

The Gibson Paradox: Real Gold, Interest Rates and Prices

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Abstract

This paper aims to provide an analysis and explanation of the curious empirical relationships that exist between the price of gold, the interest rate and commodity prices, operating under the English 19th century fractional reserve gold standard and the modern American fractional reserve *fiat* paper standard, known as the Gibson Paradox. This paper argues that the value and purchasing power of the British pound and American dollar are managed in relation to their rate of exchange with gold and the real rate of interest, such that, changes in the general level of prices are the effect and not the cause.

Keywords: Gibson paradox, gold standard, purchasing power of gold, real interest rate

1. Introduction

This paper attempts to offer a satisfactory explanation regarding the relationship between interest rates and prices, a perplexing phenomenon that perhaps is otherwise better known as the Gibson paradox. Although the relationship between interest rates and prices had been earlier analyzed by Knut Wicksell describing how “interest and prices very often rising and falling together” (Wicksell, 1907, p. 216), it was Keynes whom subsequently stated that the “Gibson Paradox...is one of the most completely established empirical facts within the whole field of quantitative economics” (Keynes, 1930, vol. 2, p. 198). Keynes termed the paradox after a financial journalist, A.H. Gibson, whom emphasized the close relationship between the rate of interest, as measured by the yield of Consols, and the level of prices, as measured by an index of wholesale prices (Gibson, 1923, pp. 15-34; 1926, pp. 595-612). Keynes referred to the problem as a paradox for it seemed to contradict the prediction of classical monetary theory that the interest rate is independent of the price level, being the price of loanable funds, whilst the price level is determined by the money supply as described by the quantity of money theory of prices (Sargent, 1973 p. 386). However, the paradox did not go unchallenged, indeed Macaulay (1938) stated:

It is true that, in various countries and often for long periods of time, the movements of interest rates (or rather bond yields) and commodity prices have been such as to suggest that they might be rationally related to one another in some direct and simple manner. But, over the whole range of available data, the exceptions to this appearance of a relationship are so numerous and so glaring that they cannot be overlooked (p. 185).

The exceptions relate to periods when England was off a gold standard during World War I (WWI) and in the 1930's. Wicksell (1907) and Keynes (1930) suggested that the paradox reflected a lag in commercial bank changes in the real rate of interest, yet this explanation “proved unsatisfactory...the Gibson paradox remains an empirical phenomenon without a theoretical explanation” (Friedman, 1976, p. 288). Indeed, Fisher wrote that, “no problem in economics has been more hotly debated than that of the various relations of price levels to interest rates” (Fisher, 1930, p. 399). Fisher attempted to explain the phenomenon by inflationary expectations being formed as a lag on past inflation (Fisher, 1930, p. 400), although this was challenged by Sargent “the relationship between interest rates and commodity price inflation cannot in large measure be explained by appealing to hypothesized movements in the anticipated rate of inflation” (Sargent, 1973, p. 63).

Shiller and Siegel (1977) also reject Fisher's price expectations, preferring instead that “analysis strongly suggests that prior WWI nominal long and short rates of interest can be regarded as real rates” (Shiller, 1977, p. 891). Shillers' interpretation would to some extent coincide with Barsky and Summers whom concluded that,

under the gold standard, the movements of commodity prices and nominal interest rates were similar to the inverse relationship of the relative price of gold and real interest rates under the *fiat* standard, and taking into account gold as an asset in relation to other financial assets might explain the anomaly (Barsky, 1988, p. 548). However, we disagree with Summer's findings in part, for they incorrectly presented real prices with nominal prices under the *fiat* standard, and without recourse to monetary theory and policy, a correct understanding of the Gibson Paradox would be distorted.

The paper is organized into three sections. The first section presents a detailed analysis of the mechanics of the fractional reserve gold standard and the Gibson Paradox in 19th century England. The second section, presents analysis of the Gibson Paradox in the United States under the *fiat* standard, and the third section provides a brief summary and concluding remarks.

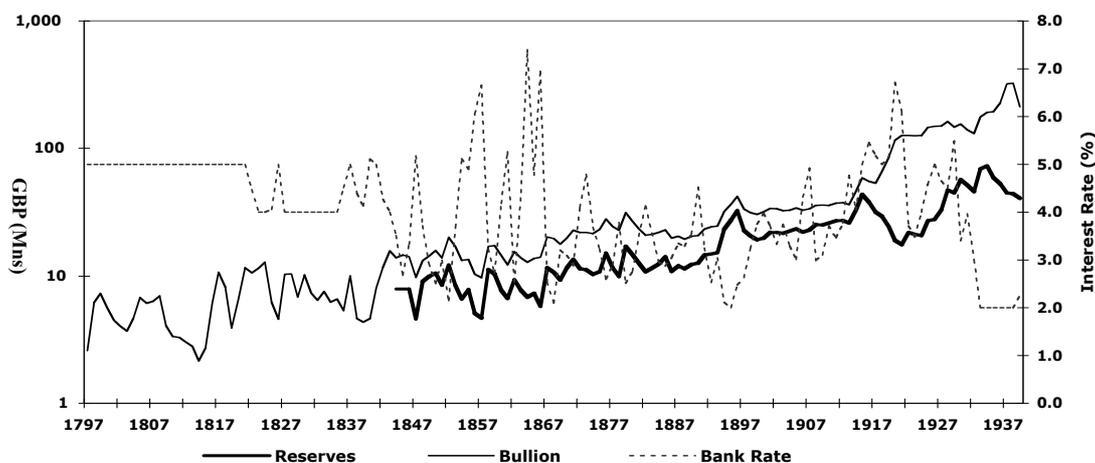
2. Gibson Paradox in England

To appreciate the Gibson Paradox in 19th century England requires an understanding of the mechanics of the gold standard operating within a fractional-reserve banking model. Cassel (1951) described the gold standard as,

A paper standard in which, the purchasing power of the monetary unit is so regulated as to practically coincide with that of gold. The aim of the gold standard administration is not to keep the general level of prices constant, but to keep the price of one single commodity, namely gold, as invariable as possible. If the purchasing power of gold as against other commodities should happen to remain constant, the gold standard is obviously identical with a paper standard regulated according to the principles laid down. But if the value of gold varies, the gold standard involves a regulation of the purchasing power of the monetary unit of account in accordance with the variations of that gold. This is indeed a very artificial and complicated system. It is clear that, in order to bring about such variations, it is necessary to keep the bank rate higher or lower than the equilibrium rate of interest, according to the requirements of the situation of the moment. Under such circumstances the gold standard involves continual deviations in opposite directions of the actual rate of interest from the equilibrium rate (p. 326).

More specifically, the gold standard linked the value of bank notes to the value of gold: the value of the British paper pound had to coincide with the value of the British gold pound - this was achieved by the using the Bank's discount rate to manage the level of gold reserves and the supply of liquidity (volume of loans and money supply) in accordance with the gold standard, by adjusting the supply of money so that the paper pound (bank notes) maintained the same value of a gold pound (sovereign coins).

Pre-1844, the Bank had only one department, and notes were not legal tender, so that an inverse correlation occurred between bullion stocks and the discount rate (figure 1), but from 1844, the inverse correlation occurred in the first instance between the notes reserves in the banking department and the discount rate.



Source: BHS (1962:441-446,456-460)

Figure 1. Bank of England's discount rate, banking department's notes reserves and total bullion stocks, annual averages, 1797-1939

In June 1822 the Bank lowered its discount rate from 5% to 4%. The lower discount rate expanded lending and generated an inflationary expansion in the money supply. The currency depreciation caused withdrawals and the Bank's gold reserves sank from £14.2Mn in 1823 to £1.26Mn by early December 1825, even down to £1.027Mn

when only coin was legal tender and the Bank had only one department (Bagehot, 1873, p. 29). As the loans were repaid, the reserves increased and money supply reduced - this deflationary contraction required the Bank to again expand the supply of money and credit but the interest rate was too low, even when it rose above 5% during a crisis in 1839, resulting in a gold outflow. The discount rate and associated changes in the volume of lending and money supply, was being used as a tool to manage the supply of liquidity in accordance with the gold standard, which transmitted out into the money market (figure 2) - the emphasis on using interest rates to manage money supply is a tool that we recognize in modern central banking monetary policy.

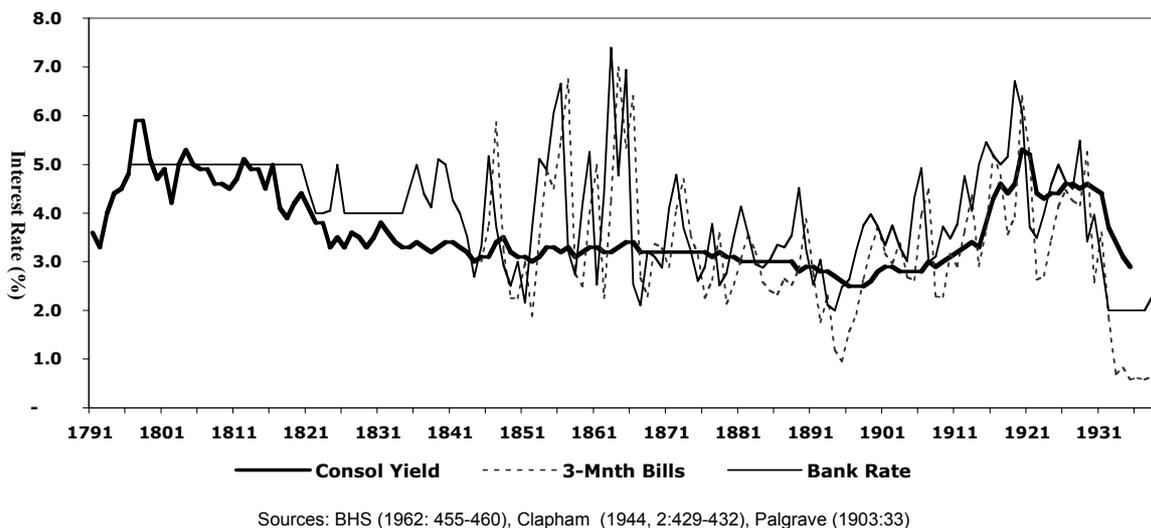


Figure 2. Relationship between the Bank of England’s discount rate, 3-months’ bank bill rate, and yield on Consols, annual averages, 1792-1939

The bank rate is transmitted into the short-term money market, as reflected in the average rate of discount for three-month bank bills - the discount rate inversely correlated to the issue department’s bullion reserves via the banking department’s notes reserves. The following series of figures and analysis for a ten year period (1881-1890), as an example, clearly demonstrate the mechanics of the gold standard in relation to the level of notes reserves and the discount rate, a policy made all the more clearer *ex post* the 1844 Banking Act and the segregation of the issue and the banking departments. Peel’s Bank Act of 1844 did not alter the control of the money supply, since although notes issued by the issue department were largely required to be backed by bullion (over and above £15Mn), the banking department had no such constraints and inflated credit and deposits in the same manner as any fractional reserve commercial bank does today. The bank’s discount rate fluctuates inversely (figure 3) with the level of notes reserves at the banking department (Easton, 1896, p. 123). By 1887 the ratio of reserves to liabilities was 43% (Clare, 1902, p. 47), and typically, the Bank’s reserve ratio was around 40% (Bagehot, 1873, p. 29).

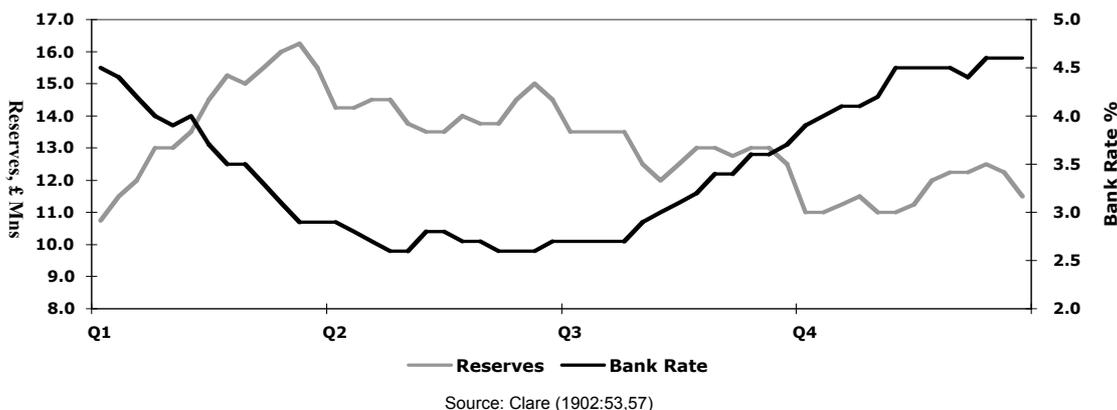


Figure 3. Banking department reserves at the Bank of England, average weekly fluctuations, 1881-1890

Notes are issued to anyone offering gold at the Bank’s buying price of £3 17s 9d per STO: notes in circulation are the difference from notes issued by the issue department and those held in reserve by the banking department. About £2Mns of bullion was typically held in the banking department as cash-in-till (Sykes, 1905, p. 172), otherwise all gold was transferred to the issue department (figure 4). For withdrawal of deposits from the banking department, the notes to that amount were taken from the reserve, returned to the issue department, then cancelled and sovereigns gold coins worth £3 17s 10.5d (the mint price) that were held against them were given in exchange (Easton, 1896, p. 119). The value of money is affected by the ratio of total bullion to gold and promises to pay gold. In 1881, gold and silver coins to bank notes, cheques and bills was 15% in the country and only 1% in London (Sykes, 1905, p. 54-55).

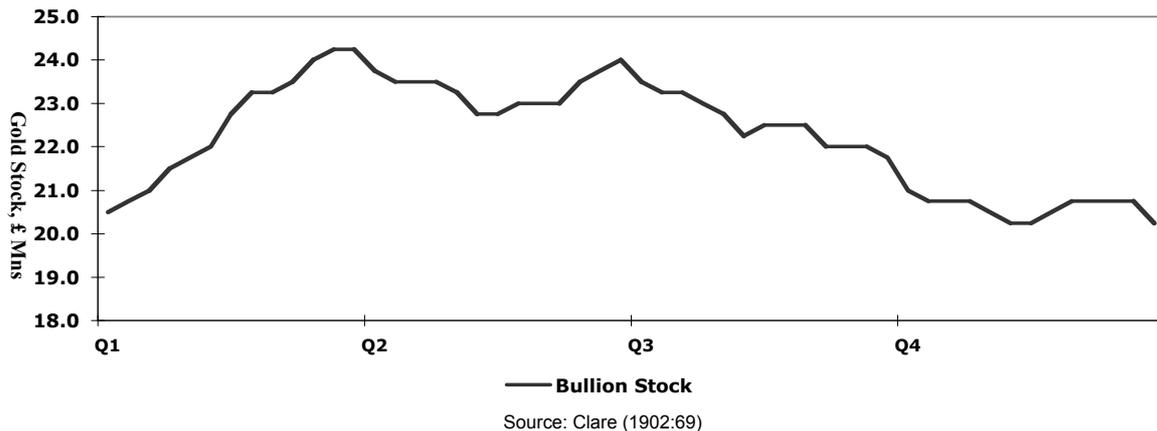


Figure 4. Stock of coin and bullion at the Bank of England’s issue department, average weekly fluctuations, 1881-1890

The factors that influence the reserve involve: (1) demand for the internal circulation of currency (figure 5); and, (2) external foreign demand and foreign exchange (figure 6), by obtaining credit with a London banker by buying bills on London, remitting them in London for discount, or by selling securities, and converting the proceeds into bank notes and cashing the notes at the issue department for gold sovereigns.

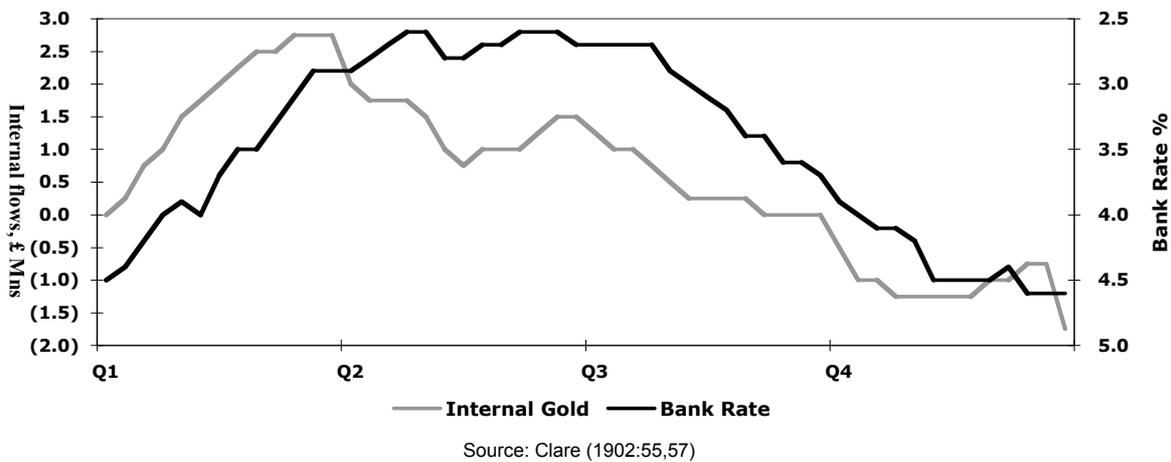
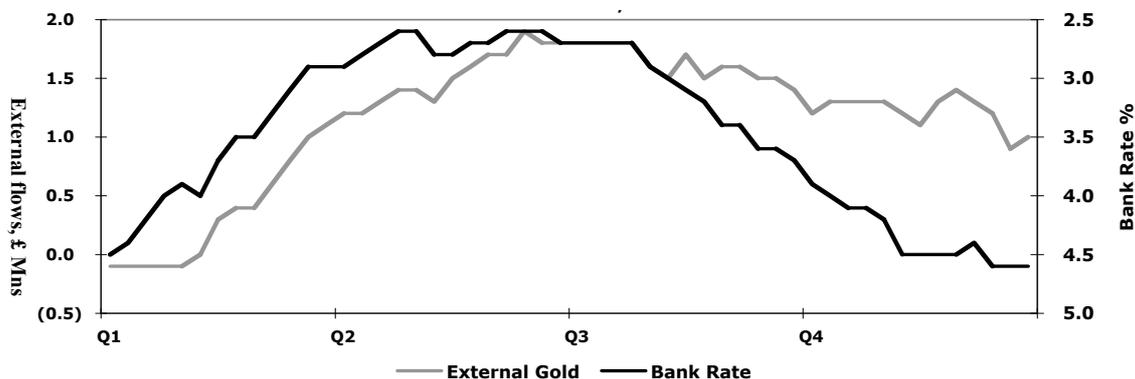


Figure 5. Internal gold movements compared with changes in the bank rate, average weekly fluctuations, 1881-1890

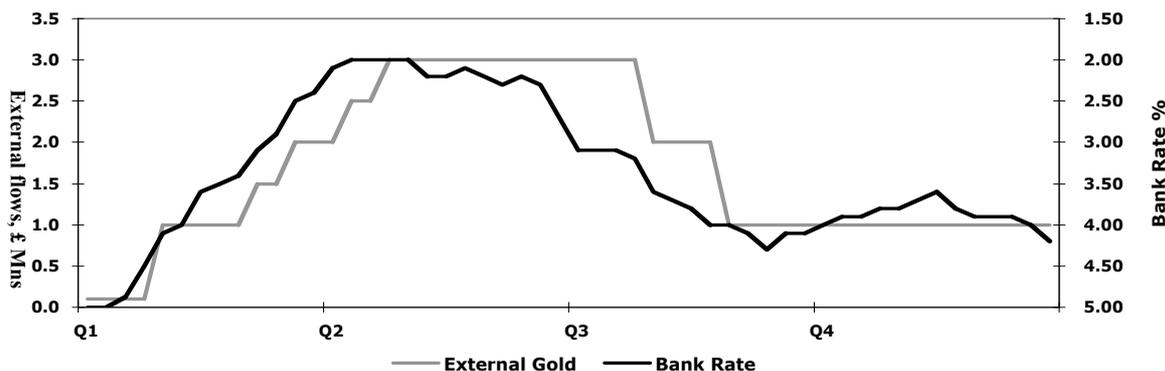
In figure 6, the gold line reflects an exceptional transaction of about £500,000 worth of gold purchased by the Bank from France, Russia and others, at the end of November 1890: by deducting this amount from end November onwards, the two curves are brought more into agreement.



Source: Clare (1902:57,69,70)

Figure 6. External gold movements compared with changes in the bank rate, average weekly fluctuations, 1881-1890

In figure 7 for 1887, we can observe clearly that as gold flows in, the bank rate falls and as gold flows out, the rate rises. A gain of £1Mn worth of gold from foreign sources is equivalent to a 1% reduction in the bank rate, and *vice versa*.

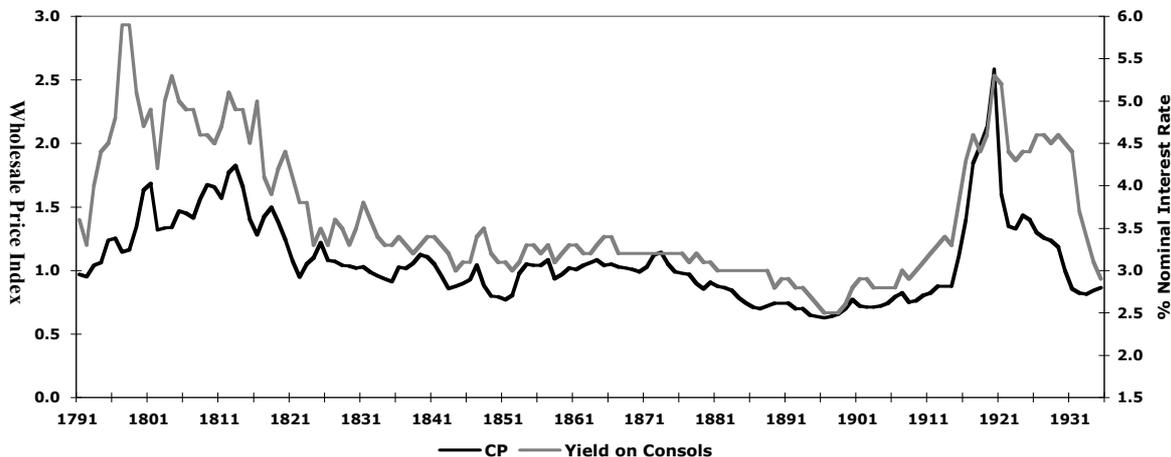


Source: Clare (1902:57,71)

Figure 7. External gold movements compared with changes in the bank rate, average weekly fluctuations, 1887

To summarize, the Bank thus used the discount rate to manage the supply of liquidity in accordance with the gold standard: if gold was flowing in to the Bank’s reserves, it expanded the monetary base by lowering its discount rate – at the lower rate, lending would increase and the reserves would decrease – the increase in lending would increase the supply of notes, thereby lowering the value of the paper pound (bank notes) in relation to the value of gold pounds (sovereign coins); if gold was flowing out of the Bank’s reserves, it contracted the monetary base by raising its discount rate – at the higher rate, lending would reduce and reserves would increase – the reduced lending would decrease the supply of money. Certainly the Bank, via its bullion broker Rothschilds, effectively controlled the market price of gold, given that the premium over the Bank’s buying price was negligible: from 1844 to 1914 the average market price was £3.8888, whilst the average Bank’s buying price was £3.8875 – a difference of only 0.03%. Under the gold standard, the redemption or rate of exchange between notes and coins was fixed, and if the market price of gold (PG) was stable, the supply and demand for short and long-term securities, credit, and the supply and demand for deposits would all depend on the real rate of interest. An increase in interest rates would increase the reserves of monetary gold, but decrease the demand for non-interest bearing monetary gold in circulation, whilst at the same time increase the demand for interest-bearing deposits, thereby increasing Bank notes in circulation, and with the money multiplier would in turn increase commodity prices (CP). The increase in the discount rate moved in tandem with commodities prices (CP), but also reduced the price of Consols and increased their yield (Williams, 1912, p. 399), accordingly we have the “Gibson’s Paradox [which] is one of the most completely established empirical facts within the whole field of quantitative economics” (Keynes, 1930, vol. 2, p. 198). In figure 8, we have constructed a wholesale commodity price index (CP) for the period from 1791-1935, derived from the Gayer, Rostow and Schwartz Price Index (GRS) from 1791-1850 and linked with the Sauerbeck-*Statist* Price Index (SS) from

1850-1935. We may observe the co-movement between wholesale commodity prices and long-term interest rates, as reflected in the yield from British government Consols.



Sources: CP - GRS, SS ; Yield - BHS (1962:455)

Figure 8. The Gibson paradox in England, 1791-1935

Under the gold standard, with the value of gold being held constant, the purchasing power of the British pound (PPB) coincided with the purchasing power of gold (PPG). The reciprocal of the PPB and the PPG ensured that nominal prices expressed in pounds coincided with real prices expressed in gold (the correlation coefficient is unity from 1821-1914). With the gold price constant, interest rates were low and held within a narrow band of 2-5%. The Gibson paradox is observed in the co-movement of interest rates and prices. Under the gold standard, in the absence of devaluation, nominal interest rates are real rates of interest, as gold is acquired at the nominal rate, given the convertibility of the currency. By altering the nominal rate, the Bank altered the real rate, thereby altering the real cost of bank note reserves and thus the real cost of borrowing. Fractional convertible bank note reserves affected 'loanable funds' as a money multiplier. The use of the interest rate as a monetary policy tool has continued under the *fiat* standard. The Bank inflated and deflated the value of the British pound in relation to the gold stock (in the issue department) via the note reserves (in the banking department). Historically, monetary policy was anchored to convertible bank notes (redeemable in gold coins), where the discount rate was a tool to adjust the supply of bank money in accordance with the gold standard, whilst the *fiat* standard is floating and anchored to the volume of debt, with *fiat* money being debt organized into money, so that the supply of money via the supply of debt, is the tool by which the market interest rate is adjusted in accordance to a central bank interest rate target.

Thus, the Bank of England evolved into a central bank with the following aims: (1) regulating interest rates; (2) preventing any liquidity-shortage; (3) management of the money supply in relation to the gold standard; and (4) by manipulating interest rates, it perfected a monetary policy encompassing all of the three previous aims. By managing the purchasing power of the British paper pound (PPB), this implies an ability to provide stable prices, and yet prices are supposed to change, in order to efficiently transmit information and organize an economy. The flow of trade and economic development can involve higher prices. Higher prices as a result of trade are distinct from monetary distortion. This distortion is revealed when there is no settlement in gold, when there is no convertibility of bank notes due to the suspension of payments and the inability to redeem paper notes for gold or silver coins. With convertibility, the value of bank notes could not fall much below the value of precious metal they represented, and any over issuance of paper money by the Bank resulted in redemption of bank notes in gold or silver coins. This is precisely what Adam Smith stated in 1776,

The whole paper money of every kind which can easily circulate in any country never can exceed the value of the gold and silver, of which it supplies the place, or which the commerce being supposed the same would circulate there, if there was no paper money. If twenty shilling notes, for example, are the lowest paper money current in Scotland, the whole of the currency which can easily circulate there cannot exceed the sum of gold and silver which would be necessary for transacting the annual exchanges of twenty shillings' value and upwards usually transacted within that country. Should the circulating paper at any time exceed that sum, as the excess could neither be sent abroad nor be employed in the circulation of the country, it must immediately return upon the banks to be exchanged for gold and silver. Many people would immediately perceive they had more of this

paper money than was necessary for transacting business at home, and as they could not send it abroad, they would immediately demand payment of it from the banks... There would immediately, therefore, be a run upon the banks to the whole extent of this superfluous paper, and, if they showed any difficulty or backwardness in payment, to a much greater extent; the alarm which this would occasion necessarily increasing the run (1999, vol. 1, pp. 397-398).

That being said, whilst Adam Smith is deemed the ‘father of modern economics’, so it is with some unease to note that nowhere in the writings of the classical economists including Smith and Ricardo, is there any mention of the possibility of interest rate manipulation by the Bank of England, despite the fact they lived through monetary crises and already had access to over a hundred years of data as to its behaviour. When we analyze the period from 1717 to 1931, during which England was on a *de facto* or *de jure* gold standard (table 1) for a total of 214 years, in fact, we notice that it was on the gold standard for 180 years, and off the gold standard for 34 years, in other words, it was on the gold standard for 84% of the time.

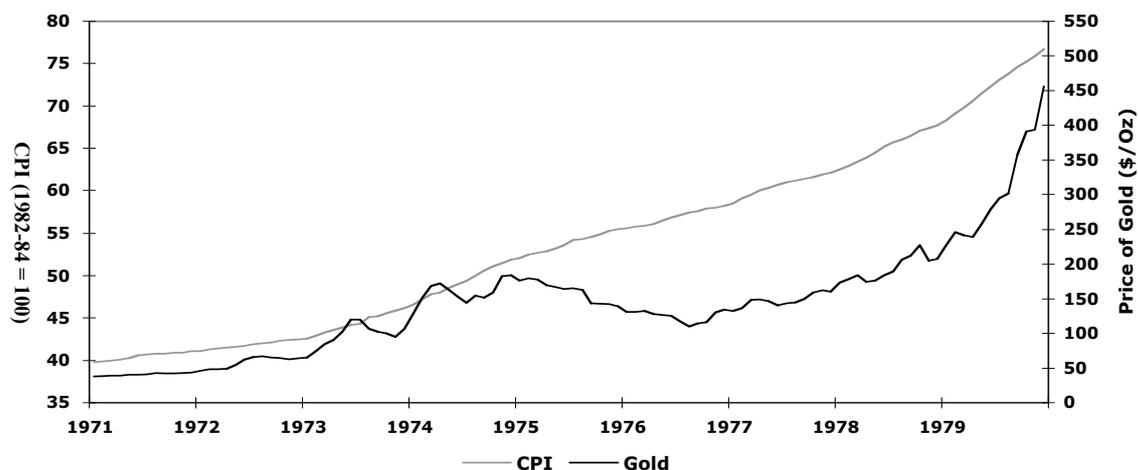
Table 1. England and the gold standard

	on	off
1717-1796	80	
1797-1821		24
1821-1914	94	
1915-1925		10
1925-1931	6	
	180	34

For the remaining 16% of the time that England was off the gold standard, it was either at war with France during the restriction period, or at war with Germany during WWI, and during these crises, citizens were prevented from redeeming their bank notes, which would otherwise have caused a run on the Bank and bankrupted it. Without convertibility the production of bank notes went unabated and the value of the paper pound depreciated as a unit of account in exchange for gold and commodities: a monetary theory of value would argue that the decline in the value of money is a result of the inflated over supply of bank notes in relation to demand, reflected in higher exchange rates with a fixed amount of gold, resulted in an increase in prices generally, as reflected in a higher wholesale commodity price index.

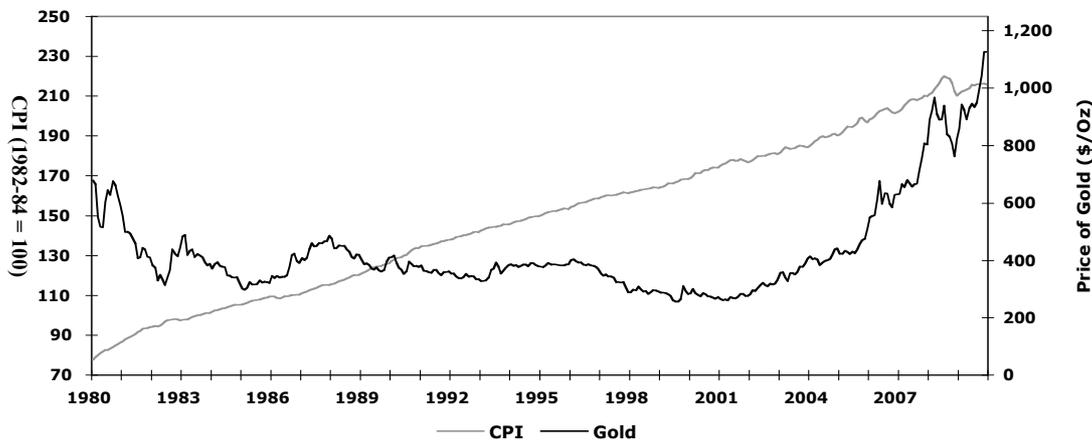
3. Gibson Paradox in America

Overall, the nominal price of gold (PG) acted as a reasonable hedge against inflation (CPI) during the *fiat* standard in America. If we look more carefully at the PG and CPI between 1971 and 2009, we notice two differing periods: figure 9 reveals a positive relationship between 1971-1979, but in figure 10, we may notice that from 1980-2009, gold as a hedge against inflation is less obvious and nominally breaks down at least surrounding the period from 1990-2005.



Sources: Federal Reserve Statistical Release H.15, BLS, WGC

Figure 9. The price of gold and inflation, United States, 1971-1979



Sources: Federal Reserve Statistical Release H.15, BLS, WGC

Figure 10. The price of gold and inflation, United States, 1980-2009

As a former executive of Goldman Sachs in London, Robert Ruebin developed an idea to borrow gold from central banks at minimal interest rates of around 1%, sell the gold for cash and use the proceeds to invest in higher yielding assets and investments to fund Goldman Sachs’ operations. Central banks participated, confident that the borrowed gold would be repaid, and this started the gold carry trade. When Ruebin became Treasury Secretary he operated an identical carry trade, but on a much larger scale, which became the principle mechanism for the ‘strong dollar policy’. Subsequent Treasury Secretaries have reiterated their commitment to the strong dollar policy, implying their continued commitment to feed official gold stocks clandestinely into the market to support the dollar and suppress both interest rates and precious metal prices. If gold swaps are rolled over or expanded, the implication is that the initial gold lent is not being returned. Former Treasury Secretary Larry Summers and successor to Reubin, whilst a Professor at Harvard University, co-authored a study (Barsky, 1988), which concluded that, not only under the gold standard, but under the *fiat* standard, gold prices move inversely with real interest rates, and conversely, if gold prices were fixed then interest rates can be maintained at lower levels.

In figure 11, we present an update of Gibson’s paradox in the United States both in terms of the log price of real gold, being the purchasing power of gold (PPG), adjusted by consumer prices (CPI) (1).

$$PPG = PG / CP \tag{1}$$

In figure 12, the Gibson paradox is presented in terms of real prices (CPIgc), since gold is money, being the inverse of real gold (PPG) (2).

$$CPIgc = 1 / PPG \tag{2}$$

Both real gold (PPG) and real prices (CPIgc) are presented together with real interest rates (*r*), being the nominal rate of interest reflected in the yield of 10 year Treasury bills (*i*), less the annualized rate of inflation derived from the CPI (π), so that (3).

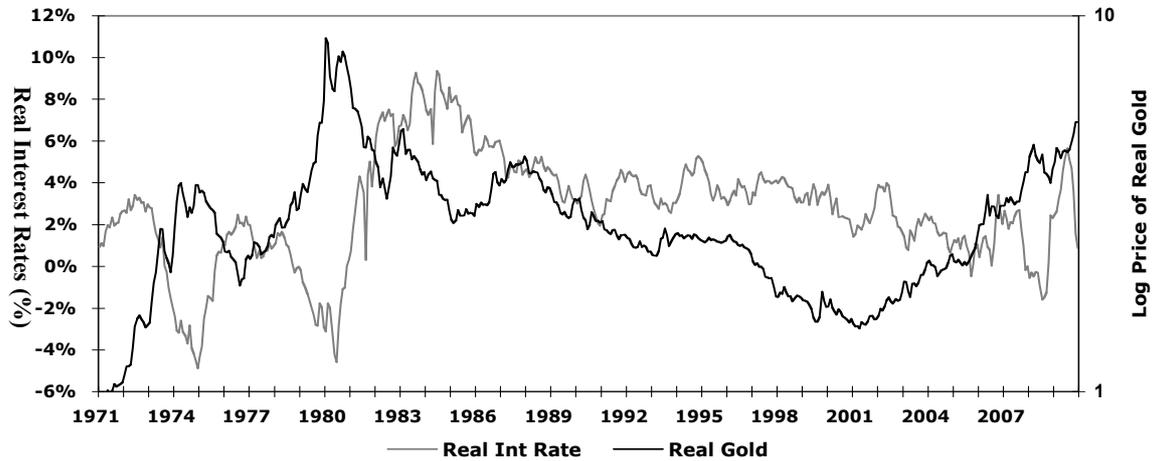
$$r = i - \pi \tag{3}$$

CPIgc, or real prices, are prices expressed in terms of a weight of gold, and GC is the index of the gold content (GC) contained in a unit of account, which reflects the intrinsic market value of the rate of exchange of gold for a fixed unit of account. It follows that the GC is the inverse of the index of the price of gold (PG), reflecting the rate of exchange between a unit of account and a fixed weight of gold (one troy oz). Hence, real prices (CPIgc) may be found through multiplying nominal prices (CPI) by the intrinsic value of the pound expressed grams of pure gold (GC), being identical to the inverse of real gold (PPG), hence (4).

$$CPIgc = CPI \times GC = 1 / PPG \tag{4}$$

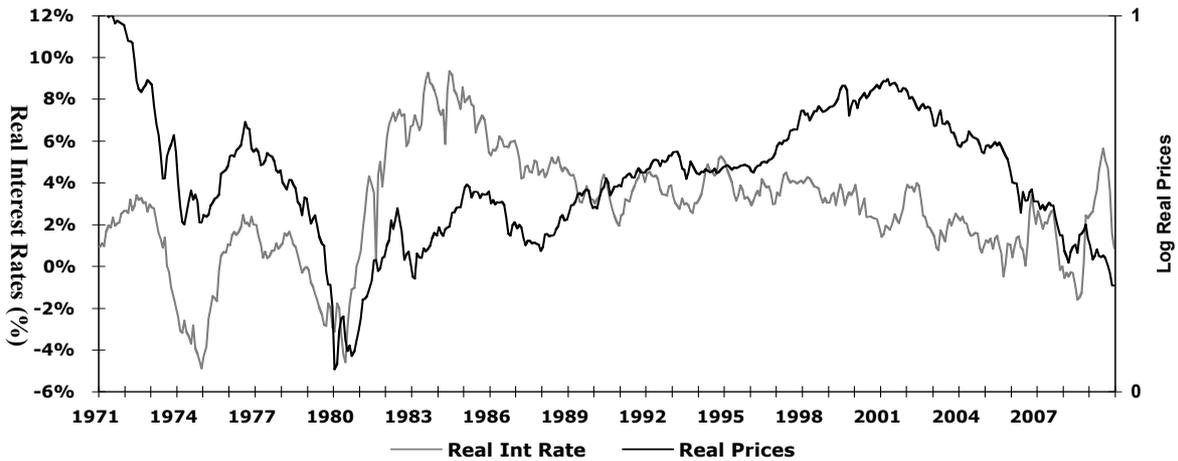
It should be noted therefore, that PG or GC reflect the value of money (VM), this being distinct from what gold can purchase at a particular point in time as reflected in its purchasing power (PPG): the VM is therefore distinct from the purchasing power of money (PPM). By presenting log real gold (PPG) in figure 11 and real prices (CPIgc) in figure 12, we may observe that real gold moves inversely with real interest rates, whilst real prices moves in tandem with real interest rates, the latter being identical to the log inverse of real gold presented in figure 13. Hence, the nominal price level under the gold standard moves in a similar fashion to real prices, being

the reciprocal of the real gold, under the *fiat* standard.



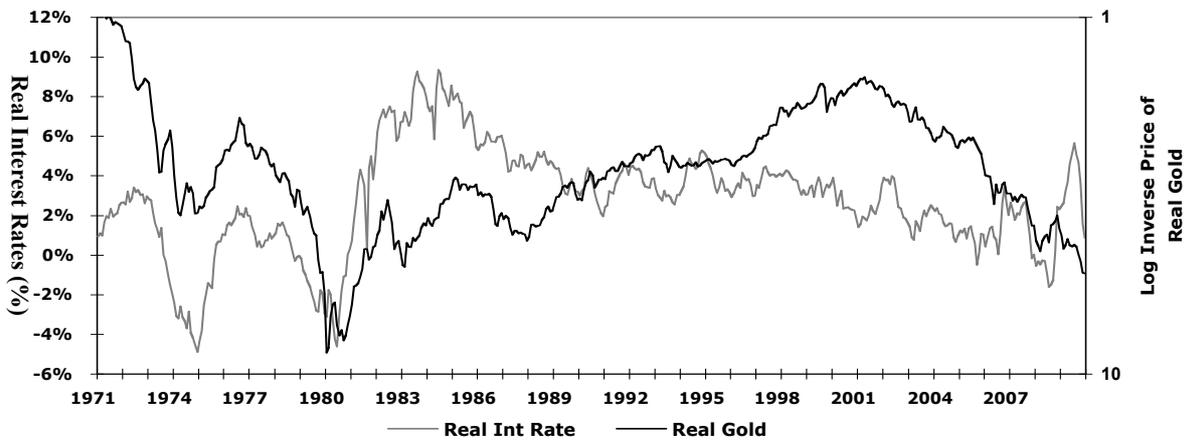
Sources: Federal Reserve Statistical Release H.15, BLS, WGC

Figure 11. Gibson’s paradox in the United States, 1971-2009, log price of real gold and real interest rates



Sources: Federal Reserve Statistical Release H.15, BLS, WGC

Figure 12. Gibson’s paradox in the United States, 1971-2009, log real prices and real interest rates



Sources: Federal Reserve Statistical Release H.15, BLS, WGC

Figure 13. Gibson’s paradox in the United States, 1971-2009, log inverse price of real gold and real interest rates

Summers considered gold as a durable asset, and its price would move inversely to the real interest rate, such that a monetary standard based on a durable commodity, implies that the authorities under a gold standard would endeavour to main a constant nominal price of gold (PG), and since real gold (PPG) is the reciprocal of the general price level, interest rates are related to the general price level, for real gold is a function of the nominal price of gold adjusted by nominal prices (Barsky, 1988, p. 529). Under the *fiat* standard, we do not agree with their analysis, for the reciprocal of real gold (PPG) is real commodity prices (CPgc) and not nominal commodity prices (CP). Similarly, the paper pound note would not be worth the same as the gold pound coin, during periods of suspension of payments by the Bank of England (BoE) when the price of gold increased, for example, during the period from 1797-1821, where the difference between the purchasing power of the British pound (PPB = 1/CP) and the purchasing power of gold (PPG = 1/CPgc) is the difference in the intrinsic value of money. We suggest that a monetary theory of value equally applies to both the gold and *fiat* monetary standards, in that the reduction in the value of money, as a result of an excessive increase in the supply of paper money in relation to demand, resulted in increased prices, such that price inflation is the effect and not the cause: this accounts for both quality and quantity and not just merely the supply of money. When BoE notes could not be redeemed for specie it implies a lack of backing by a precious metal, which is precisely the case under the *fiat* standard.

As with Gibson's Paradox in England under a gold standard, a fall in the price level corresponded with a decline in interest rates (reflected in the yield on Consols), and with a gold price that was fixed, the PPG thereby increased. Under a U.S. *fiat* standard, falling real yields make holding financial assets less attractive, whilst rising real interest rates increase the opportunity cost of holding gold (with zero or minimal yield), hence the price of gold rises as the attraction and confidence in financial paper assets declines. There is a clear correlation between the general trend of real interest rates and the inverse movement in the real price of gold, [Which] comes out of hiding as real yields on financial assets decline and especially as the risk of a financial crisis in terms inflation or deflation rises. As the risk rises, the role of gold as 'true' money and a store of value re-asserts itself. In essence, gold acts as a barometer of the financial attraction and confidence level of paper money (Cheuvreaux, 2006, pp. 38-39).

This was re-iterated by Former Federal Reserve Governor, Wayne Angell, in the minutes of an FOMC meeting, who explained that, the price of gold is pretty well determined by us...but the major impact on the price of gold is the opportunity cost of holding the U.S. dollar...We can hold the price of gold very easily; all we have to do is to cause the opportunity cost in terms of interest rates and US Treasury bills to make it unprofitable to own gold (FOMC, 1993, pp. 40-41).

Indeed, this might explain why central banks are enticed to lend out their gold, since the relationship holds true today, with a real interest rate of less than zero and a gold price around USD 1,700/oz, although central banks are finding it more worthwhile to retain, and even expand their gold stocks, when not only real rates of return are negative, but sovereign debt is not only being downgraded (the U.S.) but questioned altogether (Euro-zone). On the other hand, resistance to an increase in the price of gold may also arise in the money market in the presence of a lack of liquidity. The gold lease rate (the rate at which central banks will lend their official stocks to bullion banks, "GLR") equals the rate of interest banks purportedly charge each other in the inter-bank money market (London inter-bank overnight rate, or "LIBOR") less the rate a bullion bank is willing to lend gold on a swap against U.S. dollars, being the cost of carry of a forward contract in gold (gold forward offered rate, or "GOFO"), hence $GLR = LIBOR - GOFO$. A negative cost of borrowing in the GLR, may imply that certain "central banks stand ready to lease gold in increasing quantities should the price rise" (Greenspan, 1998) and thereby improve liquidity, but it could also imply that LIBOR rates are being held artificially low or are being misreported, particularly in the absence of actual transactions (due to an illiquid money market), thereby maximizing the spread on the cost of borrowing official stocks of gold by bullion banks, and the yield on invested proceeds from the sale of those stocks.

In fact, the opinions of Summers (1988) and Angell (1993) are not dissimilar to that of Salant (1978), in that gold as an exhaustible commodity should be priced according to the Hotelling theory (Hotelling, 1931). The implication is that not only central banks, but also investors generally, perceive that as real interest rates move lower (from r to r' in figure 14), they are likely to remain low and thereby depress returns on investments for an extended period of time. The effect on the Hotelling path for gold would imply a flatter curve, as investors require less price appreciation to have an incentive to hold gold. A flatter curve that leads to consumption of the existing stock before attaining the choke price, above which there is no demand due to gold being uneconomic or altogether depleted.

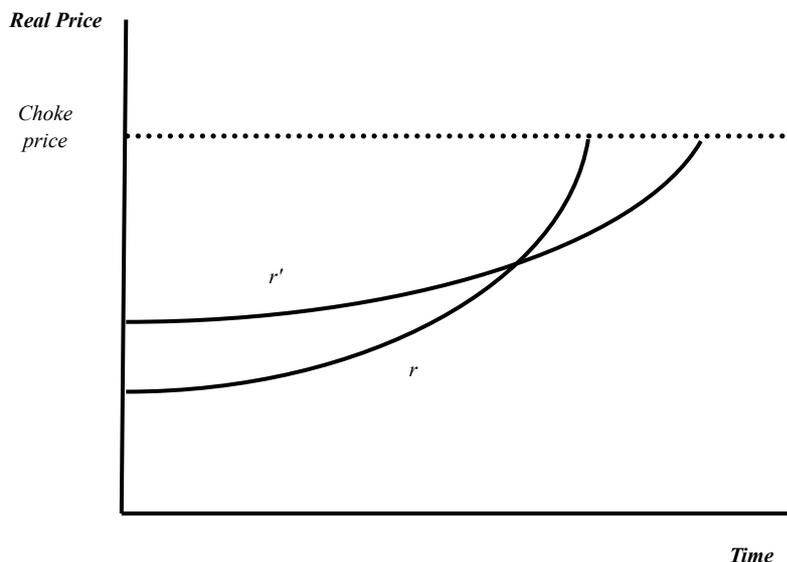


Figure 14. Hotelling paths and the gold price

However, a change in the path would imply a higher initial price, and this suggests a higher price in the short run. Thus, when investors realize that monetary policy requires low interest rates for the foreseeable future, the price of gold will not only increase, but significantly so in the short term.

4. Conclusion

As mentioned earlier, it would seem that the Gibson paradox in England contradicts the quantity theory, which would expect the supply of money to determine commodity price inflation, being independent of interest rates, whereas under the gold standard, commodity prices and interest rates were positively correlated and moved in tandem over the long term. The Gibson paradox in the United States was reflected in the inverse relationship between real interest rates and the purchasing power of gold, or conversely, if the price of gold was fixed, interest rates can be maintained at low levels. Hence, under the *fiat* standard and under the gold standard, gold prices were inversely related to interest rates. The opportunity cost of holding gold increases, with rising interest-bearing financial assets under the *fiat* standard, or under the gold standard, higher interest rates on deposits and short-term investments such as 3-month bills, which would transmit out to longer-term investments with higher yields on Consols. The demand for cash deposits and discounting of bills in the money market would increase prices.

Under the gold standard, the market price of gold was controlled by the Bank's buying price and was essentially fixed, but the value and purchasing power of the paper pound varied in accordance with the gold standard. Higher rates of interest would decrease the demand for monetary gold, but if credit and notes expanded too far, redemptions of gold sovereign coins would occur. When England went off the gold standard and the Bank suspended specie payments between 1797 and 1821, the value of the paper pound would decline as reflected in its higher rate of exchange with a fixed amount of gold (a higher gold price), as a result of the excessive inflationary issuance of Bank notes, in relation to demand, the effect of which was to increase commodity prices. In other words, a monetary theory of value rather than the quantity theory (or the mercantilist purchasing power theory) can explain the underlying monetary theory at work.

Whether under a gold standard or a *fiat* standard, aggregate interest on deposits and loans will increase total money supply and debt, in the presence of a fractional reserve system, resulting in the depreciated value of paper money. Over issuance of paper notes would be limited when specie could be redeemed, and in the absence of redemption, no limit to the production of credit would occur, the effect of which would be to raise prices. Without any recourse to gold backing under a *fiat* system, high real interest rates imply a low price of gold and *vice versa*, but the cumulative growth of unfunded debt at interest organized into paper monetary aggregates, has resulted a long term exponential decay in the value of *fiat* money, as a result of the exponential growth in money supply, in relation to demand. We argue that there is not a paradox, but an illusion: investors should now realize that opportunity cost of gold at higher rates of return on financial assets has only served to finally undermine the real value of the paper unit of account. At negative real interest rates, the opportunity cost of holding financial assets not only disappears in the face of structural shocks and de-leveraging that liquidate asset values in the

short term, but in the realization that counterparty risk associated with holding physical gold is zero. Subsequent monetary and quantitative easing suggests a much a higher gold price is likely in the medium term, thereby confirming the illusion that paper is a safe store of value – an illusion only made worse, if markets confirm (as suspected) that gold and silver are also operating on a fractional reserve basis.

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