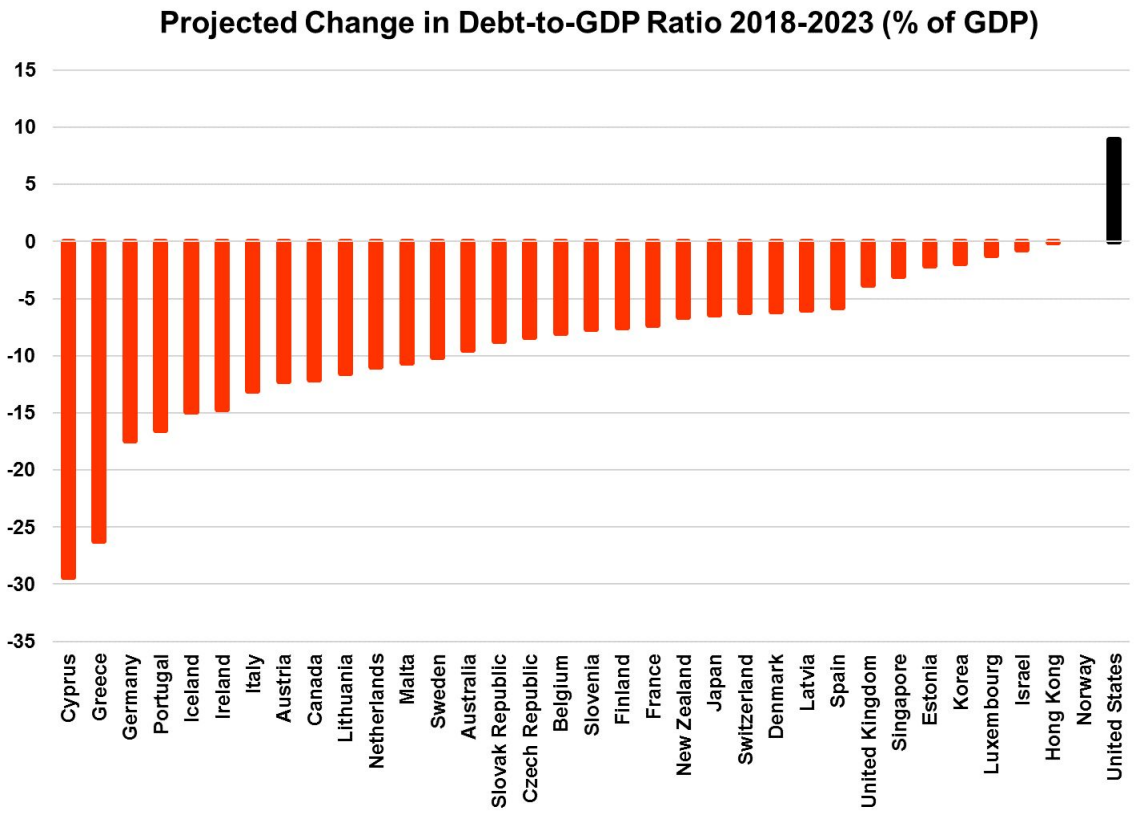


Chart: (Bourne, 2018).

The International Monetary Fund (IMF) notes that global debt is at a new record high and warns that the combination of high debt levels with rapidly increasing debt is a historical precursors to financial instability and declines in broad economic activity. While the IMF recommends debt reduction at times of economic growth, the US is on course to do the opposite. This chart above (Bourne), based on IMF data, shows that the US is the only advanced country projected to raise government debt-to-GDP ratio in the 5 years between 2018-2023 (International Monetary Fund, 2018).

4.3 Depreciation

Most people think that when they “own” money or commodities, wealth or value belongs to them. In reality, many assets depreciate over time, meaning that you can acquire less in trade for the asset (loss of purchasing power). Depreciation is the measure for how much *less* you can acquire than before. Some depreciate drastically, leaving holders with the shriveled husk of what used to contain value. As a result, holding money can be expensive in the sense that as you try to hold onto it, the value can slip away (Peterson, 2002).

Wampum, the beautiful part of certain seashells crafted into beads, was once used as currency by indigenous North Americans. When Europeans colonized North America in the 1600s, they also used wampum for trade. When colonists developed techniques to mass produce wampum,

they contributed to *supply inflation* that devalued the local currency. Since that time, wampum has been completely devalued as a currency. Wampum is now valuable only for art, jewelry, and artifacts (Ceci, 1982).

It comes as no surprise that seashells lost their value as currency. What's more surprising, however, is the devaluation of the US Dollar over time. Snce just 1918, the Dollar has depreciated by 94% as a result of inflation (Durden, 2009). If you had a US Dollar that you had buried in your backyard in 1918, its purchasing power today would be the equivalent of around $0.06 in 1918.

4.4 Power and Control

Private citizens are deprived of economic power and control over their wealth by governments in at least two ways. First, government regulations restrict access to certain financial instruments and markets. Second, governments and central banks control monetary policy, leaving individuals who simply want to work, earn, and save with no way to control their financial futures.

4.4.1 The U.S. Securities and Exchange Commission

The United States Securities and Exchange Commission's (SEC) was formed in the wake of the Great Depression through the Securities Exchange Act of 1934 (SEC, 2013b). Although the United States Securities and Exchange Commission's (SEC) applies to the U.S., it is addressed here because the SEC actively exerts global influence on regulatory practice well beyond its jurisdiction. The SEC's Office of International Affairs (OIA) engages in "international efforts to raise regulatory standards and promotes cooperation among the world's securities regulators" (SEC, 2014).

The SEC restricts ordinary citizens from participation in many financial markets. For example, only "accredited investors" with a net value of over a million dollars can legally participate in "private placement" offerings (SECa, 2013a). These restrictions are supposed to be for the good of the ordinary person, but they also sustain an economic apparatus that is designed to increase the concentration of wealth in the hands of the already wealthy.

The SEC has some genuinely good reasons for introducing restrictions, namely to prevent a repeat of what happened when large swaths of ordinary citizens became invested in the stock market in the early 1930s. First, many people invested in risky schemes and outright scams and had no recourse when they lost money. Second, when the US economy collapsed, ordinary citizens who were heavily invested in corporations that went bankrupt lost everything. The exposure was vast. It also meant that private citizens were unable to fulfill their debt obligations, further harming banks and lending institutions (SEC, 2013b) Limiting that exposure to risk was a way to mitigate the effects of any future economic catastrophe.

There is a paternalistic theme running through SEC regulations that is noble in origin: imposition of power and control is necessary to protect smaller market participants from the overwhelming

strength and threat of larger entities. In essence, the goal is, or was intended to be, a level playing field.

Risk disclosure is supposed to help the individual investor, but once those disclosures are made and consent is given, large and powerful economic actors (including governments) wash their hands of potential harm, assigning all risk to the consenting individual. The customer's consent is a "get out of jail free" card, that protects the decision makers from liability for the individual's losses, which are sometimes devastating.

The SEC's regulations have a secondary function. Since the markets appear to be regulated and since regulations appear to be periodically enforced against, for instance, insider trading, the rules collectively tend to perpetuate the illusion that the markets are actually fair and free. The truth is that they are controlled by powerful private interests that can leverage inside information to manipulate markets. In other words, the existence of regulations serves to quell potential unrest about actual market inequalities. Meanwhile, the risks to normal people continue to increase and dangerous monetary policies (discussed below) are needed to clean up the mess.

4.4.2 Monetary Policy

Monetary policy is another area where powerful economic actors have the ability to restrain and control individuals with the goal of maintaining the larger economic system. This may take the form of slight interest rate adjustments or the printing of money that occurs under quantitative easing.

The monetary policy that helped the United States get out of the Great Depression is essentially the same one that was used to jumpstart the economy during the financial crisis of 2008. The policy of deficit spending likely contributed to the economy's recovery. The practice, however, of going into debt to improve future productivity has its limits and can incur serious risks. If a nation goes bankrupt and cannot repay its debts, the gambit could fail catastrophically and backfire.

During the Great Depression, companies closed or terminated employees in an attempt to put a tourniquet on hemorrhaging losses. Spending by both corporations and private citizens shrank. The US government was the only remaining player in the economy with spending ability, and spend it did, by detaching the US dollar from the gold standard and printing more money (supply inflation) (Goldstein, 2011).

Economist John Maynard Keynes (1936) advanced the notion that, in such an economic crisis, the government was the one actor capable of jumpstarting the economy. This was done by lowering the risk for entrepreneurs to borrow money and spend it, increasing economic liquidity. This practice, in combination with World War II spending, and an upsurge in wartime production and employment, seems to have successfully refueled the economy.

During the great depression, the US economy, including all of the newly impoverished citizens, was too big to fail and the government stepped in to rescue it. In 2008 the financial crisis was

more contained. Only the wealthiest of investment banks were too big to fail. It was the bankers who got the bill out by the government, not the country as a whole (Lewis).

The government responded with bailouts of select troubled investment banks followed by programs of “quantitative easing” which fueled new spending and prevented a dangerous downward spiral (Lewis). While such programs may provide the appearance that the economy is humming along nicely, they also maintain a status quo of a lightly regulated financial industry that is too big to fail and will be protected at great cost to taxpayers with inflationary monetary policy that incrementally increases risk of further financial catastrophe.

Many governments around the world base their monetary policy on an optimistic expectation of the future national gross domestic product (GDP). A look at the increasing number of banking crises from the 18th century to the current day, however, establishes that this optimism is misplaced. In the 1700’s Europe and the United States experienced four instances of massive withdrawals as people feared their banks could not be trusted as a place to store value. In the 1800’s, this number went up to twelve. In the next century, there were seventeen banking crises, including the Great Depression. More important, however, is the fact that thirteen of these seventeen disasters occurred in just the last twenty-five years of the 1900’s. In the current century, this frequency continues to increase, as we have seen another thirteen banking crises in less than twenty years (Reinhart & Rogoff, 2011). Put another way: the number of banking crises in the last forty years (26) is more than the number of bank crises in the 275 years from 1700-1975 (20). Governments and monetary policy, once imagined to stabilize economies and bring confidence to government issued currencies, are proving ineffective (Bouvatier, 2017).

So while the bankers and pundits are yelling that Bitcoin is a bubble that’s going to burst, an economy based on government issued currency is unreasonably risky with stakes that cannot be underestimated. The notion that people and businesses will take the bait of cheap credit, low interest loans, and other cheap debt, and then spend that money, causing the economy to flourish, is not only unfounded but actually dangerous. What if the optimism were to burst? What if there were suddenly good reason for pessimism? The answer could be financial catastrophe. We have seen it before and we are frighteningly close to seeing it again.

The disaster could start with a local morning news report of a run on a few area banks. Images of people in lines around the block desperate to get their money before their bank folds could spread like wildfire through cable, internet, and social media in a contagion of fear, driving national panic. The day could end with the collapse of faith in the government issued currency, or even global failure of the international banking system altogether.

For the fortunate who are well informed about finance and current events, a crisis of confidence could precipitate a flight to safety in the form of more reliable assets like silver, gold, and bitcoin. Selling the dollar puts further downward pressure on its value, wreaking havoc on the lives of the ones left holding the bag. When governments control private individuals’ use of their own money, it further locks them in to dependence upon assets tied to the government backed currency, regulated by hazardous policies over which ordinary citizens have almost no control. Attempts to diversify retirement portfolios by using mutual funds including only a mix of stocks and bonds — all tied to the USD economy — leaves those investors with almost no protection from the risks of international panic.

4.4.3 Autonomy and Choice

The way to counteract this unreasonable imposition of power and control is the creation of autonomy and choice. People want to engage in meaningful financial management without governmental and regulatory restraints. People are currently trapped by a regime where almost every asset is tied to, or dependant upon, the US Dollar. Even this brief assessment of current conditions shows what a risky scenario that creates, and the SEC and monetary policy either try to paper over those risks or actually make them worse. A new asset class that is not backed by government authority and not subject to government regulation can provide that autonomy and choice so that everyday people can take back control of their financial destinies.

5.0 Savings: Market Assessment for XDM

Saving is rightly regarded as a universal good — something from which everyone can benefit regardless of who they are or how much money they have. Few other concepts, regardless of context, have achieved such widespread acceptance as the beneficial aspects of saving. The reasons to save are easily understood and widely known: unexpected medical bills, volatility of social security, education costs, and retirement to name just a few. Unfortunately, as more and more people borrow, they put off saving in order to keep up with credit card payments and other debt maintenance. This has lead to the perception that saving is only available to the very wealthy who can contribute to some savings instrument that will increase in value over the long term.

A recent survey shows the extent to which Americans are not saving and the reasons they give (Tepper, 2018):

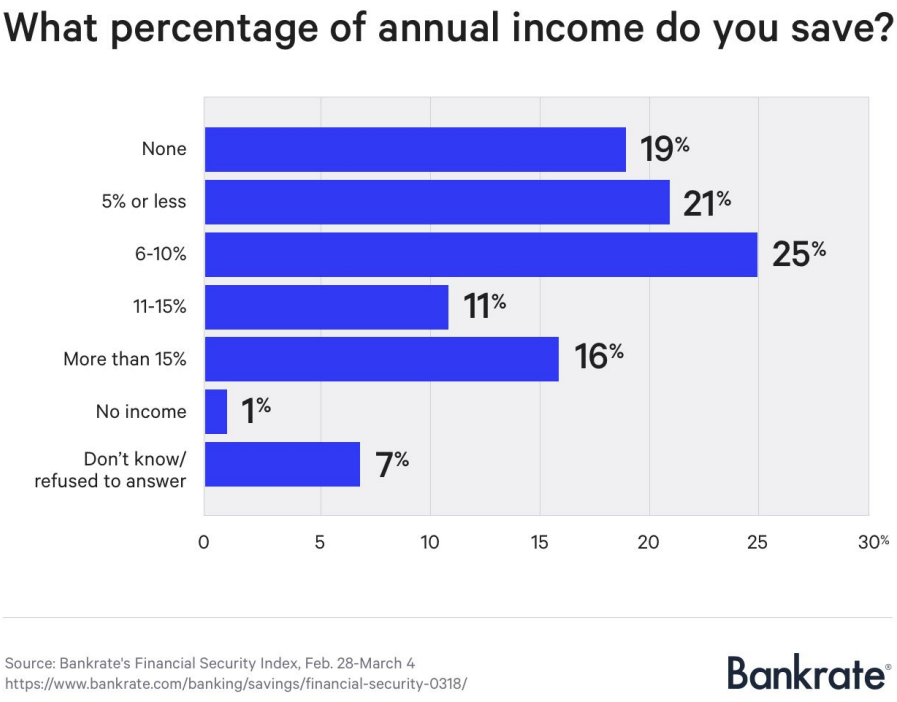


Chart: Percentage Americans save annually (Tepper)

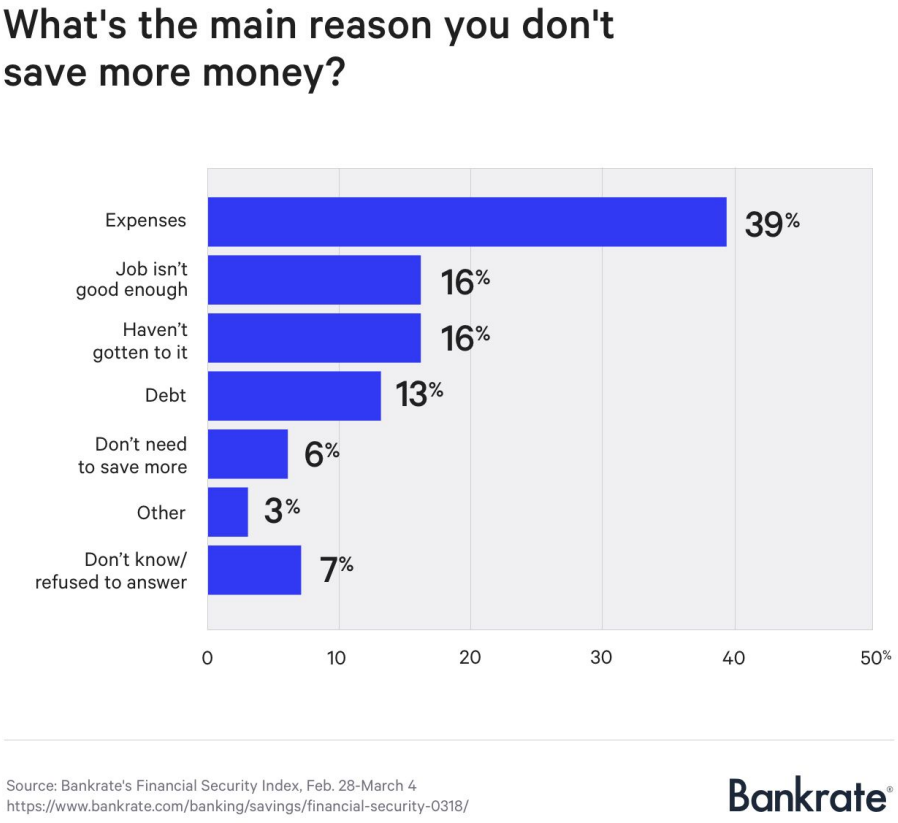


Chart: Main reasons Americans don't save (Tepper)

While these survey results may show alarming trends about a precarious situation for so many Americans, they also reveal an extraordinary market opportunity. There is a vast amount of room for growth in the savings market. Everyone already knows they need to save. Until now the options have been limited, confusing, expensive, and far riskier than they purport to be. Dark Matter is a democratizing asset that makes financial management accessible to many more people by avoiding regulatory barriers that strategically impede and discourage people from saving their own money and shaping their own financial destiny.

6.0 Stores of value today

Assets can utilized in a any number of ways and sometimes in multiple ways at the same time. A homeowner may use his house for shelter, but it also acts as a store of value. US Dollars are useful for the purpose of buying goods, but their utility as a store of value is weakened by the ever present risk of spiraling inflation. People need a safe place to store the value that they have worked so hard to obtain. Diversified investment portfolios seek to balance safety with some risk in the hope of growing the value of assets owned.

Economists and historians of money define a number of properties that contribute to an asset's status as a Store of Value (Desjardins, 2015). This section characterizes the qualities of five familiar assets currently used to store economic value to compare and contrast Dark Matter with widely adopted legacy solutions.

6.1 Definitions of terms

Mobility — An asset with high mobility can be easily transported. A $100 bill is easier to carry than $100 worth of gold (at present values).

Divisibility — An easily divisible asset can be precisely divided into subunits of exact fractional value. Smaller value banknotes and coins make it fairly easy to make change for a larger bill. Several small pieces of gold have the same value as one piece that equals the cumulative weight of the small pieces. When there is greater difficulty and expense in creating exact subunits of fractional value, the asset is less divisible.

Resistance to regulation — An asset is resistant to regulation when it is not highly vulnerable to arbitrary changes in monetary policy, regulation, government confiscation, and social, environmental, and economic disasters. Thus, assets that are controlled by government policy, such as fiat currency are not resistant to regulation. Real estate has intrinsic value for its utility, but is still heavily regulated as a result of taxation, eminent domain, and transfer costs. Gold has intrinsic value and can readily be traded, even in the face of a cataclysmic disaster.

Fungibility — An asset is fungible when one unit of the asset is identical to every other unit of that asset. Since any single US Dollar is worth as much as every other US Dollar of the same denomination, USD is considered to be a fungible asset. If different instances of a given asset have varying values, then those assets are non-fungible. Examples of non-fungible assets include original works of art and antiques.

Dynamic fee structure — An asset with a dynamic fee structure sets network transaction fees based on a non-static property. This could be a fee that is predictable and proportional to the inflationary or deflationary supply dynamics of the asset.

Supply Deflation — A deflationary asset has a diminishing supply over time. In this document, deflation and inflation refer strictly to asset supply. Some economic traditions calculate inflation relative to purchasing power, which is usually related to the dynamic between growth of supply and growth of demand.

Predictable scarcity — An asset features predictable scarcity when the supply amount is known and when supply inflation rates are predictable and structured.

Utility — An asset has utility when individuals and/or institutions make practical use of the asset, or when there are potential or established systems of social function.

Liquidity — Liquidity refers to the market depth of active buyers and sellers. A highly liquid asset can be readily converted to another asset through an unrestricted exchange populated by buyers and sellers who approximately agree that both assets in the exchange pair have the same value.

Forgery resistance — A forgery resistant asset can be easily authenticated as genuine, and a counterfeit asset can be readily identified as a fake.

The table below summarizes how several stores of value compare along the above-defined criteria. Following the table there is a more detailed discussion for each particular asset.

	XDM	USD	BTC	STOCKS	GOLD	REAL ESTATE
High Mobility	✓	~	✓	✗	✗	✗
Divisibility	✓	✓	✓	✗	✗	✗
Regulation Resistance	✓	✗	✓	✗	✓	✗
Fungibility	~	~	~	✗	✓	✗
Structured Fees	✓	✗	✗	✗	✗	✗
Deflationary	✓	✗	~	✗	✗	✗
Predicable Scarcity	✓	✗	✓	✗	✗	~
Utility	✓	✓	✓	~	✓	✓
Liquidity	~	✓	✓	~	✓	~
Forgery Resistance	✓	✗	✓	✗	~	~

***Table*: Comparing store of value assets by their properties.**

6.2 Gold

6.2.1 Mobility

Gold has some measure of mobility, compared, for example, to real estate. It is also a very dense element whose intrinsic value is based on its physical weight/displacement. As a result, gold is unwieldy to move in bulk.

6.2.2 Divisibility

Gold has poor divisibility. Gold is known for its malleability, and with effort can be cut or melted to an approximate weight and traded for other assets at a dynamic exchange value both parties can agree upon. In practice however, precise division of gold is painstaking and time consuming. Compared to other stores of value, gold has only moderate divisibility

6.2.3 Resistance to regulation

Possession of gold is not currently subject to any regulatory restrictions. Individuals may conduct private business with gold without government interference, although the use of gold in market transactions, such as on exchanges, may be subject to taxation and regulation.

Supply of gold is regulated by governance of competitive mining companies seeking to extract gold to supply market demand. Since new technologies are evolving to locate and mine gold, corporations have little motivation to manipulate the rate of extraction to control supply. Companies do, however, make business decisions about the cost of acquiring mining rights and the cost of mining efforts relative to the current and projected market valuation of the asset. In light of these considerations, gold is highly resistant to arbitrary regulation.

6.2.4 Fungibility

Gold is generally considered to be fungible, since one ounce of pure gold, in whatever form, should be worth the same exact amount as any other ounce of gold. Any discussion of gold's fungibility must take note that gold sometimes contains impurities. If such impurities are unknown, then asset value could fall drastically below market value. On a practical level, it is difficult to have confidence that one gold ingot is equivalent to another of equal weight, so traders must either trust third party authorities that have certified the gold bar's purity and weight or test the gold to their own satisfaction.

6.2.5 Dynamic fee structure

Gold has no intrinsic fee structure for transactions. Transactions involving gold at any scale almost always involve third parties who set transaction fees according to what the market will bear. Regulatory fees and taxes are exogenous and entirely unrelated to the intrinsic properties of gold.

6.2.6 Deflation

Gold is not a deflationary asset and has no intrinsic monetary policy. As mining continues, the supply of gold perpetually increases. Gold may be removed from circulation from time to time, but is almost never permanently destroyed.

6.2.7 Predictable scarcity

Despite its perception as something rare, gold has no predictable scarcity. Supply of the commodity can be affected by new deposit or discovery, which happens regularly. Supply is determined not by demand, but by the profitability of the mining operation.

6.2.8 Utility

Gold's use as actual currency for trade has also been reduced significantly over time (Kumar, 2011). Over 50% of gold's current utilization is for jewelry, while the other 50% includes, bars and coins, central bank purchases, electronics and other industrial uses and dentistry (Statista.com, 2017).

6.2.9 Liquidity

Liquidity in the gold market depends on both local and global factors. The perception of gold as a "safe" SoV results in increased demand when there is uncertainty in other currency and commodity markets. Simply selling gold can be an exercise in itself, involving several 3rd parties and requiring a great deal of trust in each of them. Mature local and global markets certainly exist but access to those markets is not always ensured.

6.2.10 Forgery Resistance

Gold's industrial, monetary and aesthetic applications are all subject to forgery, poor quality, and imitation. Formal certification of gold's value is extremely dependent upon layers of trust, including trust in the authenticity of the certification and the certifying authority.

6.2.11 Summary: Gold as a store of value

In the popular imagination, gold is an ideal store of value. In reality, however, it's unsound. "Goldbugs," wary of the vulnerabilities of USD (addressed below), believe that gold is the only secure asset worth investing in as a long term store of value. The present analysis leads to the conclusion that gold, while beautiful, malleable, conductive, and dense, is vulnerable to supply inflation and difficult to move, trade, and divide.

6.3 United States Dollar (USD)

The US Dollar is a global currency, widely considered a reliable vehicle for storage of value. It is heavily traded internationally and functions as a crucial instrument for debt management both within the United States and around the world.

6.3.1 Mobility

On a transaction-by-transaction basis, USD has good mobility. The amount needed for everyday transactions, such as purchasing groceries, or paying for a haircut, or filling the car with gas, can easily be held in a pocket or traditional wallet. The number of bank notes needed, even for all three of the examples, is relatively light and merchants and service providers can certainly be counted on to make change.

There are, however, costs imposed on the exclusive use of cash, which include inconvenience and potentially disastrous social burdens. Picture small business owners having to temporarily shut down their establishments as they take bags full of USD to the bank for safekeeping. In terms of social burdens, there is often a presumption that young individuals who carry large amounts are engaged in illegal drug trade. This is especially true in the young African American population (Wing, 2015). Thus, mobility of USD is constrained by convenience and social stigma.

In many United States jurisdictions, the law imposes civil forfeiture upon a mere showing of probable cause. This means that an individual's property may be seized by the state until the individual is acquitted (Wing, 2015). The easiest thing for the government to take possession of is USD that is on the person being charged.

Transporting or sending USD across international borders can be expensive and time consuming, and is heavily regulated (Orozco et al., 2016). Even low dollar value remittances can be burdened with such exorbitant costs that poor people lose most of the value they are trying to send to their even poorer relatives. International transfer of high USD values also can trigger regulatory requirements for proof of identity and may be associated with significant fees and taxes depending on the banks and nations involved. Even international transport of one's own USD can be complicated by the bulk of bank notes and regulatory disclosure requirements.

ATMs, credit and debit cards, near field transmissions, and other electronic transfers all appear to add to the mobility of cash, but such convenience comes with costs. Obviously credit cards add significant cost to any transaction. The same is true with electronic transfers like Western Union and Apple Pay. An ATM transaction, even if no specific fee is collected, still requires a large physical machine (as opposed to a portable device that one would carry routinely, such as a phone).

6.3.2 Divisibility

USD is divisible to the penny, or 1/100th of a dollar. For most transactions, cash is sufficiently divisible at current USD values. It is conceivable that, by means of electronic transfers and centralized computer ledgers, the dollar could be divisible beyond the penny. Considering how little value a penny has in world markets, it is hard to see any incentive towards such divisibility. Stated another way, the market value of USD means that the penny is a sufficiently precise unit of division.

6.3.3 Resistance to regulation

The U.S. Federal Reserve regulates money supply, by adjusting the quantity of total USD in circulation. The Federal Reserve has nearly unchecked power to issue USD, adjust lending rates, and impose conditions of Federal Deposit Insurance Corporation (FDIC) protected lending institutions (institutional and commercial banks) (Wisner, 2016). Accordingly, USD is profoundly vulnerable to regulatory influence.

6.3.4 Fungibility

One dollar bill is completely interchangeable with another dollar bill. A ten dollar bill has the equivalent value as the combination of a five dollar bill and five one dollar bills. One twenty dollar bill is completely interchangeable with another twenty. As long as neither of the bills is counterfeit (U.S. Treasury 2006). According to the United States Department of Treasury, an estimated $70 million in counterfeit bills are in circulation,or approximately 1 note is counterfeit for every 10,000 in genuine currency, with an upper bound of $200 million counterfeit, or 1 counterfeit per 4,000 genuine notes (Federal Reserve Bank of San Francisco, 2004). Genuine USD is fungible. Valueless counterfeit USD dilutes this fungibility.

6.3.5 Dynamic fee structure

Banks and financial service providers charge large fees for simple services, even the ones from which the banks make further profit. Checking and savings accounts, and credit and debit cards, are all laced with fees. Customers that participate at large scale (commercial, industry and wealthy clients) get the best discounts, but for most customers there is no fee drop mechanism. Financial service providers can be expected to charge what the market will bear.

The most insidious fees are the ones that can’t be seen on a bank statement. As central banks unilaterally decide to print more money without your consent, your government issued currency loses value.

6.3.6 Deflation

USD is inflationary, not deflationary. Supply inflation comes through various central bank programs that go by innocuous names like, “quantitative easing,” and “interest rate adjustments,” but amount to printing money. Every time supply increases, value of USD decreases. If you had a US Dollar that you held since 1918, its value today would be around $0.06. The cumulative rate of inflation over 100 years is 94% (Durden, 2009).

6.3.7 Predictable scarcity

USD has no supply cap. The Federal Reserve has authority to issue up to an infinite amount of US Dollars. With no supply limits, inflation is inevitable and theoretically unlimited. In practice, the rate of inflation is unpredictable and autocratically regulated.

6.3.8 Utility

USD has significant utility as it meets all the criteria for functional currency: USD functions as a store of value, a medium of exchange, and a unit of account.

We now have inflation as a sustained and predictable force in our economy. We know for certain that we are losing buying power year after year. The only solution is to “use it or lose it,” because $1.00 spent today is worth more than $1.00 spent tomorrow. An educated investor knows that holding USD in favor of an increasingly valuable stock or other asset is tantamount to simply burning money.

6.3.9 Liquidity

USD markets currently have a high level of liquidity. Generally, one can always find someone to accept USD as a form of payment. That could change in an instant when erosion of confidence in the U.S.’s ability to repay its debts reaches a tipping point. At that point, USD value would go into a free fall as economic actors exited the USD market *en masse*. Examples of such currency crises can be found in early 1980’s Argentina when a new peso, equaling 100 billion of the old pesos, needed to be instituted (Sørensen, M., 2001). In 2007, Zimbabwe had to print a 500 million dollar bill to keep up with %11,000 inflation (The Source). In 2018,Turkey’s borrowing spree finally caused the Lira to crater and required a $15 billion bailout from Qatar to stave off a total economic collapse (Inman, P. et al., 2018). After such an economic collapse in the United States, the USD would lose most, if not all, of its liquidity.

6.3.10 Forgery resistance

USD is vulnerable to forgery. According to the United States Department of Treasury, an estimated $70 million in counterfeit bills are in circulation, or approximately one counterfeit note for every 10,000 in genuine currency (U.S. Treasury, 2006), with an upper bound of $200 million counterfeit, or 1 counterfeit per 4,000 genuine notes (Federal Reserve Bank of San Francisco, 2004).

6.3.11 Summary: USD as a store of value

While investors generally regard the US Dollar as “safe” relative to volatile stock markets, the reality is that USD is designed, by policy and practice, to lose value through deflation. Not only that, USD’s value is interconnected with the stock market performance, such that severe fluctuations in the markets can affect USD value and vice versa. USD is undeniably a powerful asset for spending. For savings, the risks are both obvious and taken for granted.

6.4 Stocks

6.4.1 Mobility

Stocks, once issued as paper certificates, are now almost exclusively issued and traded digitally. People who entrust the management of their stock to trading platforms can access the asset indirectly wherever they can verify their account credentials. Investment banks and trading platform companies may limit geographic access to comply with regulations or to block unauthorized access.

6.4.2 Divisibility

Stock is generally issued as shares that are distributed and traded in whole numbers. Shares cannot be split into fractions with shared ownership. The key exception is that a company may initiate a stock split or reverse-split. As a store of value, it is very difficult to make change when trading shares of stock.

6.4 3 Resistance to regulation

Stocks and the companies that issue them are highly susceptible to the regulatory authorities and the vagaries of regulatory change.

6.4 4 Fungibility

Since the monitoring of stock ownership at retail level is highly centralized, all shares are essentially marked as distinct assets or collection of assets associated with an account.

6.4.5 Dynamic fee structure

Fees are set by the private corporations that manage ownership and trading of stock shares. Fees are highly variable and depend upon what the market will bear. Regulation and competition are two key factors influencing fee dynamics.

6.4.6 Deflation

In compliance with regulatory requirements, companies can issue more shares of stock or “float,” increasing the total supply of stock, diluting the value of each share sometimes dramatically. Companies may also “buy back” shares of stock, reducing the publicly available supply.

6.4.7 Predictable scarcity

Companies can issue more shares of stock without shareholder consent (see section 6.4.6 above). Companies can also buy back shares of stock. Both practices change the total number of shares. Stocks lack predictable scarcity.

6.4.8 Utility

Stock and other securities enjoy a unique kind of utility as, in many cases, they are merely debt obligations that entitle the holder to actual ownership. The issuing entity then gets more capital with which to make the thing owned more valuable. In theory, the issuing entity cannot enrich itself at the expense of stockholders because the profits, even to the issuing entity, are dispersed in a pre-ordained and predictable arrangement that was known to purchasers at the time of stock issuance and any subsequent transfer. The utility of stock to the issuing party goes beyond mere fund-raising, as it is a quantifiable sign of “public” support for a given enterprise. There is no corresponding benefit to the asset holder beyond the value of the SoV as an investment.

6.4.9 Liquidity

Stock is traditionally considered a liquid asset because a buyer for a stock listed in a major market can always be found in short order. This is not always true, however, with publicly traded stocks that do no get listed. Among traditional currencies, only cash has the perception of greater liquidity. A comparison to blockchain technology reveals that we now need to rethink that level of liquidity. Even with current technology, there are still limitations imposed on when and how stock can be transferred. While some market may always be open somewhere in the world, not all markets are open and trading at all times. Liquidity of stock is also impaired by the requirement of third parties to complete transactions. This adds extra cost and delays transaction completion. Thus, despite its reputation as a ‘liquid asset,’ stock value cannot be transferred at *any* time to *any* willing market participant.

6.4.10 Forgery resistance

Stock represents an agreement, which has no corporeal form. There are numerous ways in which that agreement can be memorialized, but the common law of contracts does not require a specific document to establish the terms of the contract. There is a risk of forgery to the extent that these memorializations can be imitated, either on paper or in digital form.

6.4.11 Summary: Stocks as a store of value

While stocks are generally considered to be higher risk assets than cash or bonds (Cheng, 2017), they represent an opportunity to participate in economic growth. In order to achieve higher rewards, market participants must also accept greater risk of loss. To manage that risk, most Americans who save for their retirement invest in mutual funds, commercially managed diversified portfolios of socks and bonds, selected according to the client’s time horizon and risk tolerance level. These vehicles are practical because portfolios can be formulaically balanced while requiring little effort or expertise on the part of the client.

On the other hand, the omnipresence of mutual funds in employment-based retirement packages means that large swaths of Americans are exposed to the risks of the financial system as a whole. If the market tanks, it’s not just the “high risk” crowd that will get hurt. The downside of entrusting wealth to third parties, besides the fees paid to money managers, is that financial knowledge is outsourced, leaving most investors with little practical understanding of

the an opaque and precarious financial system even though investors are susceptible to all its risks. Stocks are speculative assets that may provide excellent returns for some willing to risk money they can afford to lose. As a store of value, however, stocks are extremely risky.

6.5 Real Estate

6.5.1 Mobility

Real estate is a unique SoV in that its location (i.e. *lack* of mobility) is one of the strongest factors in determining value. If mobility is a desired or necessary feature of an SoV, real estate is a poor choice.

6.5.2 Divisibility

Larger tracts of land can be subdivided to create smaller SoVs out of a single asset. Such a subdivision, however, is almost invariably subject to both significant regulation and transaction costs. Also, as further discussed below, utility is highly influential in determining the value of real estate. A subdivided asset of real estate only has value if it is large enough for some use to occur within its bounds.

6.5.3 Resistance to regulation

Real estate transactions are currently subject to significant regulation with great regional and local variation. There is no data to suggest this arrangement will change in the foreseeable future. Gone are the days of the ‘frontier’ and manifest destiny. In every civilized corner of the world, the governing entity imposes regulation on real estate transactions in the form of taxation, recording requirements, and other burdens which impede private arrangements between the owners of real estate assets.

6.5.4 Fungibility

Because of its absolute dependence on location and utility, real estate is a uniquely non-fungible asset. Simply put, no two real estate assets are alike enough to be evenly exchanged. Even two identical units on the top floor of a condominium are not “fungible” assets. One unit may have a southern exposure, causing different lighting conditions which may be more or less desirable. Another unit may be situated next to a noisy neighbor. Thus, even in a setting where two real estate assets are the same size and in essentially the same location (and subject to the exact same burdens, encumbrances and regulations), they are not fungible.

6.5.6 Dynamic fee structure

Like gold, real estate lacks any intrinsic fee structure applicable to all transactions. There is some predictability within certain geographic markets and political subdivisions, such as tax rates, recording fees and legal fees, but these numbers vary significantly from location to location. In essence, different rules apply for holders of real estate assets in different locations,

even if those assets have the same value. The good news is that, for a given asset, the predictability of a fee structure will have some consistency over time. The bad news is that governing bodies are slow to react to changing market conditions, creating a high risk of disparity and disconnect between the imposed fee structure and the value of the asset with which that structure is associated (Woodall, 2006).

6..5.6 Supply deflation over time

Supply is a substantial factor for real property to the extent that the amount of available real estate in a given location will help determine that property's value. If location is highly desirable, a lack of real estate opportunities in the location will drive up value. On the other hand, if a developer builds a taller office tower, it could create a glut of unused real estate assets, decreasing value throughout the neighborhood. Holders of real estate assets are subject to unpredictable fluctuations based on other actors in the community who may not be sufficiently risk averse. Such actors will end up depleting their own assets' value and that of all those around them.

6.5.7 Predictable scarcity

While regulation imposes significant costs on real estate assets, a municipality's zoning regime will provide some predictability about how much real estate can actually be developed, even in high volume, urban settings. This predictability has limits, as has all too often been seen in the capricious manner and timing of changed zoning regulations and reassessments for tax purposes (Chicago Citizen, 2018). Thus, it may *seem* that SoVs based simply on available geography are predictable with regard to scarcity. In reality, the ability to transact in real estate that is many stories above ground, and the variability of changing regulations, are just two factors that diminish such predictability.

6.5.8 Utility

Utility, along with location, significantly influences the value of real estate assets. A particular asset may have a desirable location, but if the condition of the asset is compromised (for example, as a result of leaking underground petroleum tanks), the value will be correspondingly depleted. If a real estate asset cannot be used, the cost of remediation needed to regain utility may be even greater than the asset's value if it were in perfect condition. As a result of the myriad of government-imposed transaction costs, even relatively small problems with use have the potential to drastically lower asset value. The existence of insurance agreements is no substitute when the gas leak, natural disaster or other calamity disrupts use.

6.5.9 Liquidity

With few exceptions, real estate is not a liquid asset. Even though transacting parties may have generally shared agreement about value, a real estate asset can take months or even years to sell. Such delays invariably result from one party hoping to get more than, or pay less than, market value. The ensuing period of negotiation may be extremely brief where the market is especially robust, but this is still a time-consuming process when compared to the liquidity of currencies.

6.5.10 Forgery Resistance

There is no risk that a real estate asset would be inauthentic as to location. Evaluation of such an asset as a viable SoV, however, must include reference to the volume of litigation resulting from real property disputes. While the costs in money and time consumed by such disputes may not (all) be the result of forgery, many claims of ownership are quite literally inauthentic. This can be the result of countless factors, from actual malice to illegible ancient documents. The point is that, although real estate assets cannot be forged in the way some currency can, they are highly susceptible to competing claims, the costs of which must be considered in connection with real state as an SoV.

6.5.11 Summary: Real estate as a store of value

Real estate, as an asset class, has palpable utility. As a store of value, real estate is unpredictable and highly dependent upon external conditions and factors. Because of its great utility and potential scarcity, however, real property could potentially retain much of its value even in the event of a currency collapse. In this respect, real estate could serve as a valuable asset to help diversify one's holdings.

6.6 Bitcoin (BTC)

6.6.1 Mobility

Bitcoin can be transported securely and reliably anywhere in the world by any person who can remember a twelve word sequence. Bitcoin can also be transported in digitally encrypted files that can be instantaneously transmitted over the internet and readily decrypted by the owner of the decryption key. Proprietary hardware devices offer secure storage of Bitcoin private keys.

6.6.2 Divisibility

Bitcoin is divisible to one millionth of a whole Bitcoin. This unit (0.00000001 BTC) is called a "Satoshi" after Satoshi Nakamoto, the attributed author of the Bitcoin white paper (Nakamoto, 2008). If the exchange value of Bitcoin continues to grow at its historical pace, the number of decimal places, though ample now, may not be sufficient for the distant future.

Although Bitcoin has an extraordinary degree of divisibility, there is not yet a protocol that would allow adjustments to extend divisibility in the future if needed.

6.6.3 Resistance to regulation

Bitcoin is an open source development project and its implementation is a globally distributed network. No single governing entity controls the Bitcoin network or protocols. Governance is achieved by consensus among eligible network participants (computer operators that maintain full nodes eligible to signal adoption of protocol by the selective direction of hashing power). It is

hypothetically feasible for an agent or collective to engineer a 51% attack on the network (Kagan 2018).

6.6.4 Fungibility

Theoretically every Satoshi of every Bitcoin is the unqualified equivalent of any other Satoshi on the Bitcoin network defined by the same protocol. The dictum held by sophisticated cryptocurrency users is, “If you don’t control your own private keys, you don’t own the cryptoasset.” Some online services offer Bitcoin web wallet hosting, meaning that the company manages your private key, and mediates access to your holdings. The entity accounts for your deposits and withdrawals by means of a centralized corporate ledger (Acheson, 2018). The movement of the clients’ tokens are not necessarily accounted for transparently on the distributed blockchain.

When web wallet clients entrust their Bitcoin to the corporation, they outsource the responsibility for security to a third party. This trust may or may not be well placed. When USD holders entrust their funds to a checking or savings account, the bank may or may not have insurance in the event that the centralized agency (a single point of failure) is robbed, hacked, or otherwise attacked. Likewise, web wallet clients are wise to perform due diligence to satisfy any concerns about the trustworthiness and reliability of the web wallet holder. A reliable web wallet holder should be trustworthy, accountable, and have a track record of diligently protecting the security of assets and the networks that used to access funds. Web wallets that maintain insurance on assets they hold may be yet more trustworthy.

Since the Bitcoin code and the functional network has been “forked” multiple times, there are many blockchains that have identical address structures and parallel public/private cryptographic key pairs (Redman 2017). That means that a person who controlled a private key with a balance of 1 BTC before the Bitcoin Gold fork would also have a 1 BTC balance in the parallel address with the identical public/private key structure immediately after the fork. This has a significant implication for fungibility.

If I initiate a transaction from my Bitcoin Gold wallet to the public address associated with “Bitcoin” (*not* Bitcoin Gold) generated for my account on an exchange, the transaction will only be valid on the Bitcoin Gold ledger, and will not be reflected on the Bitcoin ledger. Many exchanges, by policy, will not return the erroneously spent Bitcoin Gold and return it to the customer. The initial statement of this section asserted that Bitcoin is fungible within a network defined by the same protocol. The reality of hard forked blockchains means that Bitcoin is interchangeable with Bitcoin, but Bitcoin is not directly interchangeable with Bitcoin Gold (or Bitcoin Cash, etc.)

6.6.5 Dynamic fee structure

Bitcoin fees are somewhat unpredictable based on demand via a bidding process when the block is full. The fee, however, is not enforced by protocol. It is up to the miner to determine which transactions are included. Transaction fees have ranged from under a penny to over $20 USD (Lee, 2017). Bitcoin transactions may be more or less complex depending on the number of inputs and outputs, and the complexity corresponds to the size of the digital documentation

(in bytes or kilobytes) that must be recorded on the bitcoin blockchain. Since the size of each block is limited, when there are enough transactions to fill the maximum capacity of a block, transactions with higher fees are usually accorded higher priority by miners who will receive the fees. Transactions with lower or no fees are deferred to later blocks and may be integrated into a subsequent block when transaction volume is lower or when an altruistic miner accepts the transaction regardless of the fee.

Innovations in Bitcoin technology have facilitated lower transaction costs and mitigated blockchain bloat (Hertig, 2018). In 2017, the fees grew so large that smaller value transactions were prohibitive. When it cost $5 just to spend Bitcoin, buying a cup of coffee with Bitcoin simply didn't make sense. While the network has largely solved this problem for now, there are additional potential challenges to the Bitcoin network that could drive up transaction fees. Bitcoin still needs to be able to scale as transactional velocity increases. As the Bitcoin coinbase, the block reward earned by the miner solving a given block, drops toward zero, miners will rely entirely upon fees to make it worth their while to continue providing network security operations. When miners control the price of transactions, their minimal competitive fee must still be sufficient to cover the costs of computer hardware and energy costs in order to sustain a functional network.

Bitcoin lacks a mechanism that would dynamically adjust the transaction fee in relation to the price of Bitcoin. Hypothetically, then, as in 2017, lower value Bitcoin transactions could become cost prohibitive, driving exchange of value users and storage of value users to other assets, and potentially freezing out lower value unspent transactions in Bitcoin. Small balances could not be moved because the cost of moving them would wipe out the value of the asset being moved.

6.6.6 Supply deflation over time

Bitcoin is a disinflationary cryptocurrency. With every block added to the blockchain, the coinbase or block reward is distributed to the miner that solves the cryptographic puzzle for the block. From the start, a disinflationary protocol was embedded into Bitcoin's code, scheduling graduated reductions in the size of the block reward. Since the coinbase is reduced by 50% each period, the transition to the next lower reward size is called a "halving." Since the Bitcoin distributed as a reward to the winning miner is generated anew (it is not taken from some pre-existing source, but is verifiably added to the total Bitcoin coin supply by network consensus), it technically constitutes a form of supply inflation. Inflation is thus predictable, scheduled, and limited, and since the rate of inflation declines predictably over time, the asset is considered disinflationary.

The rationale for Bitcoin's inflationary supply is sound: block rewards incentivize miners to contribute real work (in the form of computational calculations or hashing power) that contributes to network security by verifying the entire ledger of all historical network transactions. The mining labor in itself also means that miners have in fact invested in the cryptocurrency in the form of hardware, energy costs, and management of the hardware and software necessary to mine Bitcoin.

The rationale for block reductions or "halvings" of the coinbase is also sound: the original developer/s of Bitcoin predicted that demand for Bitcoin would increase: with a limited supply,

the demand would eventually drive up bitcoin's exchange value. Periodic halvings would maintain some reasonable balance of rewards sufficient to incentivize miners to secure the network.

6.6.7 Predictable scarcity

Bitcoin is provably scarce and has a predictable and ultimately fixed supply. It is possible to calculate the total Bitcoin supply at any future moment. Bitcoin is so scarce that if every millionaire on the planet attempted to acquire one Bitcoin, there wouldn't be enough to go around.

6.6.8 Utility

Bitcoin's monetary policy and characteristics as a cryptocurrency make it useful as a medium for the exchange of value, a store of value, and as a record of transactions (a ledger).

Bitcoin's utility as a medium for the transfer of value is somewhat limited by its volatility. Some mainstream companies like Microsoft accept BTC as a form of payment, but swiftly exchange BTC for dollars to ensure that the company captures the dollar value, the native currency of the company's business model. If a company were to adopt Bitcoin as the native currency, the volatility could threaten operations or even bankrupt a corporation with narrow profit margins. . Likewise, if a company agreed to pay employees weekly, a fixed payday amount denominated in BTC might be sufficient to pay rent one week, but insufficient to buy groceries the next. Volatility and unpredictable value are not unique to cryptocurrency. In countries that have very unstable local currencies Venezuela, Bitcoin has enjoyed popularity both as a as a store of value and as a medium for the transfer of value.

As a store of value, BItcoin's econometric properties suggest that it may have ongoing utility as an SoV because of its predictable and provable scarcity, disinflationary monetary policy, growing demand for the asset, and increasing transactional velocity.

Bitcoin is defined by its distributed ledger, maintained, in full, by every full node. Bitcoin's ledger has unrivaled security and transactions on the blockchain are irreversible. Because the ledger is public, it is possible to audit every transaction on the Bitcoin blockchain.

Bitcoin is programmable, making it valuable for smart contracts. Its potential utility has not been exhausted.

6.6.9 Liquidity

Bitcoin has liquid international markets with ample buy and sell depth in multiple fiat currencies (including USD, EUR, KRW, and JPY) as well as many other cryptocurrency markets (including ETH, LTC, and USDT).

6.6.10 Forgery resistance

Bitcoin is extremely forgery resistant. Technically speaking, there are no “bitcoins,” only an authoritative ledger of all transactions that is collectively verified by the network. When someone says they have one bitcoin in their wallet, what that really means is that they control the private keys to a Bitcoin address that every node in the network agrees holds an “unspent transaction” of 1 BTC. Since Bitcoins cannot be duplicated, the closest analogy to forgery would be a “double spend attack,” in which someone attempts to spend a single unspent transaction more than once (Kagan, 2018).

The aim of a double spending attempt would be like trying to use a debit card worth $10,000. to buy pay for a $10,000 car and at the same time use the same card to buy a $10,000 boat. Banks communicate with centralized computers to prevent both transactions from occuring. Once the money is spent, it cannot be spent again. Bitcoin’s decentralized network is designed to prevent that from happening, too, but instead of a single central authority, all Bitcoin full nodes retain a complete ledger of every transaction that occurs on the network. For a transaction to be added to a valid block that gets added to the comprehensive ledger, the majority of nodes would have to agree that the unspent transaction exists and is now being spent, so the majority of the network would reject any subsequent announcements that an already spent transaction was being spent again. Nevertheless, theoretically, the design could be hacked through a “51% attack” (Karame, Androulaki, and Capkun, 2012).

A 51% attack is an attempt to corrupt the consensus by temporarily controlling the majority of the network that determines which transactions are added to the Bitcoin ledger. The attempt would require an actor (or coalition) to control over half of all consensus agents (full nodes backed by expensive computational power) to manipulate network consensus. While not impossible, the barriers (billions of dollars in hardware and electricity) are nearly prohibitive.

Furthermore, commandeering the majority of nodes does not guarantee the attacker's success.The attempt could fail if the seller refused to release the product (the car or boat, for example) to the buyer until after a reasonable number of block confirmations had occurred. Waiting for ten block confirmations would mean that the entire network agreed over and over and over that the payment was indeed now under the seller’s control (or that the payment transaction was rejected). Waiting for multiple transactions, while time consuming and cumbersome, is considered a best practice to reduce susceptibility to such an attack.

If the attacker were able to sustain the 51% attack, controlling all transactions on the blockchain, the consensus mechanism would have proven a failure. The block rewards would go only to the monopoly reducing incentive to participate, Bitcoin users would lose faith in the network, and the price of BTC would collapse.

While technically possible, the economic disincentives would prevent the attempt. Who would spend billions for just a boat and a car, only to be left with a broken Bitcoin network and valueless bitcoins? Hypothetically such an attack could be performed strategically to eliminate Bitcoin, say, by a threatened government, but the actual outcome would likely be the development of more secure blockchain technology.

6.6.11 Summary: Bitcoin as a store of value

“It’s gonna moon!” “It’s a bubble!” Financial pundits’ opinions about bitcoin are as volatile as the asset itself. Despite the hand wringing that “Bitcoin’s value isn’t based on anything,” Bitcoin’s structural properties make it one of the best stores of value in existence. For now, Bitcoin’s volatility constrains its utility as a universal currency for short- and medium-term storage of value and spending. Time will tell if price discovery and utility settle to make it a more stable coin.

6.7 ION as a store of value asset

6.7.1 Mobility

ION, like Bitcoin, is a cryptocurrency with an independent blockchain. ION shares the same mobility properties as Bitcoin. Both are highly mobile assets.

6.7.2 Divisibility

ION shares the same divisibility properties as Bitcoin. Both are highly divisible.

6.7.3 Resistance to Regulation

ION is highly resistant to regulation, in the same way that Bitcoin is. External regulators have almost no capacity to control a decentralized network.

6.7.4 Fungibility

ION is highly fungible. Because ION incorporates zero knowledge proof technology, ION holders have the option to mint zerocoin ION (xION). Once minted, xION can be spent anonymously by instructing the blockchain to generate new ION and deduct the newly minted amount from the zerocoin balance. Since the xION is newly generated by the blockchain, the originating address provides no clues about the identity of the sender. The mathematical proofs that power this technology ensure that only validly minted xION can be spent. By contrast, Bitcoin transactions are merely pseudonymous. One need not provide a “real name” or identity to use or spend Bitcoin, but once the identity of the sending wallet is known, every related transaction can be traced through the blockchain-based ledger.

6.7.5 Dynamic fee structure

ION transaction fees are calculated based on the complexity of the transaction and the storage size of the text necessary to communicate that transaction to the network. Some blockchains, including Bitcoin and Ethereum, have had extraordinarily high fees because of network congestion, limiting the transactional utility of those assets. Ethereum, in particular, remains congested because the core blockchain cannot handle the transactional volume of tokens on the network. ION anticipates growth in scale of token utilization by offloading the potentially

burdensome data requirements to the secondary masternode layer. Masternodes can dynamically adapt to the demands leaving the ION core lightweight, nimble, and affordable.

6.7.6 Supply deflation over time

ION,like Bitcoin, is a disinflationary cryptocurrency; the size of block rewards declines over time. The rate of decline is initially steep and gradually levels off until rewards approach zero. As block rewards drop, network transaction fees will incentivize participation in network security operations.

6.7.7 Predictable scarcity

ION, like Bitcoin, is disinflationary. In ION, however, the scheduled block reward diminishment is steeper and faster, meaning that supply inflation drops to a very low sustainable level over a short period of time.

6.7.8 Utility

ION's primary utility is as a transactional asset. ION has seen adoption primarily on the web platform ionomy.com which accepts and facilitates ION as payment for digital goods and services. A gaming community and game development infrastructure has grown up around the ION ecosystem. ionomy Studios, for instance, has released three games so far that use ION as an incentive for competitive gameplay and has several more games in active development. Another developer, Rekall Games, has also demonstrated progress towards incorporating ION in the gameplay incentive structure for its flagship multiplayer fighting title, Rumble Arena. Using the "ionomy PWR-GRD" suite of game developer tools specifically designed to facilitate an improved gaming experience, Rekall is able to offer cost effective in-game currency purchases and cash prize tournaments with ION (Rekall, 2018; ionomy, 2018). With each adoption of the developer tools, ION gains greater utility and broader exposure.

With the execution of IIP #2, "secondary tokens," (Matlack and Pfeiffer, 2018), ION gains new utility for the generation and maintenance of new tokens on the ION blockchain. ionomy has announced that it intends to convert Atoms, an existing digital asset, into tokens. ionomy Studios has announced plans to generate tokens for in-game assets for specific games. The ionomy PWR-GRD service called "Thunder" facilitates the production of tokens that can replace in-game currency, and ionomy offers to list such tokens on the Alchemy exchange on ionomy.com, facilitating real money trade (RMT). By making adoption of ION and ION tokens easy, the PWR-GRD makes the ION ecosystem ripe for population explosion with consumers and creators alike filling the ecological niche. The PWR-GRD makes it easy for game developers to access the future of incentivized gaming, and at the same time creates a seamless on-ramp for gamers to discover the future of money just by having fun.

6.7.9 Liquidity

Like that of many cryptocurrencies, ION's liquidity fluctuates with demand. As more exchanges list ION and trading becomes more accessible to international market participants, and as more

game developers utilize the suite of services that integrate ION, the combination of greater accessibility, demand, and interest may lead to greater consistent liquidity.

6.7.10 Forgery Resistance

ION shares forgery resistance properties with Bitcoin. Both are highly forgery resistant. There are differences in the mechanism, cost, and deterrence of attacks because Bitcoin employs a proof of work (PoW) protocol while ION employs a proof of stake (PoS) protocol.

Like BTC, ION is technically vulnerable to a “double spend” attack via a 51% attack. In all cases, the attacker would have to control 51% of all masternodes, which are the primary consensus agents on the ION network. The ION blockchain requires 20,000 ION collateral per masternode. This degree of ION ownership constitutes proof that the masternode owner has a stake in the integrity of network and ledger (Matlack and Pfeiffer, 2016).

To perpetrate a successful attack on the ION blockchain the attacker would have to overcome a cascade of barriers. First, the attacker would have to obtain approximately one-quarter of the entire coin supply, which is 55,000,000. That exorbitant cost alone serves as a prohibitive disincentive for any attack. Even starting the process of accumulating that much ION would generate escalating buy pressure, dramatically driving up the cost of ION and making it more difficult for the attacker to obtain 51% of masternodes. Existing ION masternodes and staking rewards would quickly become much more valuable, reducing other ION owners’ willingness to part with such a valuable asset for anything less than extraordinary prices. These additional supply restrictions would escalate the cost of attack.

Even if the attacker were successful in acquiring enough ION to control 51% of all masternodes, the practical outcome would leave the attacker with very little, if any, value gained. Once the attack was complete (assuming an attacker with extraordinary resources), people would lose faith in the asset and its value would plummet, meaning that the attacker would be harming their own interests, not helping them. In short, the massive economic disincentives to attacking a proof of stake network mean that masternodes earn their authoritative position in validating network consensus by proving that they have so much of a stake in the network that an attack would harm their own self-interests.

ION Improvement Proposals 4, “timelock-based block reward distribution,” and 5, “masternode collateral halving” (IIP #4 and IIP #5), which have been affirmed by community vote, introduce features that will further protect ION’s PoS security and consensus protocol. IIP #5 proposes a reduction in the masternode escrow requirement by half. A masternode will be operational with only 10,000 ION instead of 20,000 ION, making masternoding more accessible and expanding competition to people who can afford smaller amounts (Matlack and Pfeiffer, 2018).

By itself, IIP #5 would not increase network security, except by potentially increasing the price if the change spurs greater competition. In combination with IIP #4, however, ION’s network security would be considerably heightened. IIP #4 proposes to reward masternoding by degree of commitment. The longer one time-locks their ION, the higher the percentage of the block reward they can earn. This conditional reward factor potentially drives much greater masternode adoption. Currently the 50/50 split of the block reward between masternodes and staking wallets

creates incentives for roughly an equal number of IONs to be distributed in staking wallets and masternodes. IIP #4 shifts the balance in favor of masternodes. If more ION are locked for a longer period of time, there will be fewer available to buy on the open market, making the cost of attempting an attack even higher and and the risks of failure even more devastating. Until these innovations are implemented, ION and Bitcoin may be on par for forgery resistance, but the proposed block reward model could intensify security by potentially requiring much more than 51% of the token supply to complete an attack (Matlack and Pfeiffer, 2018).

6.7.11 Summary: ION as a store of value

ION was designed as a transactional currency, not primarily as a store of value. This makes it ideal as a payment network for a gaming ecosystem. The proposed improvements to the ION protocol are projected to add some structural elements that may enhance ION's utility as a store of value. As a relatively new asset with an emerging ecosystem developing around it, it is too soon to recommend ION as a vehicle for savings. However, like Bitcoin, ION is independent of fiat markets and can function as a hedge against risks inherent in government issued currencies. It may also be suitable for more risk tolerant users that want exposure to emerging markets as well as to node operators that are interested in its unique earnings potential.

6.8 Dark Matter (XDM)

6.8.1 Mobility

Like Bitcoin, XDM can be transported securely and reliably anywhere in the world by any person who can remember a twelve word sequence.

6.8.2 Divisibility

Blockchain SoVs provide unsurpassed divisibility; XDM is no exception. Dark Matter can be subdivided to twelve decimal places or increments as small as 0.000000000001 XDM. Dark Matter's extraordinarily small supply forces the developers to anticipate that any substantial demand could push up the price of each unit.

Readers may wonder, "If more than 71,000 people want XDM, there's just not enough to go around!" Divisibility solves that problem because owning even a fraction of XDM could have potential value in the future.

The technical divisibility of XDM available for modest to large spends is constrained by the fee when it comes to very small spends. If an XDM holder wanted to buy an item worth, say, $0.50 USD, the transaction costs (initially) could exceed the value of the spend. This phenomenon reduces the value of Dark Matter as a currency for everyday expenditures, while maintaining its utility as a Store of Value asset.

6.8.3 Resistance to regulation

Like Bitcoin, Dark Matter is highly resistant to governmental regulation. Protocol changes of fee are predetermined and automated in the Dark Matter code, as is the protocol change for the decimal shift (see XDM "Divisibility" above). Subsequent forks to the Dark Matter protocol would require consensus approval by the governance of the ION blockchain.

6.8.4 Fungibility

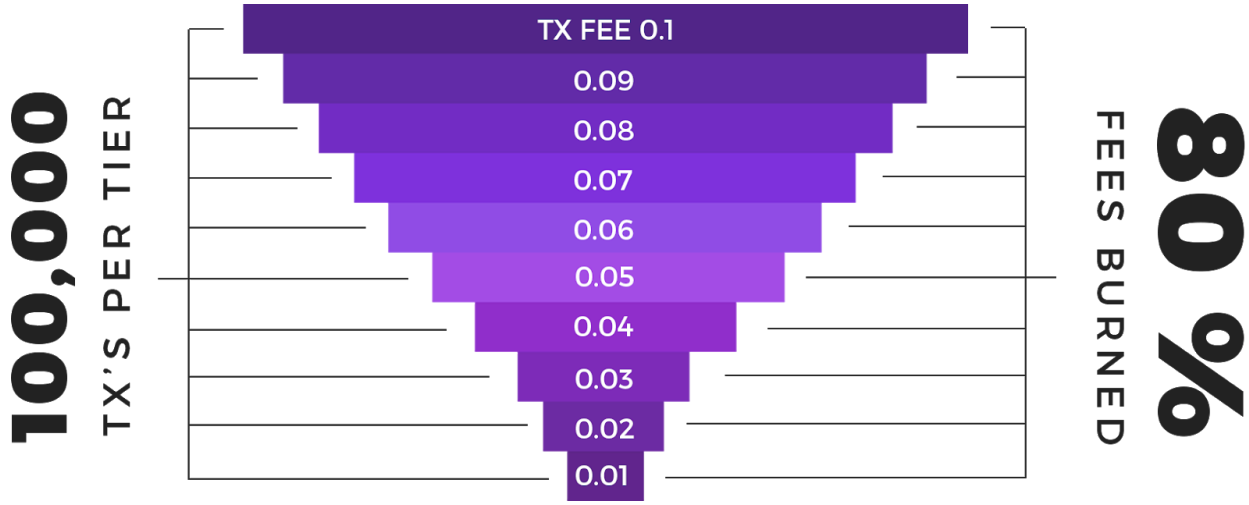
Dark Matter on the ION blockchain is entirely fungible: any unit of XDM is equivalent and interchangeable with any other unit of XDM of equivalent quantity.

6.8.5 Dynamic fee structure

XDM offers a profoundly different approach to its dynamic fee structure. The unique deflationary aspect of XDM is inextricably linked to the decreasing fee. As XDM is exchanged over time, its overall supply diminishes. As scarcity increases, relative demand increases. But while this is happening, the transaction fee gradually decreases along the same temporal schedule, marked in increments of 10k transactions. This design may keep the price of transactions somewhat proportional to the market price of the underlying asset (XDM). Keeping the fee fixed could deter transactions, which is not desirable. Increased transactional velocity also implies increasing adoption. So, XDM's fee structure could be said to be calibrated to a proxy for adoption Adoption, in turn, serves as a proxy for projected market price.

6.8.6 Supply deflation of time

The Dark Matter supply diminishes with each transaction of Dark Matter over the ION blockchain. The supply deflation mechanism is built into the fee structure. Each time a user spends a Dark Matter transaction on the ION blockchain, a fee is charged. 80% of that fee is burned (permanently destroyed). Of the remaining 20%, 10% of the fee is awarded to the masternode winner for the ION block containing the transaction and 10% is awarded and distributed across the Atoms supply (total supply: 10,000 Atoms). The XDM transaction fee starts at 0.1 XDM/transaction (regardless of the amount spent). The fee declines every 100,000 transactions.



The primary effect of the XDM supply deflation mechanism is to tie supply reduction to transaction velocity. Since deflation can drive up the price of the asset (assuming free market dynamics of supply and demand), the fee would become increasingly expensive in fiat value without an adjustment mechanism.

6.8.7 Predictable scarcity

The total Dark Matter supply is very low: 71,000 XDM. There is no mechanism for the creation of new tokens (supply inflation). The mechanism for burning 80% of transaction fees causes continuous deflation. As the transaction velocity increases, the acceleration of fee destruction drives hyperdeflationary conditions. To observe the effect, please see the spreadsheet displaying calculations of the number of Dark Matter tokens remaining at each graduated fee decrease. Notably, after one million transaction, only about 50% of the original Dark Matter token supply remains.

Because the fee declines, fractional amounts of XDM that were impractical to spend initially gradually become increasingly spendable. This also means that the practical available supply may increase slightly with each fee step down. This “melting” process contributes to added liquidity.

6.8.8 Utility

6.8.8.1 XDM's Utility as a Store of Value

Dark Matter was developed primarily as a Store of Value asset. In economic terms, XDM is "M2" like a savings account, not "M1," like a checking account. Since XDM was designed as an outstanding store of value, not a transaction currency, its mechanisms encourage long term savings over short-term spending.

6.8.8.2 XDM's Transactional Utility

While Dark Matter is not primarily a transactional asset, deflation depends upon token movement. To some degree the gradually declining network fee deters sending XDM because each transfer incurs some loss of XDM. In addition to buying, selling, and trading, the Dark Matter network will have transactions because ION blockchain charges a fee each time a new token is generated, and that fee is denominated in XDM.

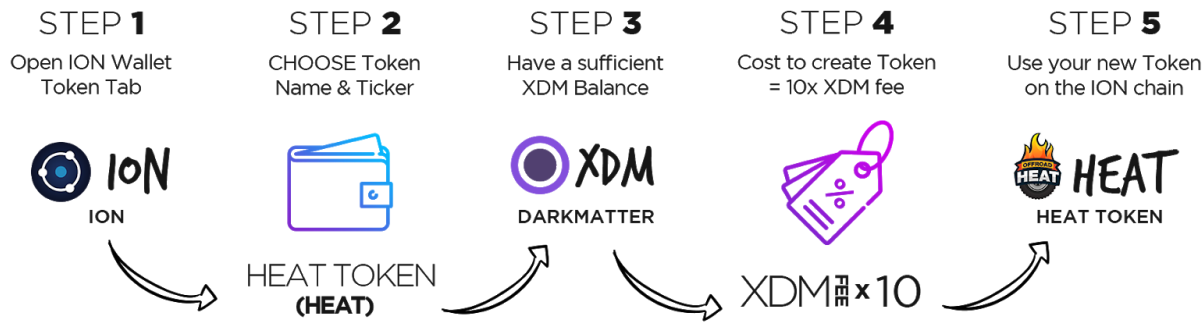


Figure: Step-by-step breakdown showing how tokens are created on the ION blockchain.

Any time a game developer wants to create a token for use as in-game currency, for instance, they must pay a fee that calculated as ten times the current transaction fee for Dark Matter. So since the initial XDM transaction fee is 0.1 XDM, creating a new token would cost 1 XDM. Since Dark Matter is required to create any subsequent tokens on the ION blockchain, XDM is considered the "governing issuing token" for ION token creation.

From the start, Dark Matter has utility both as a SoV and as payment to form new tokens. Additional future uses for XDM are limited only by the imagination.

6.8.9 Liquidity

New assets typically have illiquid markets. Furthermore, the relatively high initial transaction cost will likely deter low value Dark Matter transfers.

Liquidity depends upon market positions taken by those who hold more than 0.1 XDM (because amounts less than 0.1 would not be transferable initially due to the graduated fee structure) and

positions taken by potential buyers. As awareness of this new asset grows, and as potential users discover its utility as a Store of Value, a two-sided market is likely to grow in depth. If third parties should design additional utility for the token through adoption or other forms of integration, the asset may also grow in demand. As usage rises, the mechanics of the token ensure that a growing percentage of the total supply permanently and provably gets destroyed.

The distribution model for XDM may facilitate awareness and discovery of the asset and its utility as a Store of Value. Half of the total Dark Matter token supply will be distributed promotionally, primarily via airdrops to existing cryptoassets.

6.8.10 Forgery resistance

The ION blockchain instantly recognizes valid XDM tokens and easily and unambiguously rejects any token that does not conform to the XDM protocol. Like Bitcoin, Dark Matter is extremely forgery resistant.

7.0 Conclusion: XDM is a superior store of value

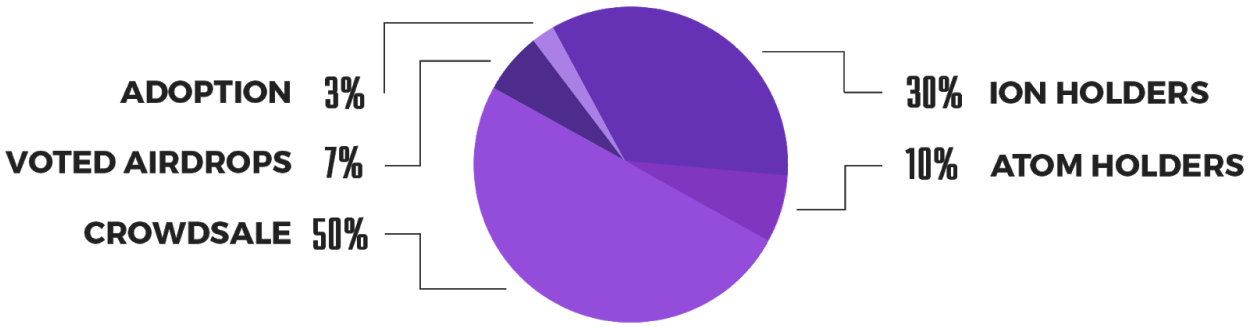
XDM is a total disruption of the *status quo* among stores of value, and even surpasses other blockchain products by transcending the traditional understanding of currency. XDM incorporates crucial functionality not previously available.

As the forgoing analysis establishes, XDM is an improvement when compared to the broad spectrum of currently available SoVs. It is eminently mobile and can be carried, in any quantity, on any smartphone. Dark Matter can be subdivided to twelve decimal places. Its resistance to regulation is an essential part of its coding, with fee, divisibility, supply and deflation all being inalienable features. Since each unit of Dark Matter is exactly identical to every other unit, Dark Matter is completely fungible. XDM has as an essential part of its coding a dynamic fee structure that decreases as scarcity increases, giving the holder a revolutionary degree of control over inflation.

Unlike USD, there is not, and can never be, any threat that more XDM will magically appear like a stack of fresh $20 bills. Dark Matter's revolutionary coding includes both a limit on total number of units *and* deflationary reduction of supply as fees are collected.

XDM eclipses other cryptocurrency as a store of value with its deflationary characteristics and scarcity. Unlike cryptocurrency that was developed to challenge USD use, XDM was developed to challenge the very definition of cryptocurrency. Production of a revolutionary SoV was the primary goal when XDM was developed, and its utility and liquidity are secondary considerations.

8.0 Distribution



50% of the XDM token supply will be available through a crowdsale.

47% of the XDM token supply will be distributed through airdrops. Of the airdrops, 30% is allocated to ION, 10% to ATOMS, and 7% to other coins to be selected by vote.

3% of the token supply will be allocated for adoption.

9.0 Risk

As with any asset that depends upon a distributed network, the value of XDM depends upon the continued existence and integrity of the ION blockchain platform. There is a risk of total loss with XDM, just as there is a risk of total loss with most traditional stores of value, that could be realized if the ION token network disappeared. While Dark Matter cannot completely eliminate risk of devaluation, there are structural mechanisms that reduce the risk. In the case of network functionality, it must be remembered that XDM holders are not reliant on a particular person or company to ensure network functionality. The genius of a blockchain cryptocurrency network is its decentralized monetary policy, which is resistant to bad actors. Once the system is up and running it will continue to function so long as there are sufficient users, because block rewards and transaction fees provide sufficient incentives for indefinite network security maintenance.

The market price of new assets is often initially volatile over a period of price discovery. Because the supply is limited, XDM could potentially be a coveted asset. Those looking for a “quick buck” should look elsewhere precisely because of the well known dynamics of new markets.

As time goes by, Dark Matter’s deflationary policy quantifiably reduces the XDM holder’s exposure to risk.

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