

Four Ways to Achieve Price Parity in Financial Instruments

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Exchange Traded Funds (ETFs) and the growing number of crypto stablecoins have mechanisms that enable them to trade at a specified price. They build on a long history of parity methods from the era of currencies based on the gold standard. I would like to suggest there are four mechanisms by which this parity is or can be achieved. Two mechanisms are active, requiring intervention in the market. The other two are passive.

I hope this discussion is of value for two reasons. First, the two active mechanisms can have significant risks associated with them that are not disclosed in the prospectuses of ETFs or the White Papers of stablecoins. The second is that there are a range of innovations taking place that suggest new combinations of the mechanisms to achieve price parity. For example Bitcoin Enhanced is the first of a new class of self-managed investment products that only uses passive parity mechanisms.¹

Active Mechanism	Passive Mechanism
Hold Underlying Assets	Purpose
Active Management of Supply	Passive Management of Supply

Figure 1 Four mechanisms for maintaining price parity between to financial instruments

The two active mechanisms are the holding of underlying assets and the active management of supply. Let us deal with these first.

Holding Underlying Assets

Holding Underlying Assets is perhaps the most obvious way to maintain the parity of one financial instrument with another. For example the SPDR Gold Shares ETF (GLD) holds physical gold in vaults in London against the value of its shares listed on the NYSE. In the stablecoin world, US Dollar Coin (USDC) launched in October 2018 holds one US dollar for every crypto coin its issues. Accounting firm Grant Thornton LLP releases monthly statements to verify this.²

This seems an obvious and sound approach to maintaining parity from an investor perspective. Yes, GLD shares actually own less than their value in physical gold due to commission charges. Yes, issuance and redemption fees as well as market making activities such as the bid/ask spread can reduce this parity³ but in general the approach seems straightforward and easily understood.

¹ <https://bitcoinenhanced.io/>

² <https://cryptoiq.co/usd-coin-usdc-rapidly-growing-may-overtake-tether-usdt-to-become-top-stablecoin/>

³ <https://medium.com/blockchain-capital-blog/business-models-behind-stablecoins-cae801533798>

Underlying assets in themselves do not support price parity

It may then come as some surprise that underlying assets, or “reserves” in themselves do NOT support price parity. For example the Thai baht was roughly stable against the US dollar from about 1985 to 1997. During the Asia Crisis of 1997-1998 the Bank of Thailand wished to maintain the value of the baht to around 25 per dollar. However despite having reserves, not of 100% like GLD or USDC but of 224% of the total money supply, the baht continued to weaken against the dollar, reaching a low of about 57 baht to the dollar in January 1998.⁴ The moral: holding reserves does not provide parity.

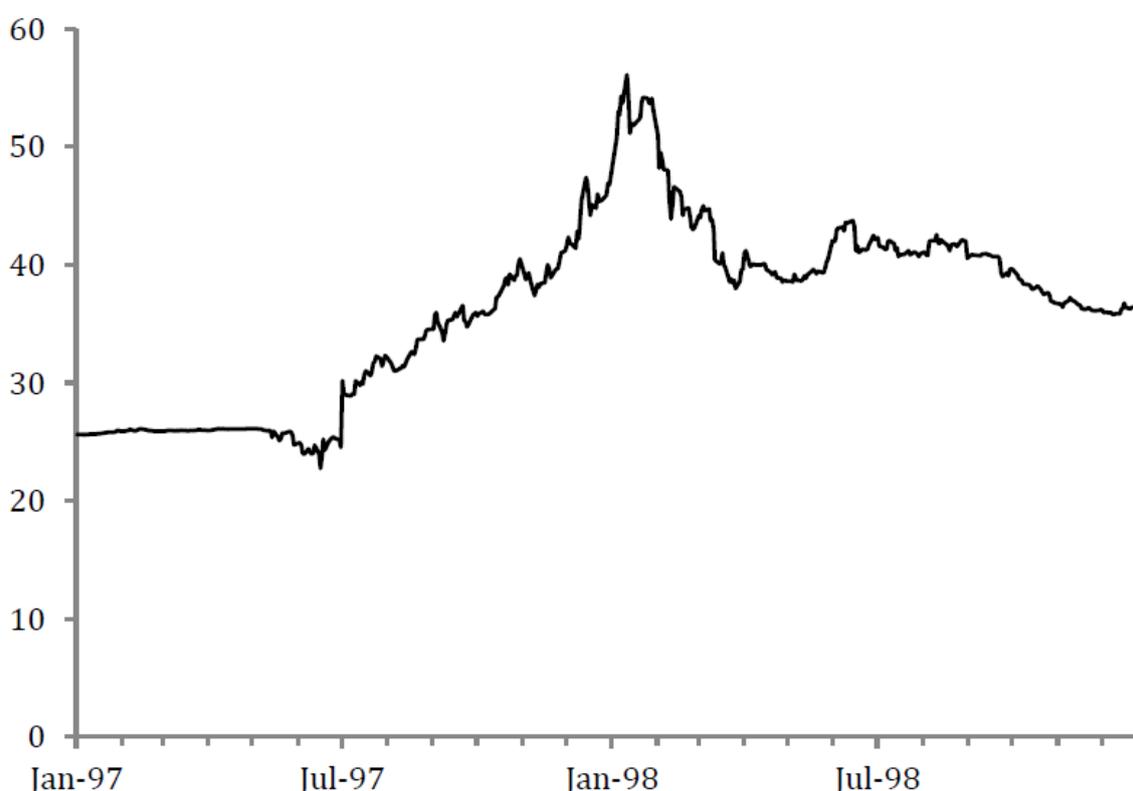


Figure 2 Thailand: Baht per U.S. Dollar, 1997-1998 Source: Nathan Lewis, *Gold, the Monetary Polaris*, p128.

Not only is holding reserves not a mechanism for achieving price parity, the selling of those reserves is not a mechanism either. Thailand’s foreign exchange reserves began to drop dramatically in early 1997 as the Bank of Thailand sold US dollars to buy baht in an effort to halt the decline in its value. From a peak in October 1996 of \$39.9 billion reserves fell to a low of \$25.9 billion in August 1997 when the Bank of Thailand halted its intervention for fear of running out of reserves. The sale of \$14 billion of reserves had not restored confidence in the currency. Once the bank’s selling of reserves stopped the bhat value against the dollar declined dramatically demonstrating how ineffective the intervention had been.⁵

⁴ Nathan Lewis, *Gold, the Monetary Polaris*, p128.

⁵ Nathan Lewis, *Gold, the Monetary Polaris*, pp. 128-131.

The truth is underlying assets only help maintain price parity when their sale or purchase takes place *in conjunction with adjustments in supply*. That is to say, the Bank of Thailand would have needed to take each bhat it purchased with its foreign reserves out of the base money supply for the currency's loose parity with the US dollar to be restored.

During the Financial Crisis of 2007-2008 the Russian authorities followed the example of Thailand with similar disastrous results until November 2008 when an op-ed appeared dealing with these issues in *Pravda.ru*. The result was that the authorities changed tack and removed all rubles purchased from circulation. This contracted the money supply by 22% compared to the previous month in February 2009:

“The ruble immediately stopped falling in value, and soon began to head higher, rising in value by 10% in March 2009 alone.”⁶

Russia learned what Thailand had not – reserves are only of value in maintain parity if they are used in conjunction with supply mechanisms that expand or contract the base money supply.

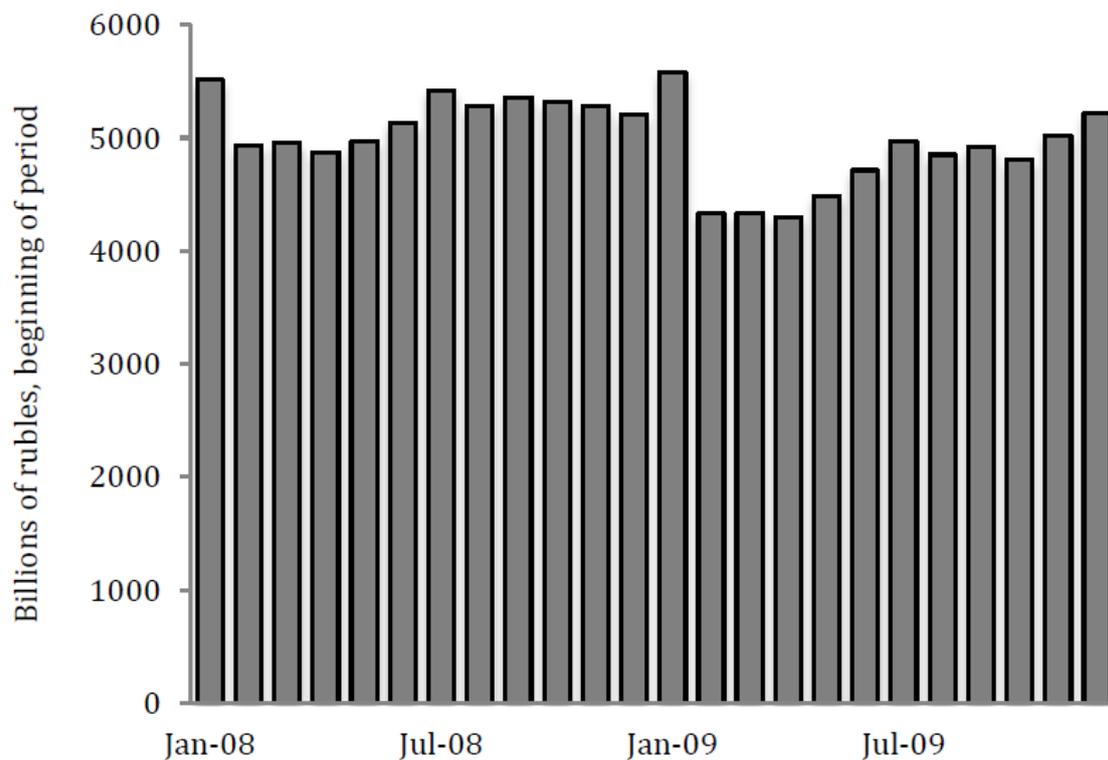


Figure 3 Russia: Monetary Base, 2008-2009 showing the contraction of the base currency in February 2009 as purchased rubles were removed from circulation. Source: Nathan Lewis, *Gold, the Monetary Polaris*, pp. 137.

⁶ Nathan Lewis, *Gold, the Monetary Polaris*, pp. 137.

Catastrophic failure – systemic risk

As well as its need to operate in conjunction with an adjustment in the supply of the pegged instrument, holding underlying assets as part of an active parity management program carries significant risks for the investor. These risks became apparent on 15th September 2008 with the collapse of Lehman Brothers.

Today the overwhelming majority of financial instruments are derivatives in exactly the sense where an underlying asset supports their value.⁷ Because one instrument depends upon the value of another, the value of one institution buying and selling these instruments, now depends upon the value of the other institutions it trades with. This has made the financial system a network of dependencies where the failure of one institution can lead to the collapse of the entire system.

This is why the US and other governments around the world had to step in after 15th September 2008 with trillions of dollars of bailouts and the guarantee of bank deposits – it was not concern over the loss of a single investment bank, it was the potential catastrophic failure of the entire system.

Warren Buffett is famously quoted as saying that: “In my view derivatives are weapons of mass destruction, latent for now but potentially lethal.”⁸ This systemic risk is talking about. However it is not found in the GLD prospectus or the white papers of stablecoins.⁹

Instruments such as ETFs and stablecoins using underlying assets as a mechanism to achieve price parity have bound themselves to the risks associated with the dependent nature of value in the financial system.

It may be argued that the underlying asset of GLD is gold itself, a commodity that has uniquely held its value throughout history. Where is the risk in holding gold as the underlying asset? The same case can be made for USDC where the underlying asset is the US dollar – still the world’s reserve currency and the preferred medium of exchange for the majority of the world’s trade.

The answer lies in the fact that holding gold by GLD, and USD by USDC involves counterparties. For example USDC needs a bank account to hold its dollars. These counterparties tend to be large institutions that by their nature are also involved in other aspects of the financial system and are therefore susceptible to the risks of its dependencies.

So it may not matter what the underlying assets are, the use of counterparties connect GLD shareholders and USDC coin holders to the risks of the system. The trigger for systemic failure may have nothing to do with the ETF or the stablecoin. It may be US student loans, or an economic crisis in Italy, the loss of liquidity in VIX volatility trades or any other of the current contenders. The point is that holding underlying assets, however good their pedigree, implicates the investor in the risk of catastrophic collapse of the system as a whole.

⁷ <https://www.visualcapitalist.com/worlds-money-markets-one-visualization-2017/>

⁸ <https://www.visualcapitalist.com/worlds-money-markets-one-visualization-2017/>

⁹ http://www.spdrgoldshares.com/media/GLD/file/ETF-GLD_20180630.pdf

Passive investment products create their own risk

As if the scale of risk attached to using underlying assets as a means of maintaining price parity was not enough, there is also concern that the massive increase in the use of ETF's and passive investing in general are themselves the cause of market instability. According to Investopedia:

"ETFs have played major roles in market flash-crashes and instability. Problems with ETFs were significant factors in the flash crashes and market declines in May 2010, August 2015, and February 2018."¹⁰

Christopher Coles at Atremis Capital in Austin Texas has gone further and built a model to show the destabilising effects of ETFs. He finds:

"Passive is just a crowded 'liquidity momentum' trade and its outperformance compared to active managers may be self-fulfilling and ultimately de-stabilizing in the long run."¹¹

Rotten Assets

Finally, there is another source of risk associated with using underlying assets to keep prices pegged. That risk is associated with the integrity of the underlying asset itself. If the underlying asset is rotten, the peg of your instrument to the asset is going to mean very little to the investor as its value disintegrates.

This use of rotten assets was exactly the cause of the 2008 financial crisis. Sub-prime mortgages were bundled together, given an attractive credit rating and sold as mortgage-backed securities (MBSes) and collateralized debt obligations (CDOs). The value of both MBSes and CDOs was derived from the underlying mortgages. When the default rate of these mortgages increased the true value of the asset was disclosed.¹²

Active Management of Supply

The second active mechanism to maintain a pegged price is to manage supply and demand. According to the principle of supply and demand, buyers and sellers will reach a price equilibrium (the price they are willing to transact at) depending upon their respective needs. As their needs change, for example if there are less people wanting to buy the product, the price lowers until a new equilibrium point is reached. So ETF's, stablecoins and other instruments such as currencies interested in keeping the price equilibrium at a certain point simply turn the equation on its head and buy or sell the instrument so that the pegged price is maintained.

¹⁰ <https://www.investopedia.com/terms/e/etf.asp>

¹¹ <https://static1.squarespace.com/static/5581f17ee4b01f59c2b1513a/t/5ba146f40ebbe8c212e8b7c7/1537296120640/Artemis+Letter+to+Investors+What+is+Water+July2018+2.pdf>

¹² Michael Lewis, *The Big Short*.

The active management of supply is just this: the commitment of the instrument’s manager (or their appointed agent) to buy or sell the instrument on the open market at the parity price. People know they can always transact at this price and this provides the peg. The process is purely mechanical.

While stablecoins will often perform this function for themselves ETFs generally use a large institutional investor:

“The supply of ETF shares is regulated through a mechanism known as creation and redemption, which involves large specialized investors, called authorized participants (APs). An AP can redeem ETF shares by selling them back to the fund’s sponsor. Selling assets (stocks, bonds, etc.) to the ETF sponsor, in return for shares in the ETF, is called creation. The amount of redemption and creation activity is a function of demand in the market and whether the ETF is trading at a discount or premium to the value of its assets.”¹³

This rebalancing of supply to maintain the published price generally takes place once a day. The amount of rebalancing required depends on the demand for the instrument. Two instruments pegged to the value of the same asset can have very different supply and demand profiles.

For example the below graph shows the number of shares outstanding in 2010 for GLD as a result of the supply management process.¹⁴

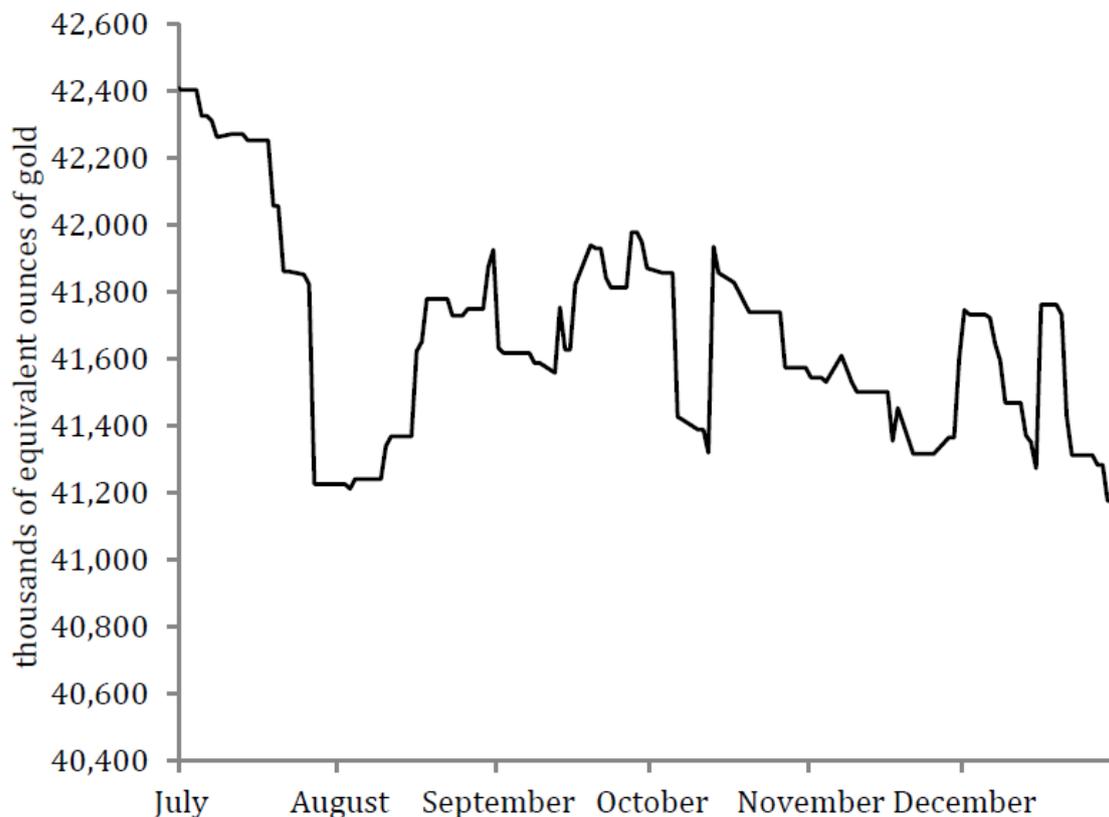


Figure 4 SPDR Gold Shares (GLD), Shares Outstanding (equivalent ounces of gold), 2010. Source: Nathan Lewis, *Gold, the Monetary Polaris*,

¹³ <https://www.investopedia.com/terms/e/etf.asp>

¹⁴ Nathan Lewis, *Gold, the Monetary Polaris*, p49.

The next graph is of iShares Gold Trust (IAU), also showing shares outstanding for 2010.¹⁵ Like GLD the goal is to remain pegged to the price of gold but the supply/demand profile is quite different.

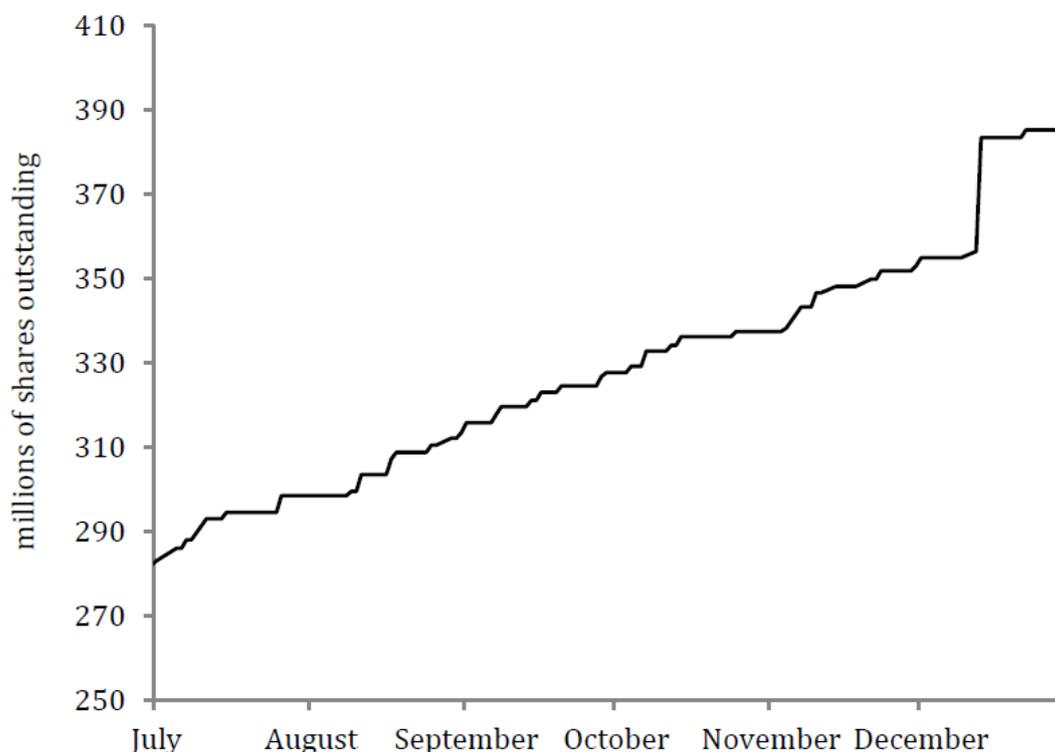


Figure 5 iShares Gold Trust (IAU), Shares Outstanding, 2010. Source: Nathan Lewis, *Gold, the Monetary Polaris*,

One of the great strengths of using supply to manage price parity is its successful track record over hundreds of years. It was the active mechanism, along with a gold reserve, used to maintain the gold standard in Britain, the US and elsewhere. In 1821 David Ricardo, one of the founding fathers of classical economics wrote:

“It is on this principle that paper money circulates: the whole charge for paper money may be considered as seignorage. Though it has no intrinsic value, yet, by limiting its quantity, its value in exchange is as great as an equal denomination of [gold] coin, or of bullion in that coin.”¹⁶

Britain had several periods during the gold standard era when redemptions were suspended by the Bank of England in order to help fund wars. During these periods the peg to gold was effectively abandoned. When a war ended, for example in 1815 with the final defeat of Napoleon, the supply mechanism was used to return the pound to its parity with gold:

¹⁵ Nathan Lewis, *Gold, the Monetary Polaris*, p50.

¹⁶ Nathan Lewis: <https://newworldeconomics.com/the-gold-standard-in-britain-1778-1844/> quoting David Ricardo *Principles of Political Economy and Taxation*.

“Particularly after Napoleon’s defeat at Waterloo in 1815, which ended the Napoleonic Wars, an effort was made to return the pound back to its pre-war parity at £3 17s 10.5d. (That’s three pounds, seventeen shillings, 10.5 pence. There were twenty shillings to a pound, and twelve pence to a shilling.)

“You can see a few results of this decision. After a rather brisk expansion in banknotes outstanding, beginning in 1815, the amount becomes stable around £27 million. Then, it starts a decline to £18 million in 1822. This of course was the mechanism by which the pound’s value was raised back to its pre-war parity.”¹⁷

Risks of the active supply mechanism

Despite its extensive track record active management of an instrument’s supply to keep the price pegged to a certain value carries the same risks as holding the underlying asset.

Counterparties are involved, usually large banks even in the case of stablecoins who perform the supply adjustment themselves.

These risks can potentially be avoided by stable coins that use on-chain assets as collateral or an algorithm to manage supply rather than underlying assets.¹⁸

Passive Management of Supply

Supply can also be controlled passively. In 1923 German hyper-inflation came to an end with the introduction of the Rentenmark. The two defining features of the new currency were its (supposed) collateralisation against land, goods and Gold Loan Bonds (there was no gold to be used) and a strictly limited issue. The total authorized issue was limited to US\$ 762 million, about 70% of the demand for base money.¹⁹ In December 1923 the government attempted to increase supply but this was strongly resisted by the management of the Rentenbank. The incident helped to strengthen confidence in the new money and demonstrated that quantitative restraints to supply (but not active management), can also be effective in maintaining price parity.²⁰ Supply did in fact increase rapidly, but in line with demand rather than the need of government to fund its spending.

The man responsible for the success of the Rentenmark was Hjalmar Schacht. By December 1923, one month after its issue the currency had been stabilized. Economists differ in the emphasis they place on different factors of the event but it is clear that public confidence in the new currency was the underlying factor to its success. Some accounts credit the quantitative discipline (limiting the expansion of supply) to Schacht himself who, it seems would regularly phone from his office (a

¹⁷ <https://newworldeconomics.com/the-gold-standard-in-britain-1778-1844/>

¹⁸ <https://medium.com/blockchain-capital-blog/business-models-behind-stablecoins-cae801533798>

¹⁹ <http://www.economia.puc-rio.br/gfranco/Ch10.PDF> p.16

²⁰ Ibid.

recently converted janitors closet) to check the value of the rentenmark against the dollar to which it was pegged.²¹

Today, with the advent of the blockchain this quantitative discipline can be purely passive. Bitcoin Enhanced has its tokens traded on the Waves platform. It cannot sell new tokens from its website (increasing the supply of tokens) unless the traded price of the tokens is greater than or equal to the Target Price (pegged value) which would indicate market demand. Recently the Swiss central bank has had a similar policy in relation to the euro.²²

In terms of risk the passive management of supply does not implicate the investor in the risks of the financial system as no counterparties are required. The instrument simply has a policy and/or passive mechanism of restricting supply. In an era of the blockchain, supply can also be restricted by a hard cap on tokens issued.

However, management of supply works because people perceive the value of the currency or token is not going to be devalued through inflation. This works, as in Germany in 1923 when there is strong demand. Without demand the restraint on supply may do little to prevent the currency or token from falling below its peg. In other words, the passive mechanism fulfils half of the active mechanism approach, checking an over expansion of supply, but not contracting supply if demand falls.

Purpose

The purpose of a financial product is the final parity mechanism I want to discuss.

The factsheet for GLD clearly states its purpose:

“The investment objective of the Trust is for SPDR® Gold Shares (GLD®) to reflect the performance of the price of gold bullion, less the Trust's expenses.”²³

For USDC:

“USD Coin is a US dollar-backed stablecoin.”²⁴

In 1697 under the guidance of John Locke Britain officially pegged 3 pounds, 17 shillings and 10 pence (GBP 3.891667) to one troy ounce of gold.²⁵

In each case the purpose of the instrument and its link to another asset are clearly stated.

²¹ Nathan Lewis, *Gold, the Monetary Polaris*, p210.

²² Private correspondence with Nathan Lewis.

²³ http://www.spdrgoldshares.com/media/GLD/file/ETF-GLD_20180630.pdf

²⁴ <https://www.circle.com/en/usdc>

²⁵ Nathan Lewis, *Gold, the Monetary Polaris*, p87.

Now this may sound obvious and yet irrelevant. Of course the purpose of an instrument and its intended relationship to another asset needs to be made explicit but what grounds are there to suggest that this intent provides a mechanism for the peg?

Evidence comes from examples where the other peg mechanisms are absent or non-functional.

Tether

For example, throughout 2018 the stablecoin Tether was surrounded by controversy. Part of the controversy was around a lack of clear evidence that the coin was actually backed one for one with US dollars. With still no conclusive proof that this is the case it has to be assumed that Tether was not backed one for one with the US dollar, i.e. the stated underlying asset mechanism was not guaranteeing the coins value.

Other controversy involved accusations of market manipulation, particularly of manipulating the value of Bitcoin for profit. One consequence of this was that Tether lost its banking relationship causing it to suspend redemptions for a period, i.e. the supply mechanism for price parity was interrupted.²⁶

However, even with both active parity mechanisms unavailable in their fully functioning capability, Tether's parity with the USD remained, with a few exceptions, remarkably stable during the year. Were passive mechanisms at work? What was the role of user expectations of parity? Because of Tether's stated purpose did people believe in the coin's parity with the dollar and this expectation held the coin close to or at the pegged price?

The point is that purpose establishes an expectation in the mind of users. Like the expectation of cure from a visit to the doctors this can play an important role in the outcome.

The need or demand for this purpose to be true could have also played a part – throughout 2018 Tether was, and remains, the dominant stable coin with a critical role in the entire crypto currency ecosystem.

²⁶ <https://cryptoslate.com/tethers-billion-dollar-reserves-may-not-equate-backing-no-misconduct/>



Figure 6 Tether coin price January 2018 to January 2019. Source <https://bitscreener.com/coins/tether>

The Gold Loan Bond

German hyper-inflation during the 1920's has another example of price stability in the absence of active parity mechanisms.

As we have discussed in the autumn of 1923 the value of the German mark was in free fall. The situation was so bad that it is estimated there were over 2,000 currencies in circulation. The need for a stable currency was huge, especially among the working classes for whom the lack of a functioning means of exchange hit hardest.

As an interim solution before the release of the Rentenmark the government issued a number of Gold Loan Bonds to be used as a means of exchange or as collateral for other currencies. These notes had no more underlying assets backing them than the hyper-inflating mark. Nor was their supply adjusted to maintain their value. However they were accepted by the population and indeed held their value. The reason was one word printed on the notes: "wertheständig" (stable-value).²⁷

The example illustrates the ability the stated purpose of an instrument, here printed directly on the note, to achieve price parity – in this case a stable price.

Gold

The most compelling evidence for the presence of purpose as a parity mechanism comes from gold. Gold is quite literally the foundation of the financial system. Along with silver it was already being used as a means of payment by the Sumerians (3,500 – 1,800 B.C.). A Babylonian legal document

²⁷ Constantino Bressciani-Turroni, *The Economics of Inflation* pp. 341-354 abstracted in The Institute of Economic Affairs 1976.

called The Code of Hammurabi (1772 B.C.) states that if a man wants to divorce his wife and they have no children he must pay her one mina or one third-mina of gold depending on circumstances.²⁸

The reason why gold is the foundation of the financial system is because of its ability to retain a stable value – that is to say, irrespective of its political, geographic, financial or historical environment gold keeps a constant peg to its value in the past.

This stability made it possible for a wide range of currencies to be used as money in the United States before the 1850s. Dutch, English, French, Portuguese and Spanish coin circulated freely as legal tender.²⁹ The arrangement worked perfectly well because the coins were primarily gold and silver – the metal content of the coin acting as the means of maintaining parity. No underlying asset or control of supply was necessary.

As further evidence of gold's stability Nathan Lewis conducted research into its value during the 19th Century. He found that changes in the price of gold where in fact changes in the value of currency and not the metal. He also found that changes in the value of commodities relative to gold where likely to be the result of supply and demand issues with the commodity itself (e.g. bad harvests) rather than changes in the value of gold. He concluded:

“The basic premise of a gold standard system is, first, that a currency that is stable in value is an important and desirable thing. Second, gold is stable in value. Thus, if you make the value of your currency the same as gold, then your currency will be stable in value.”³⁰

This peg of gold's value cannot be attributed to any other asset. Gold itself has been since the dawn of finance the underlying asset of choice. Nor is it the result of the management of supply. The Bank of England's supply of notes was designed to keep the notes pegged to their official value in gold, not the management of the value of gold itself. What then provides gold with its constant value?

One possible reason is because people have a need for a stable means of exchange and believe that gold can provide this stability. This need along with the belief that gold fulfils this purpose could be the reason for its constant value.

This suggestion, that passive parity mechanisms are at work with gold, is supported by the loss of parity between gold and silver during the 1870's. Before that time most of the world operated on a dual metal system with silver and gold pegged to the value of each other. From 1680 to 1870 this peg was generally between 15-16 ounces of silver to one ounce of gold.³¹ The fact that in the 1870's silver lost this peg to gold demonstrates that the stability of silver's value is a human artefact. There was nothing inherent in the metal that compelled it to be pegged to gold at a given value. When people stopped believing in its purpose as a store of value the parity mechanism ceased.

²⁸ Nathan Lewis, *Gold, the Monetary Polaris*, p105.

²⁹ Hermann E. Knooss, *American Economic Development*, pp. 271-272.

³⁰ <https://newworldeconomics.com/gold-is-stable-in-value/>

³¹ <https://newworldeconomics.com/the-history-of-gold-is-really-the-history-of-the-goldsilver-complex/>

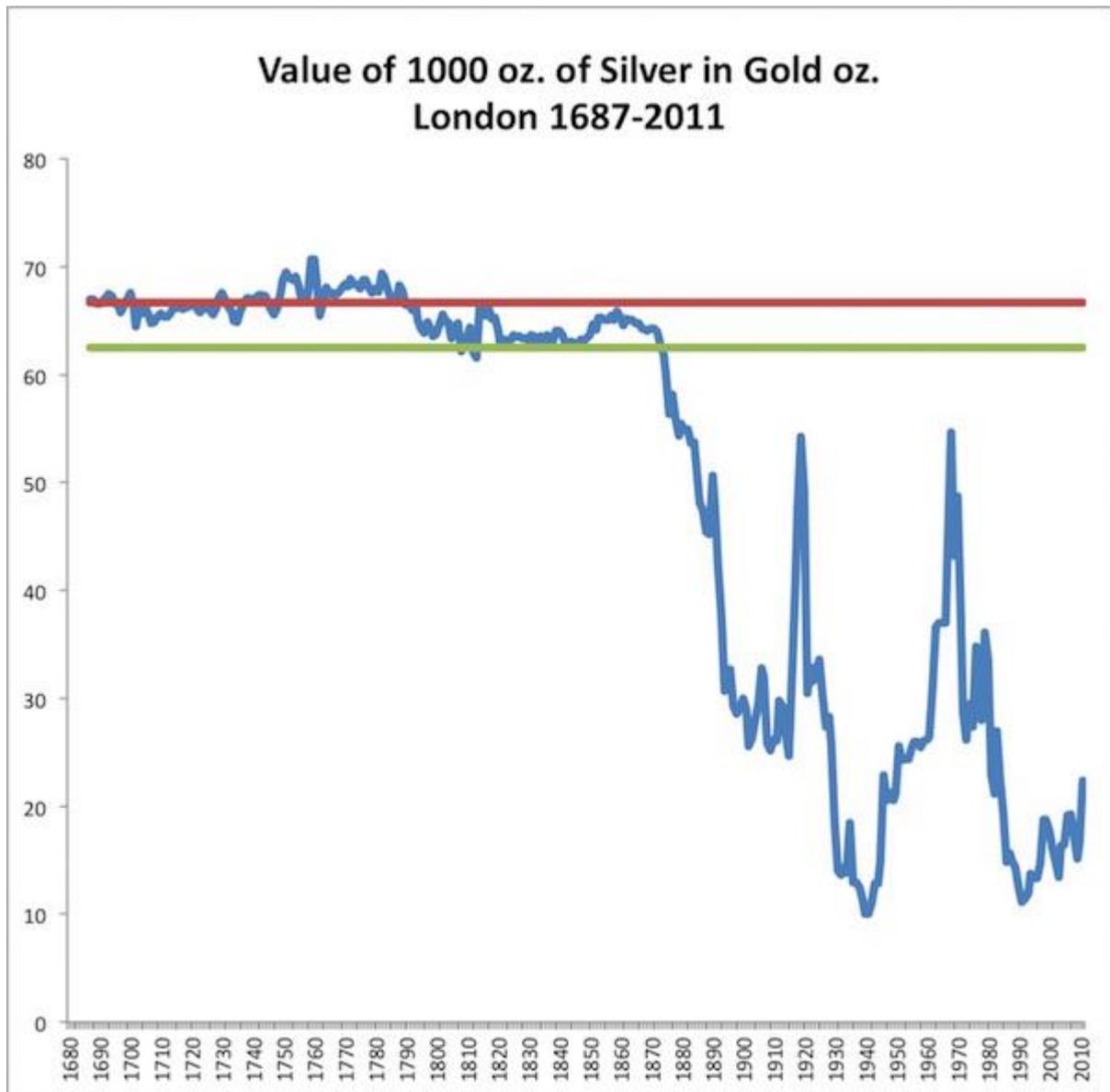


Figure 7 The value of 1000 oz of silver in gold oz in London 1687-2011. Red line 15:1 ratio. Green line 16:1 ratio. Source: <https://newworldeconomics.com/the-history-of-gold-is-really-the-history-of-the-goldsilver-complex/>

Risks of passive peg mechanisms

The loss of parity between gold and silver illustrates the risk involved with purpose as a peg mechanism: if people no longer believe in the purpose of an instrument then the peg is lost. Unlike the weight of a bar of silver, any parity created by purpose is the result of the expectations of market participants. If those expectations falter then so does the peg.

As with Tether it may be that a stated purpose of parity works when there is the need, or demand for it to work. I.e. passive parity mechanisms are also driven by demand. People need Tether to be stable and thus it is. People need a stable means of exchange so gold has a stable value. In the 1870's people perhaps no longer needed silver as a stable exchange mechanism so its peg to gold was lost.

Summary

The analysis of four mechanisms to maintain price parity reveals some interesting findings for both investors considering buying ETFs and stablecoins and how other financial products requiring a peg could be developed :

- 1. ETFs and stablecoins use active and passive mechanisms.** While the active mechanisms of holding underlying assets and the active management of supply are explicitly described in the promotional material of ETFs and stablecoins both also use the passive mechanism of a clearly stated purpose.
- 2. Underlying assets in themselves do not manage parity.** Holding underlying assets (reserves) or their sale do not support price parity. Underlying assets need to be used in conjunction with an active supply mechanism to be effective.
- 3. Active mechanisms carry catastrophic risk.** Because today's financial system is overwhelmingly dominated by derivatives, any financial instrument such as ETFs or stablecoins using active peg mechanisms carries the risk of systemic collapse. This has nothing to do with the underlying asset; it is a consequence of the need for counterparties to implement the active management of parity.
- 4. Passive mechanisms can also collapse.** Silver's loss of its peg to gold in the 1870's shows that passive mechanisms also carry the risk of collapse. With passive mechanisms collapse of value occurs if people no longer believe in the instrument's parity.
- 5. Passive mechanisms have the longest track record.** Gold has served as the basis of the financial system because its value has remained constant. This stability is likely to be the result of people's expectation of stability and their need for a stable form of exchange. There can perhaps be no clearer evidence of the role passive mechanisms play in the maintenance of price parity – in this case of gold's parity from one year to the next.
- 6. Difficulties in quantifying effectiveness.** Because peg mechanisms are almost inevitably used in conjunction with each other, their individual effectiveness is not always known. However passive mechanisms have demonstrated their effectiveness in the absence of active methods in Germany during 1923, in Tether during 2018, and with gold and silver for millennia.

	Active Peg Mechanisms		Passive Mechanisms	
	Underlying Assets	Control of Supply	Control of Supply	Purpose
Exposure to risk of catastrophic loss via counterparties	✓	✓		
Exposure to risk from loss of belief			✓	✓
Used in gold				✓

Used in gold standard	✓	✓		✓
Used in ETFs	✓	✓		✓
Used in stablecoins	✓	✓		✓

Figure 8 Comparison of 4 price peg mechanisms

END