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2019 MONEY MARKET REVIEW:
MakerDAO and the Federal Reserve

TECHEMY GROUP PROPRIETARY RESEARCH 2020

Executive summary

This year in review looks at events in the US money markets and the Federal Reserve's monetary mechanisms throughout 2019 compared to the developments of Maker DAO in Ethereum-based Decentralized Finance (DeFi). Maker in November upgraded to "version 2.0" by implementing a multi-collateral lending model which brings it closer to real-world utility.

Although signs of a recession appeared to have abated going into 2020 as more fiscal stimulus was injected by governments resuming quantitative easing, the side-effects of this money market tinkering has begun to show. The status quo model that the economy has been premised on in recent decades could now be out of balance - a scenario which has ramifications for US and global stability in 2020 and beyond.

The interconnected global banking system is primarily based on the liquidity of one reserve currency, USD, and one type of debt, US Treasuries. This exposes the entire global system to the fragilities of those US institutions and calls into question several of the tenets of the fiat system and central banking in general.

The vulnerability of the financial system can be traced back to the way money is created in the contemporary economy, the unavoidable fact that nearly all money in circulation is bank-originated debt created through new customer loans, and not by multiplying the monetary base of legal tender issued by central banks as propagated by the 'money multiplier' model in economic textbooks.

Whereas the 'money multiplier' model holds that retail bank money creation is capped by central reserve requirements, in reality, rather than controlling the quantity of reserves, central banks today implement monetary policy by setting the price of reserves — that is, interbank interest rates - which in turn determines how much new money retail banks will create in new loans.

This report we look at some of the incentives and mechanism new and old that Maker DAO has successfully used over the past two years to keep bad debt from accruing in the system and maintain price stability in its DAI stablecoin. We draw analogies with legacy banking which in contrast is reliant on the accrual of bad debt and central bank fiscal stimulus to prop up overpriced collateral to avoid debt default at all costs.

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DeFi and debt ceilings

In late 2019, the US Federal Reserve broke its debt ceiling at $22 trillion and in just 12 months it rose $1.3 trillion to over $23t today. It now appears now more than ever that US debt is being monetized to buoy sharemarkets, house prices and to stoke the last embers of inflation while wages and GDP stagnate. What does this mean for fiat currency, digital assets, stores of value and the fiat monetary system generally?

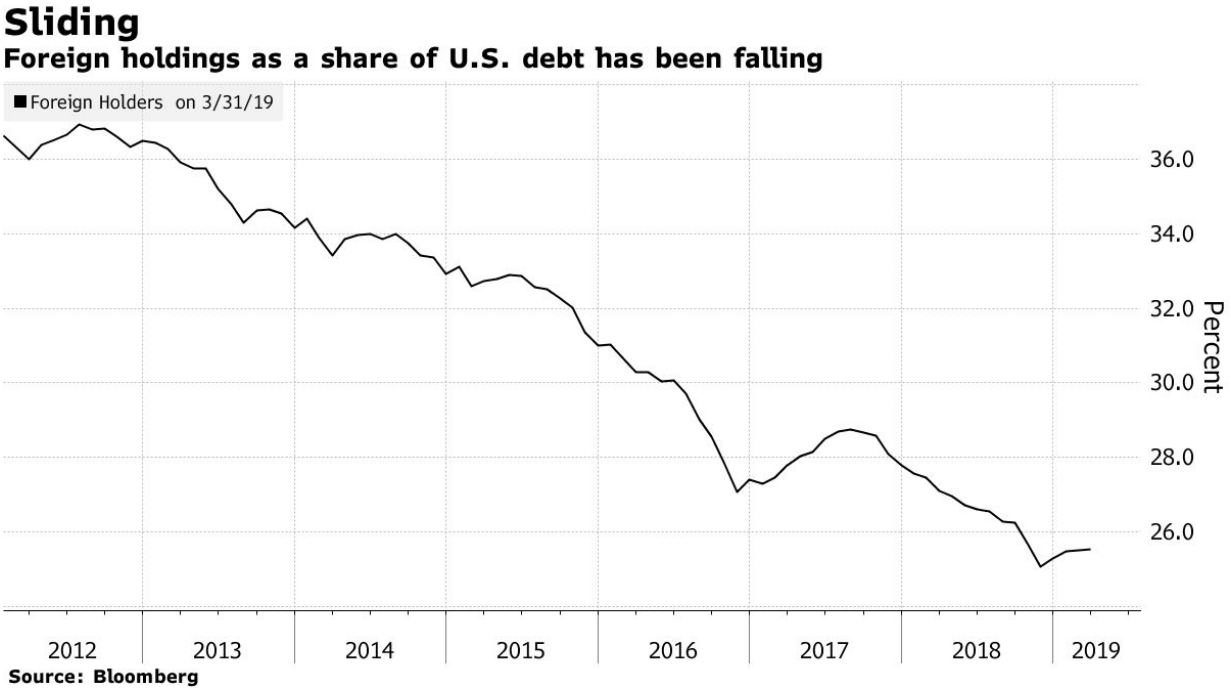
Fund manager Ray Dalio has shared his thoughts on this in several talks and articles during the year and believes that the fiat system is broken and close to its end.

"Money is free for those who are creditworthy because the investors who are giving it to them are willing to get back less than they give. More specifically investors lending to those who are creditworthy will accept very low or negative interest rates and won't require having their principal paid back for the foreseeable future. They are doing this because they have an enormous amount of money to invest that has been, and continues to be, pushed on them by central banks that are buying financial assets in their futile attempts to push economic activity and inflation up."

- Ray Dalio

The premise of Decentralized finance (DeFi) built on Ethereum on the other-hand, is to improve retail and central banking models with hard-backed loans based not on the creditworthiness of the borrower but on the quality of the asset put up as collateral.

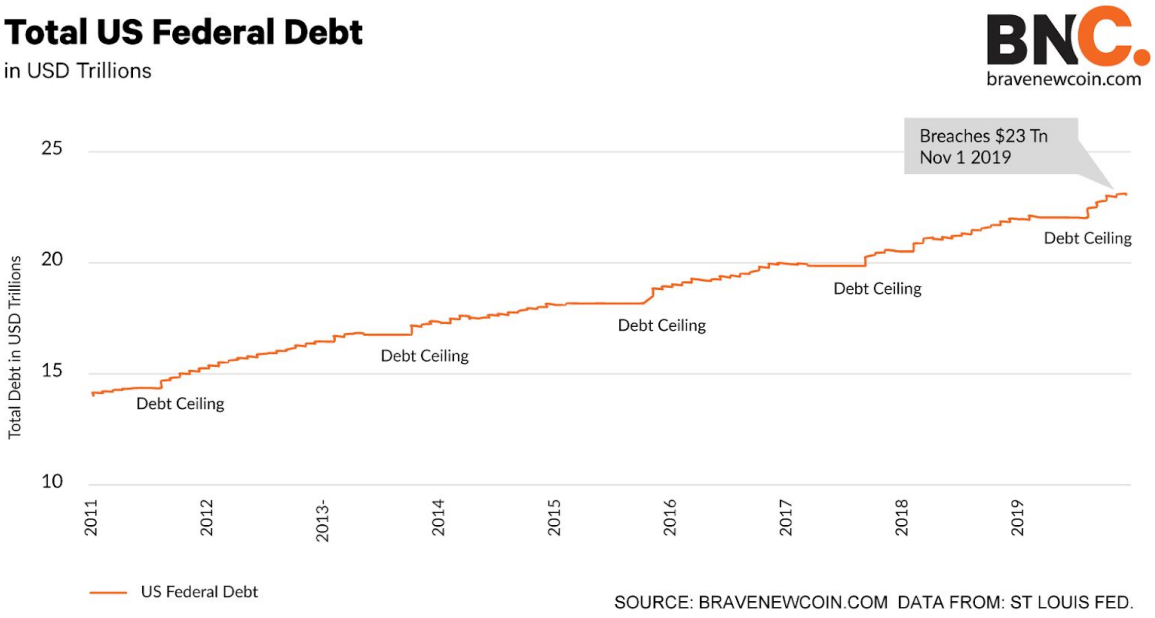
Traditionally, demand for US debt came from offshore central banks, retail banks and corporations to bolster their balance sheets with high quality assets and meet reserve requirements.



Source: Bloomberg

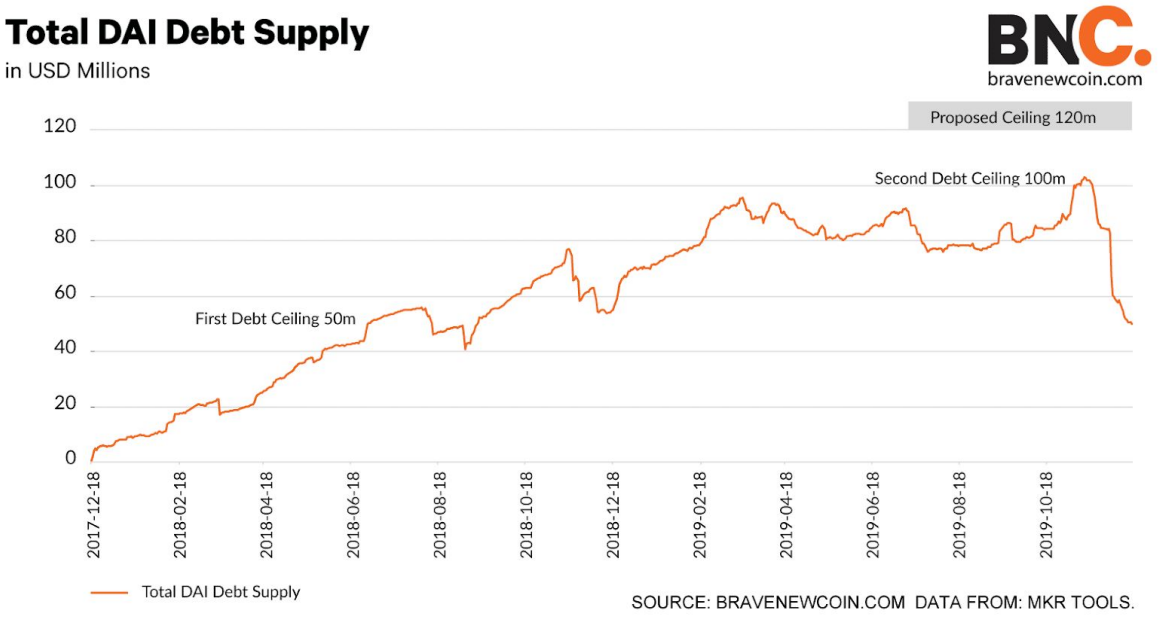
However, foreign buyers of US debt have been dwindling in the past decade and have at times during 2019 been net sellers. This waning foreign demand has occurred within a period of Quantitative Easing (QE) during which the Federal Reserve has almost doubled its total debt, from ~$14t in 2012 to $23t at the end of 2019.

A couple of possible reasons for a decreased demand from foreign buyers for US debt include retaliation relating to the US's abrasive use of its reserve status and the historically low yield on US bonds. The debt ceiling is only theoretical but the US Congress is yet to agree on a new debt ceiling level.



The US debt ceiling was lifted four times in ten years to make room for quantitative easing after the GFC. The debt has continued to climb past its current $22t ceiling to over $23t.

Coincidentally, both Maker DAO and the US Federal Reserve have reached their debt ceilings in the past couple of months and both are considering readjusting their debt ceilings in the coming months. The Maker governance body is considering readjusting the DAI debt supply up to 120m DAI ($120m) from 100m DAI as it wants to expand the economy and believes demand for multi-collateral DAI will go well beyond its current limit.



DAI is the debt token of the Maker system and its short history has reached its debt ceiling twice. However after it reached the latest debt ceiling at 100m in late November, debtors paid a large chunk of their debt, bringing outstanding debt closer to 50m DAI.

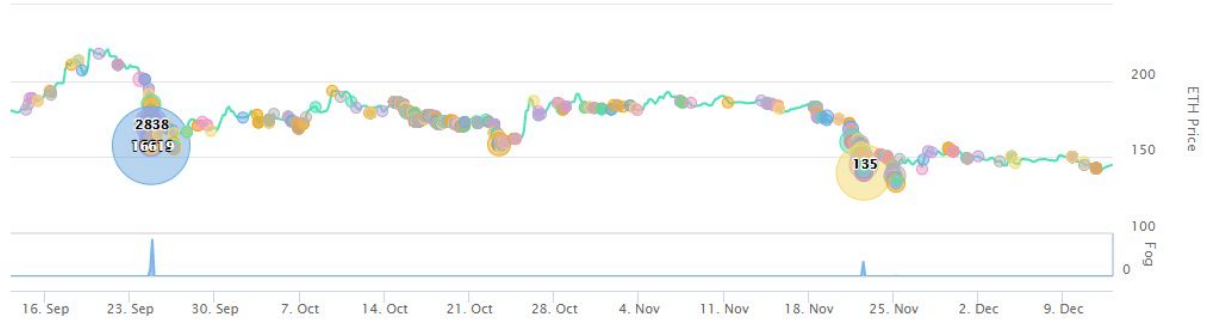
Deleveraging debt in Maker DAO

In contrast to Fed debt, after reaching its DAI supply ceiling at 100m DAI, debt in the Maker system declined by around 50% as users (CDP holders) wiped out much of their outstanding debt. This large debt wipedown might have been due to the migration of single asset DAI (SAI) to multi-collateral DAI or it could have to do with the price drop in Ethereum.

It is unclear as to what the combined figure of SAI and DAI is but the majority of debt appears to have been updated to the new multi-collateralized contract.

The large spike in 'wipes' (the pink bar) at the start of December cancelled much of the DAI debt supply (yellow line), while 'draws' (green bar) show the new DAI created
Source: MKR Tools

In the Maker economy, there are market-makers which liquidate the '*bad debt*' and loans that are close to being undercollateralized to acquire the collateral in the loan at a discount. There are several types of *keeper* bots performing various arbitrage functions to prevent bad debt accruing and keep the Maker system in 'equilibrium' - quite the opposite to what the Federal Reserve and most other central banks have been doing since 2008's GFC.



The bites performed by 'keepers'; the bigger circles indicate bigger liquidated contracts. There were spikes in late September and late November.
Source: MKR Tools

Rather than letting bad loans on the balance sheets of 'too big to fail' commercial banks and corporations take their course during the GFC, quantitative easing gave their balance sheets a shot of adrenaline to keep them going when they should have failed. Due to this there is a large amount of bad debt and highly leveraged 'zombie companies' in the financial system which still continue to issue their own debt (see the growth in the size of the 'junk bond' market) and use their shares as collateral for more loans.

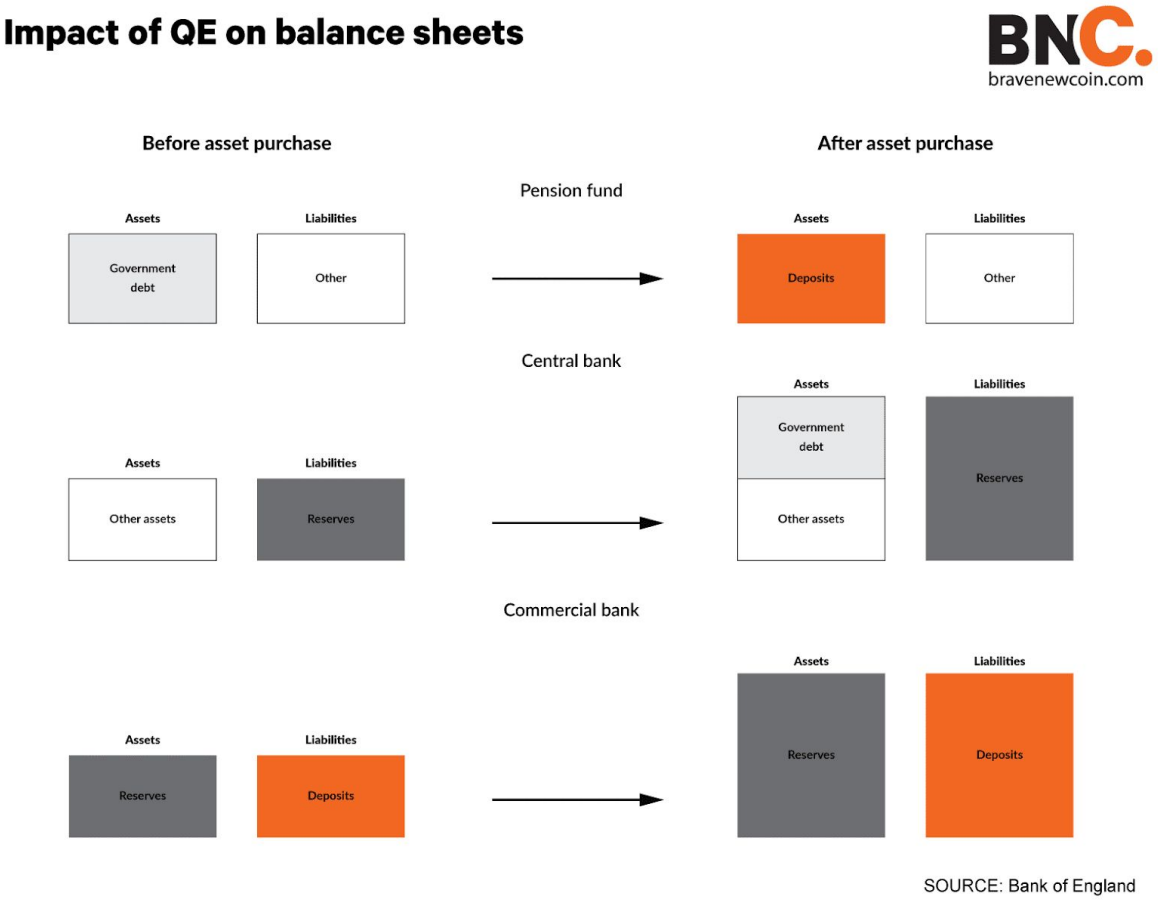
Why QE hasn't and can't work as intended

Although modern banking is premised on fractional reserve models and banks acting as financial intermediaries between lenders (consumer sector) and borrowers (investment sector) while omitting the role of credit, the reality is far different from this paper model. The Bank of England debunked the 'loanable funds' theory in a 2014 paper Money Creation in the Modern Economy, saying that "rather than banks receiving deposits when households save and then lending them out, *bank lending creates deposits*."

In contrast to contemporary banking where one can secure a loan or spend on credit without having to put down any collateral (mortgages aside), to create credit in MakerDAO one has to deposit ETH as collateral - which is why they are described as 'hard-backed loans'. The main distinction between the two systems is that hard-backed loans are based on the quality of the asset put up as collateral whereas retail bank lending is primarily based on the creditworthiness of the borrower.

After successive failures of monetary stimulus (QE etc.) to spark the economy after recessions, this simplistic view of banks as financial intermediaries lending fractional reserves has become untenable and is more reflective of 19th-20th century fractional reserve banking when lending was all conducted in cash.

The panel below demonstrates, how, according to the Bank of England, QE policy aims to buy assets, government bonds, mainly from non-bank financial companies, such as pension funds or insurance companies and because the pension fund does not hold a reserves account with the central bank, then a commercial bank with whom they *do* hold a bank account is used as an intermediary.



(Row 1) The pension fund's bank credits the pension fund's account with £1 billion of deposits in exchange for the government bonds.
(Row 2) The Bank of England finances its purchase by crediting reserves to the pension fund's bank — it gives the commercial bank an IOU.
(Row 3) The commercial bank's balance sheet expands: new deposit liabilities are matched with an asset in the form of new reserves.

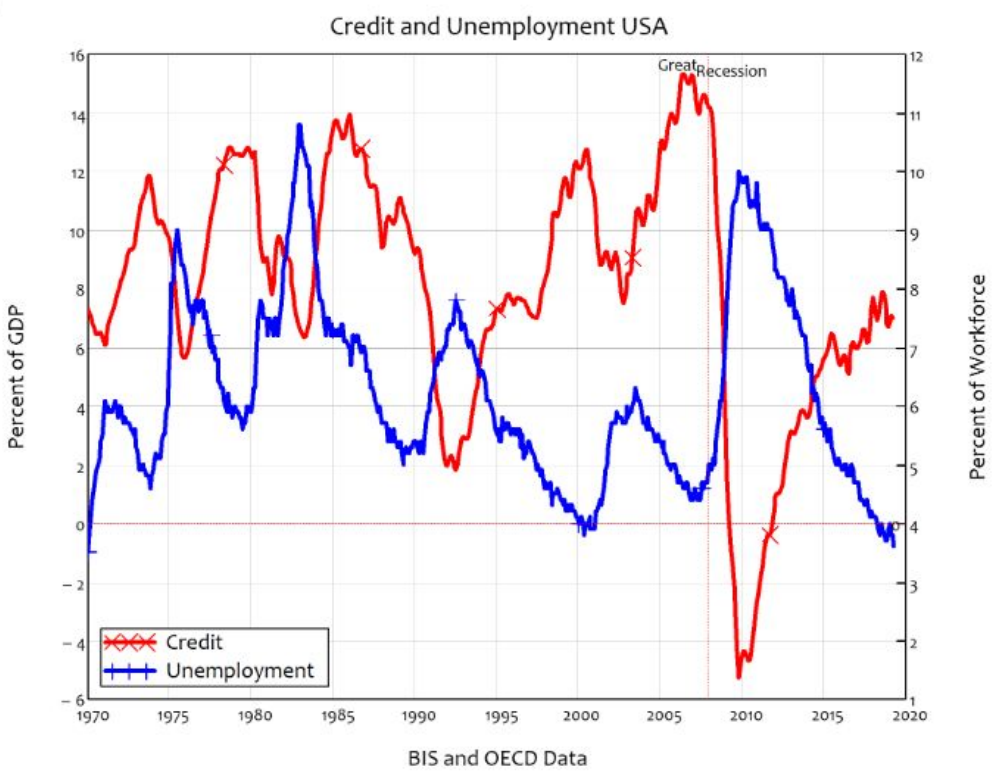
One significant misconception about QE is that it provided banks with free 'cash' to lend out to the public. However, as highlighted by the Bank of England, banks *cannot* lend out their reserves. So during QE the bonds that the government bought from the private sector are simply book-keeping entries. Bank reserves can only be lent between banks, since consumers do not have access to reserves accounts at the central bank.

So it is the lending of reserves *between banks* and central banks rather than *to consumers* that matters the most. This is one reason why interbank and money markets are so important for financial stability.

QE Part 2

At the end of 2019, the US Fed stopped its quantitative tightening cycle after just two years of selling off the assets on its balance sheet bought under QE and in all but name resumed a form of Quantitative Easing by purchasing billions of dollars of short-term Treasury-bills a month to provide liquidity to the interbank lending market.

The banking system and broader economy has been reliant on QE for growth since the GFC and in Europe it also continues. Commercial banks now need QE (or a form thereof) to maintain liquidity and to alleviate reserve and capital requirements and, in the economy, the growth of credit has become the main driver of the business cycle in many developed countries.



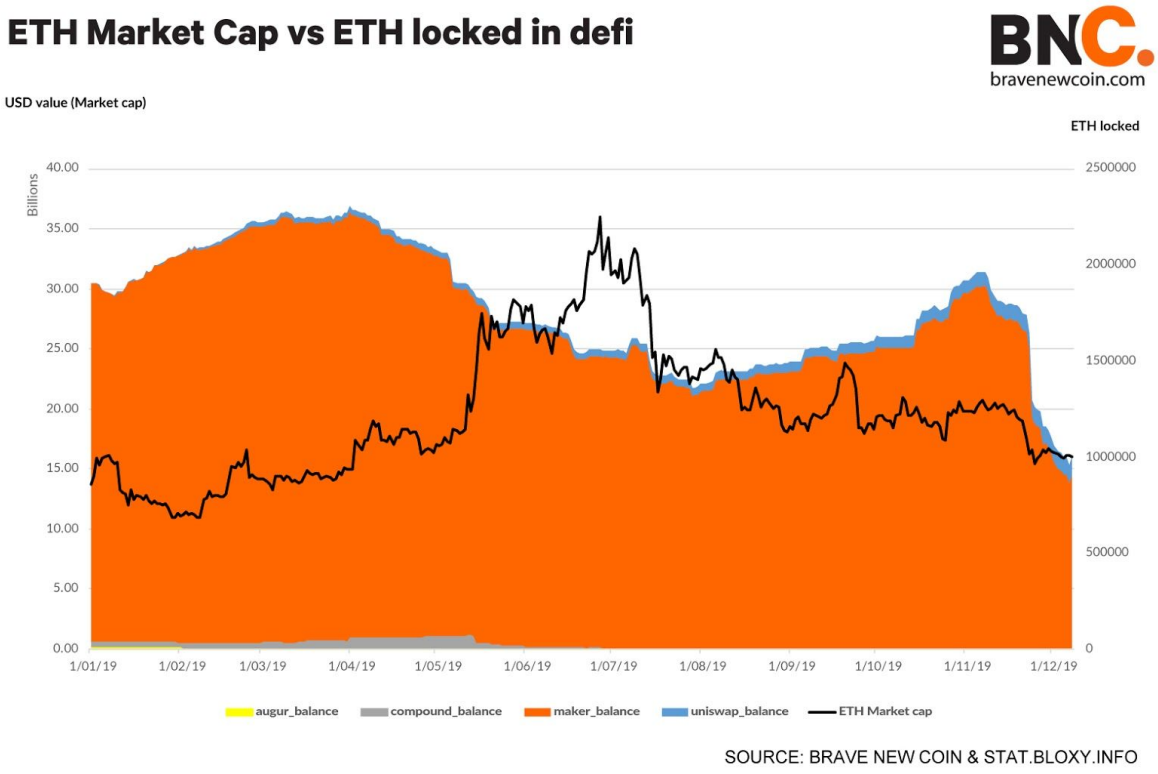
The notion that credit drives economic growth is reflected in the inverse relationship between the unemployment rate in the US and the rate of credit growth. **Source:** Prof Steve Keen

Employment, which is high in expansionary business cycles, is highly correlated with the rate of credit growth in the US economy (or shown another way in the chart above, credit is inversely related to unemployment). Credit is such a strong leading indicator of demand that tools such as the credit impulse which measures the rate of change of credit in an economy are used to forecast GDP growth.

However, in the Ethereum economy, for which we use ETH market capitalization as a rough proxy for GDP growth, the growth in credit in DeFi (measured by the amount of ETH locked up in the top 4 lending platforms) does not appear to have such a high-correlation cyclical effect. This is

most likely due to almost all loans being hard-backed by ETH as collateral and just as in commodity-based business cycles such as during gold-standard or agrarian eras, it is demand for the commodity (ETH) that leads to credit creation, not credit creating demand as is today.

This hard-backed model is perceived as a more solid, less inflationary way of creating credit and follows the economic-thinking of the 'Austrian School'.



Using the market capitalization of Ether (black line, left-hand axis in billions) as a rough proxy for its GDP size, we can see that the total ETH units locked in DeFi (right-hand axis) have no clear cyclical relationship.

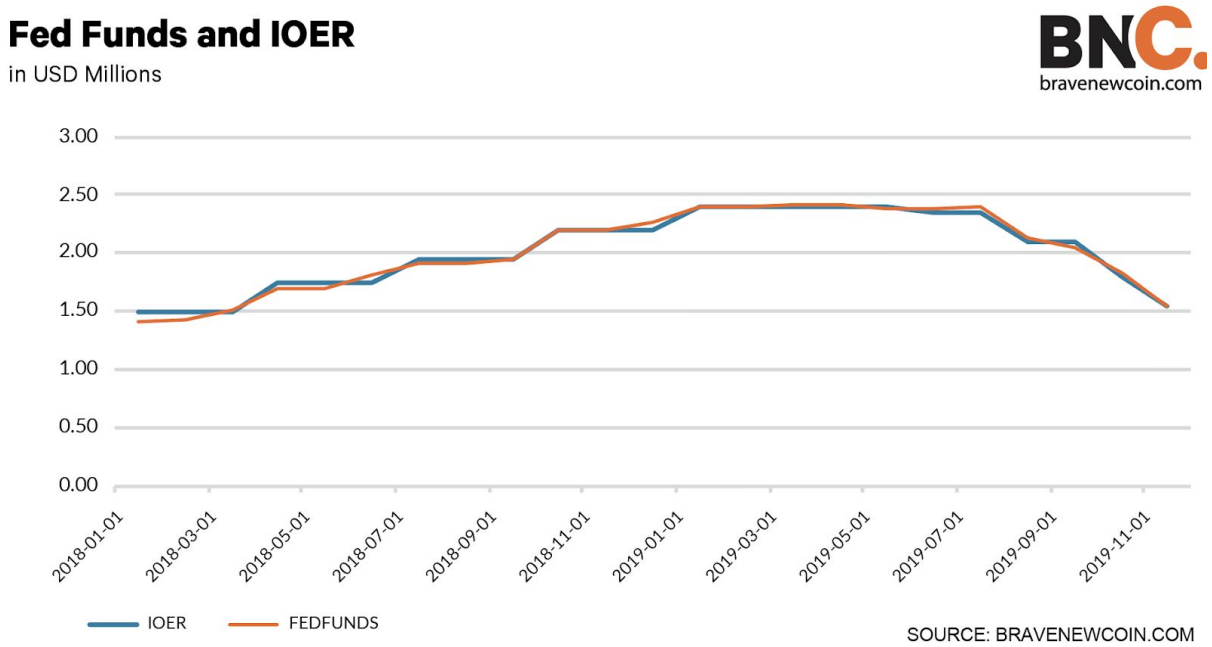
Despite the drop in price and market capitalization of ETH in the second half of the year, the amount of money in ETH terms being locked up in Ethereum-based DeFi kept growing. The sharp drop in ETH locked in DeFi in November was preceded by a similar drop in the price and market cap of ETH which would have liquidated many risky loans. Late November also coincided with the Maker DAO upgrade to MCD during which users would have closed their debt positions (withdrawn their ETH collateral) on the old system before migrating to the new.

The Fed loses control over money rates?

As mentioned previously, the 'money multiplier' model which holds that retail bank money creation is capped by central reserve requirements has been debunked - most notably by the Bank of England. In reality, rather than controlling the quantity of reserves, central banks today implement monetary policy by setting the price of reserves — that is, interest rates - which in turn determines how much new money retail banks will create in new loans.

To explain this simplistically for the US system, if the interest rate spread on lending to the public ('Effective Fed Funds rate') and the cost of borrowing from other institutions (the 'repurchase agreement/repo rate') is more profitable than keeping it on reserve with the central bank (the Interest on Excess Reserves), then retail banks will take that opportunity to expand credit and vice versa.

In 2019 the monetary policies that the Federal Reserve uses to affect the price of the USD and its liquidity appeared to have lost control of the market. It started around March when the interest on excess reserves (IOER), a recent tool that the Fed created after the GFC to improve the resilience of commercial bank reserves, went above the Effective Fed Funds (EFF) rate.



The Fed Funds rate remained above IOER from March and stayed above it until around July, which is very abnormal behaviour.

The EFF is the rate set by the Federal Open Market Committee 'FOMC' at which banks lend to each other the surplus reserves they have at the central bank and is meant to be a 'no-brainer' low-risk trade for the banks. In a normal functioning market if the EFF should go above IOER it should only do so momentarily before the spread is quickly closed by banks taking the better rate.

The Bank of International Settlements described this as "a remarkable shift" in its December Quarterly Review as "the US banking system as a whole, hitherto a net provider of collateral, became a net provider of funds to repo markets."

When the EFF went above IOER and stayed elevated for over a month, it presents banks with essentially risk-free arbitrage as the Fed is willing to pay banks over the going rate to lend to each other and create credit in the economy. But the banks haven't been lending out, as told by the sustained elevated rate and the implication is that the Fed has lost its ability to control rates through a labyrinthine system.

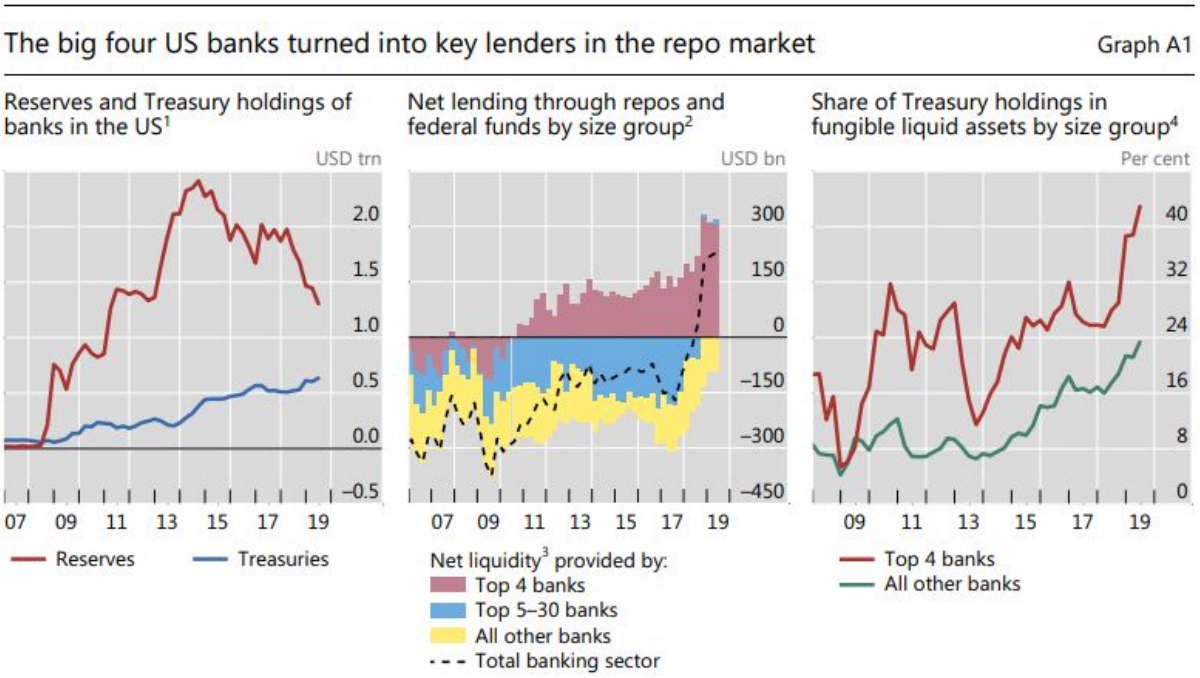
Rumble in the repo market

Later, in September, the repo rate (repurchase agreements) spiked up to 10% from its typical 2-2.5% range and spooked the markets with fears of a liquidity crisis among major institutions. Since then there have been several other spikes up to 4-6% and there are expectations for more fluctuations in the future.

Both are short-term (overnight) interbank lending rates that commercial banks use to cover their reserve requirements for customer deposits and loans at the Fed. The Fed Funds market is that for uncollateralized interbank loans *solely between banks*, whereas the repo market is for loans on US Treasury collateral to redistribute liquidity *between all financial institutions*, not only banks but also insurance companies, asset managers, money market funds and other institutional investors. Repos are usually overcollateralized where the borrower draws out less than the face value of the collateral.

The repo market helps other financial markets to function smoothly. The Bank of International Settlements warned in its December Quarterly Review, "any sustained disruption in this market, with daily turnover in the US market of about $1 trillion, could quickly ripple through the financial system. The freezing-up of repo markets in late 2008 was one of the most damaging aspects of the Great Financial Crisis."

The IOER and repo markets are two essential cogs that drive the primary US interest rate, the 'Effective Fed Funds' rate, which is set by the closely watched FOMC (the Federal Open Market Committee) meetings throughout the year. However, years of QE have caused structural changes in central and commercial bank balance sheets and possibly changed the way the money markets are intended to work and the repo market now relies heavily on four banks as marginal lenders and according to the BIS report, the composition of their liquid assets has become more skewed towards US Treasuries, diminishing their ability to supply funding at short notice in repo markets.



The structural changes in the Big Four US banks balance sheets since the GFC, showing growing holdings of US Treasuries, diminishing 'cash' reserves and the sole providers of repo liquidity.
Source: The Bank of International Settlements

In response to these events, in October, and less than two years after beginning its Quantitative Tightening Cycle the Fed started a program of purchasing T-bills to the tune of $60b per month to ensure adequate liquidity between banks.

After announcing the measures, Fed officials quickly had to distinguish between this program and quantitative easing which it appears to be by a different name. The difference is that under QE the Fed purchased bonds (10-year in duration) to flatten the interest rate curve whereas under this new program the Fed will buy bills (typically one year or less) to provide short-term liquidity.

Multi-collateral DAI: DeFi moving closer to the real world

With its November upgrade to multi-collateralized DAI (MCD) and the introduction of what it terms the 'DeFi risk-free' interest rate, the DAI Savings Rate (DSR), Maker is positioning itself as a 'de-central bank' or the 'Fed of DeFi' in Ethereum.

The upgrade brings more utility to the most prominent decentralized finance platform as it now accepts collateral in both ETH and BAT and will eventually broaden it out to real-world tokenized assets. It also introduces the Oasis lending/borrowing platform and decentralized exchange and it comes with an entire new glossary of terms with a noticeable shift to using the more official vernacular of a central bank.

Taking the perspective of Maker as a central bank and its users the 'commercial banks' when they create loans we can infer real-world analogies to more easily understand the complex vernacular of Maker and how it works.

Analogies between the Federal Reserve and Maker DAO	
Fed	**Maker**
Interest on excess reserves (IOER)	DAI savings rate (DSR)
Fed Funds Rate	Stability fee
Reserve/capital requirement	Collateralization ratio
Treasury Auctions	Surplus Auctions
Federal open market committee (FOMC)	Maker Governance Executive
M0 money supply	ETH
M1 money supply	DAI
Treasury bonds	MKR

Ultimately Ethereum is the base money (M0) upon which these hard-backed money loans are built (M1), and its price and supply regulates the credit expansion in the wider DeFi system. In a sense, Maker has taken many of the nuances from modern day banking but built it on a commodity-like reserve asset ETH, which has similarities to central banking under the gold standard.

As mentioned earlier, in contrast to contemporary banking where one can secure a loan without having to put down any collateral, to create a loan in MakerDAO one has to deposit ETH or BAT as collateral before any funds can be withdrawn - known as 'hard-backed loans'.

Main distinctions between DeFi and legacy banking	
DeFi	**Legacy**
Overcollateralized	Fractional reserve
Peer 2 peer 'loanable funds'	Customer deposits create new debt money
Collateralized debt positions/wrapped tokens	Derivative contracts, options, swaps etc.
Loanable funds	Double-entry bookkeeping
Collateral ratios	Loan-to-value
Interest rates by quality of asset	Interest rate by creditworthiness of borrower
Hard-money collateralized	Individual credit risk collateralized
Base money: ETH	Base money: Physical coins, notes
Reserve requirements: 150% overcollateralized on deposits	Reserve requirements: 10% reserve on deposits

When depositing ETH or BAT into a Maker account to open a loan, a customer's required deposit must always be worth more than 150% of the value of the loan, and the maximum amount that one can withdraw on the loan is 66%.

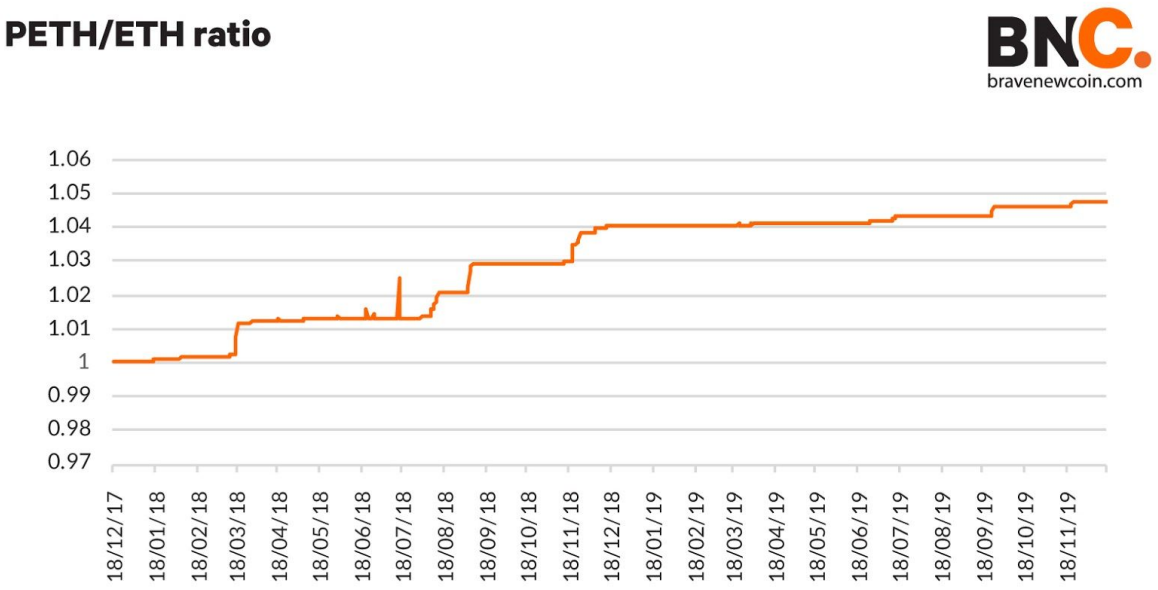
Similar to the contemporary theory of how the economy works Maker strives for an equilibrium model which is reflected in the price of DAI stability around $1 by setting monetary policies to control the amount of debt (good and bad) in the system.

Maker expands and contracts the money supply via auctions of debt, like when the Fed auctions US Treasuries which are bought by commercial banks and corporations to boost assets on their balance sheets so they can lend more. The Maker protocol will discharge surplus DAI or eradicate '*bad debt*' through buying and burning / minting and selling of the MKR token, which is used in a loose way like US Treasury debt.

Just as in the broader economy and banking system, the repayment of loans in Maker destroys the amount of money in circulation which is created through ETH/BAT deposits.

Pooled ETH: A zero-coupon bond for ETH

Pooled ETH (PETH) is the amount of collateralized ETH that is in the Maker reserve to back DAI debt. PETH is the total amount of pooled ETH deposits and a surplus of PETH is generated from the liquidations of bad loans which is then auctioned off and sold for ETH. At creation, PETH started off at a 1:1 ratio with the price of ETH but this ratio has over the years increased as the pool of PETH in Maker has been diluted to cover debt risky debt contracts.



SOURCE: BRAVE NEW COIN DATA

As the PETH ratio rose, one who pooled their ETH at a lower ratio could have later withdrawn more ETH than they initially put in.

The more the PETH ratio rises the more return (in theory) one has on holding ETH in the pool. In MCD, the debt settlement process has changed from the single-collateral method - rather than being sold at a fixed price, the ETH in MCD from risky debt positions (known as 'System Debt) is sold at auction for DAI and then used to buy and dilute the MKR token pool. Thus users are rewarded in the system for liquidating bad loans.

If holding the MKR token is an analogy for holding a regular central bank bond (with the interest rate being paid via the stability fee) then the PETH ratio is something similar to a zero-coupon bond as one pools ETH at a lower ratio and has the opportunity to withdraw at a higher ratio when PETH is worth more than ETH (while this ETH is held as bond for the duration of the loan period.

The chart above shows the interest rate on a US Zero-Coupon bond is negative -0.8%.

If we compare the above chart of the US Zero-Coupon rate with the previous chart showing the PETH/ETH ratio we can see how the two have been going in opposite directions over the past three years as the Fed creates more debt to inflate asset prices and stave off a corporate and sovereign debt crisis, while the Maker system functions exactly the opposite. Maker users are incentivized to eliminate bad debt as the liquidated collateral accrues in the form of a higher PETH ratio and 'dividend' to MKR holders which tempers debt expansion.

Conclusion

While it's also early days for DeFi and there are high hopes for it to mature as an alternative to the legacy system it is for the moment an interesting experiment as to how banking worked on commodity-based cycles rather than the credit-based cycles today.

Maker DAO, due to its jargon and complexity, is still very much remains the domain of the tech and finance savvy but its theory and practice has so far been sound and proven effective at being a de facto central bank and maintaining price stability throughout a tumultuous 2019 in its reserve asset, ETH. We expect DeFi to be a primary driver of Ethereum's growth and value into 2020.

We also expect to hear a lot more about the money markets, repo rates and fed funds in the year ahead as these are structural issues in the system and will likely continue. Whether this transpires to be the start of what Ray Dalio has unambiguously suggested as the breakdown of the capitalist system or whether the status quo will find its equilibrium again, the money markets are vital cogs to running the economy and banking system in the US and globally.

Author Bio

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Andrew writes investment research at the intersection of the digital and legacy markets which provides future perspectives on the new economy. He also leads the economic analysis working group with the Washington-based Government Blockchain Association exploring the use of blockchain in the economy, environment and society.

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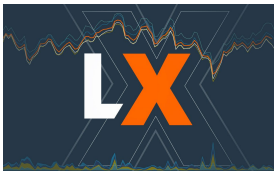

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