

BitsOfGold (BOG)

A Smart Contracts System for Buying/Selling Digitized Gold Denominations Backed by Gold Reserves

WHITE PAPER (v.20.02.01)

This white paper is intended to be an introduction and technical reference to BitsOfGold, a smart contracts system for buying and selling digitized gold denominations backed by 24 Karat gold reserves. This paper will be maintained and updated periodically to reflect fundamental concept (s), benchmarks, technical adjustments, improvements and up or down gradations in the project.

Abstract

Gold bullion and coins had been used as means for storage of value and wealth preservation since time immemorial. Relative scarcity of the yellow metal in the earth environment and physical properties like corrosion-resistance, malleability, ductility and conductivity make gold the ideal commodity for long term storage of value and wealth. Some of the recent statistical studies have clearly demonstrated the ability of gold as a hedge against ‘ex post’ as well as ‘ex ante’ inflation especially in developing economies like Pakistan. This whitepaper is based on in-depth research on the possibility of Gold being used as a means of storage of value, accumulation and preservation of wealth, and as a tool for promoting household savings using modern web-technologies especially cryptography and blockchain.

Fisher Hypothesis, Interest Rates and Inflation

Inflation (both ex-post and ex-ante) has the potential to deplete the purchasing power of investment assets overtime. As such, maintaining the purchasing power of investments over the medium and long term horizon has always been a major concern of investors and their advisers (Roache and Attie, 2009). This effect was addressed by Fisher (1896) in his famous Fisher Hypothesis which states that real interest rate is independent of monetary measures, specifically the nominal interest rate and the expected inflation rate. The relation between the nominal and real interest rates is given by the Fisher equation as under:

$$r = i - \pi^e$$

The equation states that the real interest rate (r) equals the nominal interest rate (i) minus the expected inflation rate (π^e). The equation, although a rough approximation of its time, tends to hold good unless either the interest rate or inflation is very high, or it is being used to analyze data sets over a very long period of time. A more accurate statement using continuous compounding would thus be:

$$1 + i = (1 + r) \times (1 + \pi^e)$$

If the real interest rate r is assumed as per the Fisher hypothesis to be constant, the nominal rate i must change point-for-point when π^e rises or falls. Thus, the Fisher effect states that there will be a one-for-one adjustment of the nominal interest rate to the expected inflation rate. The implication of the hypothesized constant real rate is that monetary policy actions will have no effect on the real economy like real spending by consumers on consumer durables or by businesses on machinery and equipment.

Besides expected inflation long-term investors also tend to be concerned about preserving their wealth against unexpected and sudden inflationary pressures arising from unforeseen political, social and economic events like wars, famines, epidemics etc. These concerns lead naturally to debate about type of assets or asset classes that would protect investors' wealth against expected and unexpected inflation.

The Case for and Against Gold

Historically gold has been suggested as an investment asset (Chua and Woodwards, 1982) as well as a store of value (Harmston, 1998) both by academics and practitioners. By the latter gold is viewed as a hedge against inflation and currency depreciation. Some of the distinguishing features that set gold apart from other commodities include durability, relative trans-portability, universal acceptance and ease of authentication (Worthington and Pahlavani, 2006). Based on these noble characteristics gold is often cited as a long term store of value by academics. Besides, gold's positively skewed returns might as well accord a safe-haven property to gold.

Although some neo-economists view gold as more of a "medieval relic" with no modern role to play or just another commodity that hardly adds value to a modern investing strategy (Ranson and Wainright, 2005), the public opinion (Blöse, 2010), policy makers and academics such as Wang, Lee and Thi (2011) assert that gold price tends to rise in tandem with general price levels in an economy thus providing a natural hedge against inflation. Dempster and Artigas (2010) have

argued that while gold achieves high returns in high inflation years, its returns are positive even in the low and moderate inflation years. Moore (1990) has maintained that demand for gold as an investment asset grows with rise in expected inflation. In finance and investment sectors it is a common belief that “gold loves bad news” and, as if in line with the popular belief, the literature suggests that gold provides an ideal hedge against both ex-ante and ex-post inflation. Wang, Lee and Thi (2011) maintain that effectiveness of gold as hedging asset against inflation may vary from economy to economy and is determined by the magnitude of volatility of the domestic inflation relative to changes in the gold price.

With this brief review of literature we now proceed to investigate the role of gold as an inflation-hedge in peculiar economic circumstance of Pakistan.

Statistical Hypotheses

Our basic postulation had been that for any investment asset to be considered as a long term hedge against inflation, its returns on investment must be equal to or greater than the inflation during the period under review plus the cost of carrying such asset (interest) over the same period, that is

$$\sum_{t=1}^n r_t \geq \sum_{t=1}^n i_t + \sum_{t=1}^n \pi_t^e$$

That is to say that the sum of all values of real interest rate (r) must be greater than or equal to the sum of all values of nominal interest rate (i) plus the sum of all values of expected inflation (π^e) over the same period.

For the purpose of hypothesis testing we went onto constructing two hypotheses as follows:

$$H_0: \sum_{t=1}^n r_t \geq \sum_{t=1}^n i_t + \sum_{t=1}^n \pi_t^e$$

$$H_1: \sum_{t=1}^n r_t < \sum_{t=1}^n i_t + \sum_{t=1}^n \pi_t^e$$

In order to confirm or reject the hypotheses we needed to collect, collate and analyze data relevant to the price of gold, nominal interest rates and inflation over a fairly long period of time. For this we took the period from Jan 2001 to December 2019, that is a period of 19 years which is fairly long in the context of long term investing and also consistent with the statistical need to have a large enough sample. Also it was important that the data must come from reliable and authentic sources. With this background we went on to collecting data from World Gold Council (www.gold.org), Trading Economics (www.tradingeconomics.com), Pakistan Bureau of Statistics (www.pbs.gov.pk)

and State Bank of Pakistan (www.sbp.org.pk). The detailed data is placed as Annex A to this whitepaper. Here we produce the relevant graphs and inferences from our analysis.

Graph in Figure 1 below shows the movement in the value of an interest bearing instrument with a face value of Rs.13,785.74 with interest rates maintained by the State Bank of Pakistan during the period from January 2001 to December 2020. The figure of Rs.13,785.74 is not an arbitrary figure but is equivalent to the price of a Troy Ounce of gold at the beginning of the time period in 2001. It is important to note that the interest rates announced by the State Bank of Pakistan are the rates at which liquidity may be arranged to the banks and major financial institutions (subject to fulfillment of State Bank's terms and conditions) and are seldom available to ordinary investors. Ordinary investors get to invest at rates that are much lower. Hence calculating the value of an instrument over time at SBP rates provides an extra layer of safety for the purpose of our analysis.

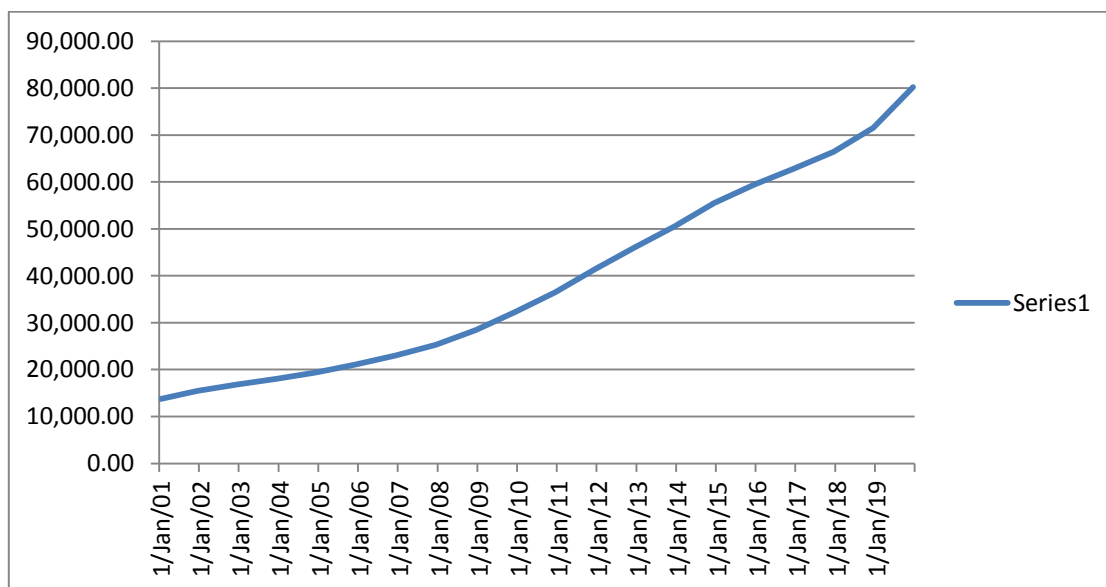


Figure 1

Graph showing the value of an Interest Bearing Instrument with a face value of 13,785.74 in Pakistan with interest rates maintained by the State Bank of Pakistan during the period from January 2001–December 2019

Graph in Figure 2 is a build onto the graph in Figure 1. The red line shows the required or desired value of the same interest bearing instrument if it was to ward off the effect of inflation at different points of time during the period under review. We can say that the area between the red and the blue lines is the loss that the investor has accumulated due to inflation. An ideal investment or asset must provide for returns at the level of red line or above it to cover the cost of carrying such asset plus the loss in the value of money over time due to inflation.

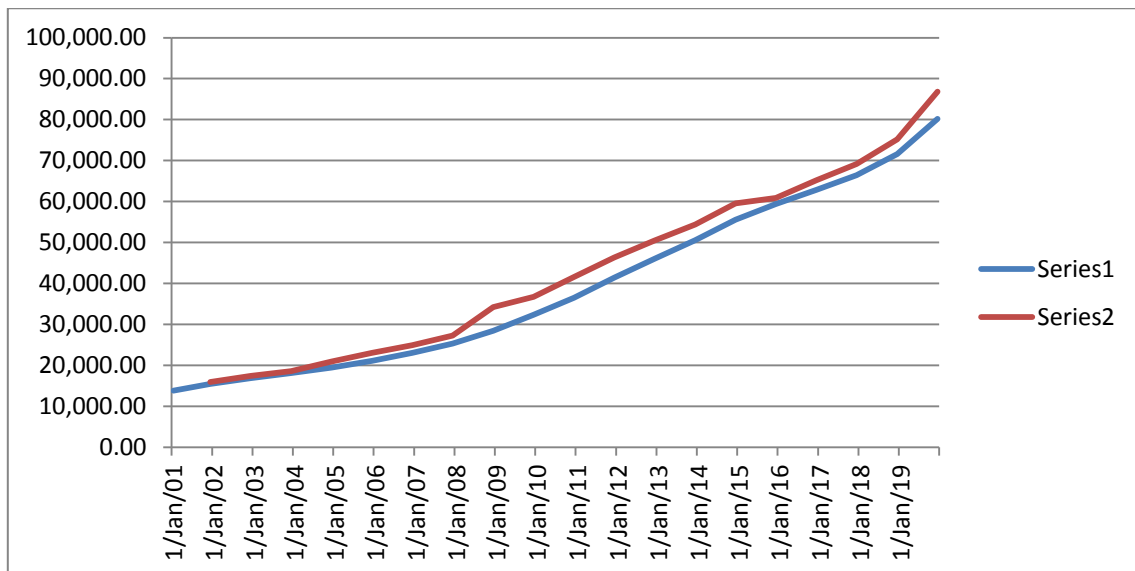


Figure 2

The red line in the graph shows the value that an Interest Bearing Instrument with a face value of 13,785.74 in Pakistan should have gained at different points in time between January 2001–December 2019 to cover the cost of carrying such instrument plus loss in the value of money due to inflation.

Graph in Figure 3 is yet another build onto graphs in Figure2 and 3. The green line shows the movement in the value of Rs.13,785.74 (price of a troy ounce of gold in 2001) invested in gold bullion over the period between January 2001–December 2019. As may be seen from the movement of the green line that gold witnessed huge volatility in the period between 2010 and 2015, never has the return on investment in gold been lower than any other interest bearing instrument. Also in the nutshell the returns offered by gold are highly positively skewed and favorable to the long term investors.

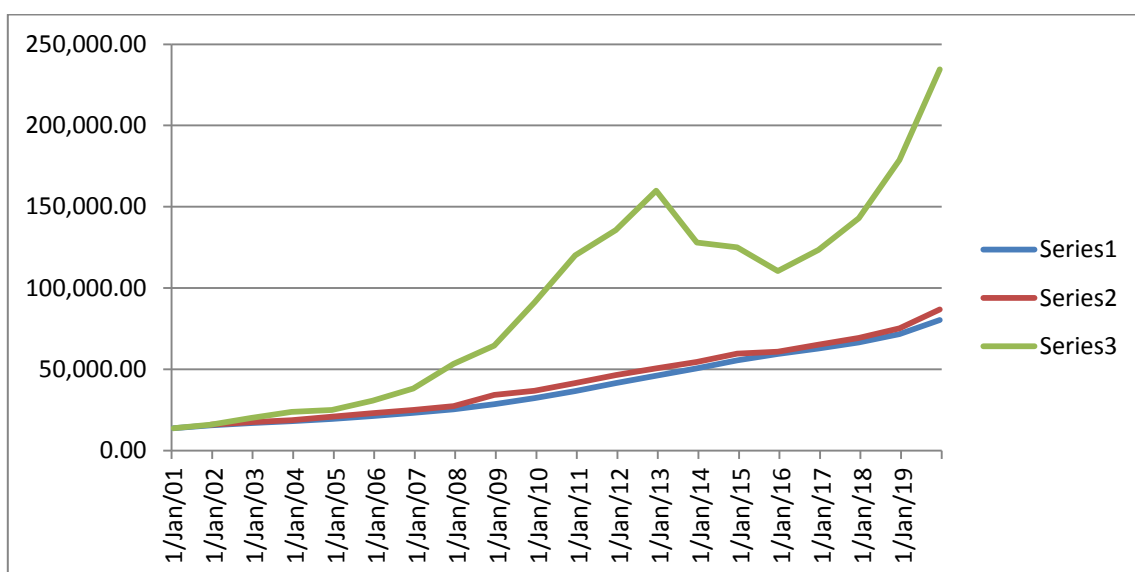


Figure 3

Graph showing the movement in the value of a troy ounce of gold purchased in January 2001 at a price of Rs.13.785.74 (green line)

Based on our mathematical calculations in the light of our hypotheses and the visual models presented above we can safely assert that gold provides a hedge against inflation and the assumption of gold being a safe-haven for long term investors holds good even during times of volatility in the price of the metal. Our alternative hypothesis (H_1) stands rejected. While we can assert that within the given data the H_0 stands validated we would like to add the disclaimer that our inferences are based on study and analysis of a specific time period as stated above and cannot be taken as a guarantee that prices of gold vis-a-vis different currencies, and outcomes from investing in gold would be the same or similar over another period of time.

Gold as a Wealth Building Asset

Gold as a wealth building asset has been used since the beginning of recorded history of mankind. This can largely be attributed to well-established traits ascribed to the yellow metal like corrosion resistance, universal acceptance and a very favorable weight-to-value and weight-to-size ratios that make gold an ideal wealth to carry, trade, transfer or re-assign. Well until 1933 gold was used as a standard to measure the strength of a country's currency. Even today most of the central banks and major private financial institutions hold gold as a commodity. In developed countries it is a common practice to hold gold as part of one's investment portfolios. Many conservative investment advisors advise holding physical bullion notwithstanding the difficulties associated with transportation, safekeeping and liquidating gold.

Gold in Emergency Funds

In North American and Europe many people hold gold bullion as part of their emergency funds primarily for the reason that gold maintains its value in the short as well as in the long run. In Pakistan gold is generally held in the form of gold jewelry and ornaments. However, holding jewelry and ornaments in wealth or emergency portfolios is predisposed to many issues like security, valuation at the time of purchase and revaluation at the time of sale. The purchase and sale of ornaments is subjected to many premiums and deductions (like 'kaat', 'polish', 'moati', and making charges) that benefit the jeweler alone and work to the detriment of the investor. For this reason the custom of holding jewelry in household's emergency funds has been on the decline. On the other hand holding gold bullion is not within the reach of common people due to slim household saving capacity as also difficulties associated with buying and holding bullion namely non-availability of small enough denominations and safe-storage. As a result common people have been left out of the gold based growth curve available to the high income groups.

The Business Possibility

The situation described above presents the possibility of commencing and doing a profitable business by way of buying gold in bulk and selling smaller denominations priced within the budget of low and lower-middle income groups provided a trustworthy system may be established that delivers on its promises and safeguards the interest of the investors. Such will help ordinary people build wealth incrementally by buying denominations of gold to be held in long term savings as well as in emergency funds. Any such initiative will also be attractive for middle and upper income groups to diversify their portfolios by buying gold as a hedge against desirable and undesirable inflation and grow their wealth outside the tax regime as earnings from gold will be reported and be taxable only in the tax year that gold will be disposed off.

The Business Objective

To sell and buyback digitized denominations of gold backed by 70 percent physical reserves in the shape of gold bullion held at a safe-storage and 30 percent cash reserves held in a bank account with the guarantee to allow redemption at the going price and/or allow physical delivery at a pre-agreed threshold (1 Troy Ounce = 31.1 grams to begin with). The physical gold and cash reserve ratios may have to be altered later in the light of learned experience.

The Business Model

The proposed business model envisages buying gold bullion in reasonable tranches of 100 grams to begin with, convert each tranche into digital denominations of 0.1 grams with each denomination being assigned a unique cryptographic identification, selling these denominations using smart contracts at the going spot rate against cash payments with guaranteed offer to buy-back at the going spot rate and / or allow physical delivery at an appropriate threshold (31.103 grams to begin with) in addition to allowing transfer of the existing smart contracts in real time between the system users.

Genesis of Name – BitsOfGold (BOG)

A ‘bit’, short for binary digit, is the smallest unit of data in a computer system and all digital information across the global networks is carried as bits. A ‘bit’ is also a conventional word used to express smaller denomination of a substance or commodity; hence BitsOfGold (BOG) implying a system that sells and buys back bits of the yellow metal in smaller denominations.

Technologies Employed

The proposed digital platform leverages on open source technologies to deploy an improvised blockchain using any open source RDBMS and Cryptography to securely generate, assign value, safely store, attribute ownership and conclusively transfer the cryptographic token that cannot be forged or regenerated. Transactions would be recorded in real time using the contiguous blocks, each block having its own cryptographic identity that would carry the digest of the previous block with a view to ensure perpetual audit, data integrity, consistency and transparency across the system.

The concept employs distributed computing by using open source containers (Docker) to run multiple images and updating of the ledger at participating nodes at all times. The system would use the Byzantine Fault Tolerance and Detection to identify any inconsistency or incongruity across the network. A broad system diagram is given below:

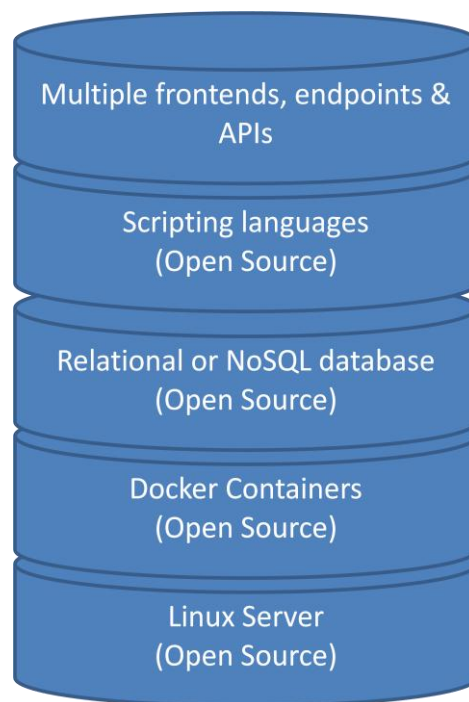


Figure 4

Conceptual diagram showing system build and technologies being leveraged

Use of Cryptography

Cryptography would be employed to create cryptographic tokens (keys) to be permanently paired with individual denominations (values) and to create digest of smart contracts and transactions.

External Data and APIs

The gold price at any moment corresponds to the COMEX (a division of Chicago Mercantile Exchange) data being fetched using gold price API that delivers price in US Dollars. The currency exchange rate data is being fetched from <https://www.exchangerate-api.com/> using cURL based application that manipulates the data to deliver prices in different currencies that are updated to the last minute.

Current Status

The project is currently hosted in a private cloud with physical computing assets located at Lahore, Pakistan. The project will be configured to all major global clouds at the launch stage and will have an endpoint API with visible linkages to forward and rearwards blocks for greater transparency across the system.

Frontend and Documentation

The project has a user-friendly front end that is fully automated and maintained. The project has properly written documentation that will be available to the general public in the shape of a whitepaper.

Project Readiness

The project has passed the alpha stage testing and is ready for beta stage user trials. Subject to permissions from SECP we would be able to launch the project in about a month time.

What a Common User Needs

- A means to connect to the internet like android cell phone, a tablet, a desktop or a laptop
- A functional internet connection
- A means to buy or load a BitOfGold which could be a peer or a nominated vendor to sell and/or redeem or a pre-paid card to be sold through a network of dealers to be appointed by the company, that is, GBC Guild (Private) Limited.

Potential Users

- Lower and Lower-Middle Income individuals / families wanting to save and grow wealth using incremental purchase of gold at the same time preserving their savings against inflation

- Upper-middle and High Income individuals / families wanted to hedge their savings against inflation and currency devaluations
- Investors wanting to diversify their portfolios and seeking protection against inflationary shocks
- Government institutions desirous to hedge their pension funds against inflation and diversify investment portfolios

Potential Beneficiaries

Supposing that the above business idea could be translated into a reality, it will have far-reaching positive consequences for the users, the company behind the business and the country's economy as a whole. A brief of the expected outcomes is given below:

a. Impact on National Economy

- (1) Would set foundations for documenting the sale and purchase of gold in electronic form that could be used for tax determination, wealth assessment, and research in consumption and spending behaviors at the national level besides fulfilling one of the longstanding demand of the International Financial Institutions and Financial Action Task Force (FATF)
- (2) Would strengthen and broaden the existing tax base
- (3) Would promote national savings in the short run and make more funds available for investment in the long run
- (4) Add more jobs to the economy
- (5) Strengthen the hands of the government in its objectives with regards to poverty alleviation by introducing a culture of responsible spending and a new culture of savings
- (6) Reduce pressure on real-estate by diverting some funds towards savings in gold and thus check further sky-rocketing of prices of real-estate that has made home ownership a distant dream (perhaps a nightmare) for the younger generation.

b. The System Users

- (1) Low and Lower-Middle Income Classes. The system would help build wealth incrementally and offer same/similar means to save available to the rich and the aware.

- (2) The Upper Middle and Upper Classes. The system would help hedge their savings against inflation at the same time allowing growth outside the tax net as income from gold will have to be reported only in the year that the gold is disposed.

c. The Company (GBC Guild)

- (1) Add valuation to the unsold share stock of the company
- (2) Enhanced corporate prestige
- (3) Profit from increase in the price of unsold denominations and administrative charges being charged upon physical delivery or redemption (0.1% of the value at the time of sale)
- (4) Enhanced company image by serving the national cause.
- (5) Possibility of expanding operations to other countries subject to success achieved at home.

This paper has been prepared jointly by the Economic Research Committee and Developer Team under supervision of the CEO GBC Guild in line with the vision of the Board of Directors GBC Guild (Private) Limited

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