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Examining the Value of Money in England over the Long Term (1259-2009)

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Abstract

This paper seeks to analyze the value and purchasing power of money in England over 750 years, during which time the pound has lost almost all of its value. This paper proposes a suitable methodology of measuring nominal inflation in England over the long term, by constructing a wholesale commodity price index in order to determine the purchasing power of money, being the inverse of prices. The index adjusts indices of the value of gold and silver, to determine the purchasing power of gold, silver, and also real prices, thereby providing a suitable technique to measure the store of value function of money. In so doing, we discover that a monetary theory of value accurately interprets the empirical evidence.

Keywords: gold, silver and price indices, value and purchasing power of money

1. Introduction

Monetary economics provides a framework of analysis of the functions of money to measure the effects on monetary systems and economies. In England in 1259, the official mint price of gold was 17*s* 9.3*d* per fine troy ounce or £0.88875/FTO (Feavearyear, 1932, p. 347), whereas the average market price of gold in 2009 was £621.59/oz, hence £1 in 1259 has sunk to £0.00143 (0.88875 / 621.59), or $1/7^{th}$ of one penny in 2009. Whilst the unit of account remained the same, the monetary standards varied. Hence, this paper involves a systematic investigation of historical empirical evidence and statistics, to establish which medium of exchange maintains its store of value. The purchasing power of money (PPM) measures the erosion of the real value of money due to inflation, and conceptually is therefore the inverse of the price level (Rothbard, 1983, p. 30). Yet the value of money (VM), or what a currency exchanges for a given weight of precious metal, is distinct from the purchasing power of money, or the ratio of exchange between money and commodities (Ricardo, 2004, p. 90). By analyzing the VM, the PPM and prices in England from 1259-2009, a monetary theory of value uncovers their causal significance from the perspective of monetary theory, monetary economics and economic history.

The dispersion of prices requires a statistically convenient definition of the movements in the general level of prices in the form of a price index number, and its reciprocal indicates the purchasing power of money (Fisher, 1911, p. 184). The change in the general price level of all commodities shows the relative value of money (Warren, 1935, p. 10). Specifically, the purchasing power of gold (PPG) or the purchasing power of silver (PPS) involves how much can be purchased with the proceeds of the sale of an amount of gold or silver. Statistically, this requires the construction of an index for the price of bullion divided by an index of the price for goods and services. It requires the construction of a unified series of commodity prices, which together with a unified price of bullion series will be able to capture changes in purchasing power in order to analyze how changes in monetary systems relate to the gyrations in purchasing power and how this has affected prices and economic well being. The construction of a price index has the purpose of measuring variations in the purchasing power of money, which requires an explanation of the methodology associated with the construction of a suitable price index, including types of commodities, the treatment of missing values, the type of mean and the compilation of relevant data.

An investigation into the value of money and prices over a long period of time, presumes both comparability and continuity, indeed price history is “a study not of isolated facts but of relations; comparison is its essence. This

makes it necessary to make as sure as we can in each case that, in comparing prices at different times, we are comparing like with like" (Beveridge, 1965, p. xxvi). In terms of purchasing power of money (in the context of gold and silver), when we contemplate nominal and real prices, what we are really assessing is whether prices take into account the value of money: Beveridge (1965) clarified that if we mean by this,

changes in the value of money in relation to commodities, the answer is that the course of prices, as recorded in contemporary money, is itself the record and measure of such changes…[if] the change in the value of money is meant a change in the silver or gold content of the currency, the answer is that [the compilation of historical prices], gives the means of converting all such prices into bullion equivalents… The main purpose of price history - [the] comparison of the values placed on different articles or services at different times as a guide to changes of economic structure or conditions – can be achieved without this conversion. The use of bullion equivalents is…for the special purposes of relating prices to the supply of precious metals or to the currency policy (p. xlvii).

The prices that Beveridge (Note 1) was referring were expressed in terms of the British pound (GBP), which as a monetary unit of account has been defined in silver, gold and now debt organized into paper (*fiat* money). Those currencies, which provide the best continuity, are of the most interest to price historians, such as the British pound (GBP). In terms of the functions of money, whatever the diminution of the bullion content, for long periods of time, the GBP has never ceased to be used as a medium of exchange, as a unit of account and as a standard of deferred payment for the settlement of a debt – however, what changed was the store of value, and this function of money is measured by the changes in the value and purchasing power of money.

Of particular relevance is the historical data and methodology compiled by Jastram on the purchasing power of gold and silver in England and the United States between 1560-1979. Roy W. Jastram (1915-1991) was an American economist, whom wrote *The Golden Constant* (1977) and *Silver: The Restless Metal* (1981), which were landmark works on the empirical study of gold and silver over the long term, but in his concluding remarks, the intent was to establish that these metals had become de-monetized and highly manipulated commodities, and in his opinion, there was no possibility of a return to a true gold standard, and yet believes that a monetary system should be "managed" (Jastram, 1977, pp. 181-5). Indeed, Jastram was by no means a 'gold bug' since he stated that "we are accustomed to thinking of gold itself as money. It is not…" (Jastram, 1977, p. 73), but did admit that gold maintains its purchasing power over long periods of time and concluded that gold was a good hedge against deflation but not inflation (Jastram, 1977, p. 132). Jastram also largely dismissed silver as having been particularly subjected to manipulation over time, "We have escaped from clipped, debased and manipulated coinage into manipulated, debased and politicized paper – not much of an exchange. World stability rests on money" (Jastram, 1981, p. 158).

Jastram commenced his analysis from 1560 up to 1790 with data derived from the Mercantile Era [1550-1830] of Beveridge's *Prices and Wages in England* (1965), before the advent of well-organized indices, which Jastram links into his series. However, Jastram ignores earlier price data available from Rogers (1866-1892), which allows research to be extended back to 1259 capturing a period of very low and stable prices up until the Great Debasement in the mid 16th century, which significantly increased prices. Furthermore, writing in the late 1970s, Jastram could not have included the very inflationary 30 years since his books were published. Jill Leyland updated Jastram's research up to 2007, and was published by the World Gold Council in 2009, however, there is still no price analysis prior 1560. Jastram adopted a wholesale price series and a simple geometric mean that facilitates the adjustment of the base year without distorting the data. Jastram argues his un-weighted wholesale commodity price index would arguably better represent the level of trade meaningful for the purchasing power of a precious metal, as opposed to a cost-of-living index of what a wage-earner typically spends on a market basket of retail goods and services that a family consumes (Jastram 1977, p. 61). It therefore includes a much wider set of wholesale commodity prices generally for the period 1560-1790 covering (for example in 1700) up to 16 categories and 72 commodities, as compared to a retail price index developed by Brown and Hopkins (BHI, 1956, 1981, p. 28-31), which although does commence at a much earlier date from 1264-1954, adopted a weighted arithmetic mean index for retail prices that was designed as a cost-of-living index for worker's families and confined to consumer goods only, comprising 6 categories and 17 commodities.

O'Donoghue and Goulding constructed a composite price index in *Consumer Price Inflation Since 1750*, which evaluates the purchasing power of money from 1750 to 2003 (ONS-CPI, 2004, pp. 38-46), but other than modern retail price data from the ONS, is largely based on the Brown-Hopkins Index. Another interesting data set on English agricultural prices was published by Clark (2004, pp. 41-124), *The Price History of English Agriculture 1209-1914*, involved a weighted-geometric mean for agricultural prices involving 26 commodities that were also presented in arable, pasture and wood product sub-series, in order to assess movements in these series in relation

to agrarian history. At first glance, a weighted-geometric mean would statistically provide the most accurate index according to Fisher (1922, p. 360). A long-term index of this nature could easily be linked into the Jastram index without the trouble of constructing a new unweighted geometric mean for the same period, though Clarks' farm price index at times understates prices given the output weights attached to the construction of the index. The weights alter by period and by commodity, and some are based "on consumption of workers in mid 19th century England", admitting to "uncertainties" relating to farm output prior this time and "speculative" arable and pasture outputs (Clark, 2004, pp. 44-45,56). Fisher added one proviso that "if the simple weighting does not happen to be too erratic, the geometric is the best formula" (Fisher, 1922, p. 212), and Keynes stipulated that constructing a consumption index for the purposes of assessing purchasing power is appropriate provided that "actual consumption furnishes us with our standard [of weighting]" (Keynes, 1930, Vol.1, p. 54), but in reality, "no such consumption data exists" (Jastram, 1977, p. 67). In essence, we concur with Jastram's views and expand on the methodology below as to why we also have chosen the simple geometric mean to construct a wholesale price index in determining the purchasing power of money (PPM), the PPG, the PPS, and other than prices expressed in GBP, also determine prices expressed in bullion.

This paper is organized into four sections. The first section details the methodology in compiling indices for the price of gold and silver in England over the long term. The second section details the methodology in constructing a wholesale commodity price index from 1259-1560, including the selection of price series, the treatment of missing values, an analysis of the type of mean adopted and an explanation concerning the compilation of the entire index, by linking up with other well-organized indices from 1560-2009. The third section presents an analysis of our findings, together with an interpretation of a monetary theory of value, whilst the fourth section provides a brief summary and concluding remarks.

2. Indices for the Price of Gold and Silver

The main reason for choosing to examine the prices of gold, silver and commodities through the GBP is that, whilst the English changed their system of weight from tower to troy pounds in 1526, the monetary unit of account has not changed at all, which provides for a consistent period of study over the long term (Note 2). For the price of gold and silver, the average annual prices of prevailing fineness, converted into troy ounces, quoted in order of preference (1) by the market, (2) by the bank's buying price, (3) by the mint. The mint price was the price fixed by law at which the mint could buy bar gold or silver. Until 1526 when the troy measure was introduced into England, the price was in tower lbs (the tower pound was 15/16 lighter than a troy lb of 5760 troy grains), and for the purposes of comparison, has been converted into troy ounces.

The market price represents the price of gold or silver freely arrived at between parties, whereas the Bank of England's and the mint's buying price represents the posted price at which these institutions stand ready to purchase bullion even if there are no takers. In reality there was no meaningful private market price beyond the mint price until the advent of the Bank of England in 1694, nor was there any meaningful market beyond the bank's selling/buying price after 1694. The market price typically fluctuated between the mint price, which was the bank's selling price, and the bank's buying price. Following the Bank Act of 1844, the market price of gold traded within a very narrow band between the bank's selling price of £3 17*s* 10.5*d* and the bank's buying price of £3 17*s* 9*d*. By the time England was firmly established on a *de jure* gold standard in 1816, the Bank was effectively controlling the market price of gold (Frankel, 1953, p. 36). Historically, English currency was silver and was typically weighed rather than accepted by tale (Rogers, 1866, Vol.1, p. 175). Soon after the Bank was established, England went on to a *de facto* gold standard from 1717, but already a market price for silver had developed from the late eighteenth century, with regular quotes for "Pieces of Eight" or Spanish dollar (*peso* or *piastre*), a very popular trade coin, that was not only adopted by the Americans (the dollar) but also by the Ottomans (*kurus*) in 1703. Sources for English prices of gold and silver are presented in tables 1 and 2.

Table 1. Compilations of the English price of gold, 1257-2009

Source	Period	Frequency	Denomination
Mint Price[1]	1257-1692	annual mint price	*s*, *d* per FTO
Houghton, Castaing's, *Lloyd's List*[2]	1693-1789	annual market price	£ / STO .917 gold[3]
Parliamentary Papers 1819[4]	1790-1818	annual market price	£ / STO .917 gold
Lutyens' *Course of the Exchange*[5]	1819-1832	annual market price[6]	£ / STO .917 gold
Sharps, Pixley Ltd London[7]	1833-1967	annual market price	£ / STO .917 gold to 1918 & .995 ex 1919
LBMA[8]	1968-2009	annual market price	£ / FTO of 995 gold

Notes: [1] Feavearyear (1932, pp. 347-8), Jastram (2009, pp. 318-330).

[2] John Houghton's *A Collection for Improvement of Husbandry and Trade* quoted gold and silver prices from 1693-1697 (Li, 1963, pp. 10-11). Castaing's *The Course of the Exchange and Other Things* included the market price per oz of standard 22k gold in £s and Spanish pieces of eight silver in pennies. It was first published in 1698 and became the forerunner of the London Stock Exchange's *Daily Official List*. The *Lloyds News* was established in 1696 by Edward Lloyd, and was the forerunner of the *Lloyds List*, which was published from 1734, and also quoted twice-weekly prices including gold and silver from 1735. For the period 1700-1717 the Bank's buying price was adopted since no market prices were quoted for these years in Castaing's (Jastram 2009, pp. 318-330).

[3] Standard gold (or 'crown') gold was 917 gold or 91.7% pure (22 karat).

[4] Jastram (2009, pp. 318-330)

[5] Jastram (2009, pp. 318-330)

[6] Rothschilds became the exclusive bullion broker to the Bank of England in 1825 (Jastram, 1977, p. 24). The first bullion brokers were Mocatta and Goldsmid with Moses Mocatta starting in 1671.

[7] Jastram (2009, pp. 318-330); Shrigley (1935, pp. 90-92) quotes market gold:silver ratios from 1687-1932, actual gold prices from 1870-1932, actual silver prices from 1833-1933; source for both Jastram & Shrigley is Sharps, Pixley (Pixley & Abell).

[8] London Bullion Market Association gold price data is from The London Gold Market Fixing Ltd.

Table 2. Compilations of the English price of silver, 1257-2009

Source	Period	Frequency	Denomination
Mint Price[1]	1257-1692	annual mint price	*d* per STO (92.5%)
Houghton, Castaing's, *Lloyd's List*[2]	1693-1810	annual market price	£, *s*, *d* per STO
Parliamentary Papers 1819[3]	1811-1818	annual market price	£, *s*, *d* per STO
Lutyens' *Course of the Exchange*[4]	1819-1832	annual market price	£, *s*, *d* per STO
Sharps, Pixley Ltd London[5]	1833-1967	annual market price	£, *s*, *d* / STO to 1944, & .999 silver ex 1945
LBMA[6]	1968-2009	annual market price	£ decimal from 1971

Notes: [1] Feavearyear (1932, p. 346) has exact prices. Jastram (1981:164-188) also carries mint prices per standard troy oz (sterling silver of 0.925% pure) with data provided for Mocatta Metals Corporation, providing tower and troy prices with metric equivalent to 4 decimals.

[2]Houghton silver prices from 1693-1697 (Li, 1963, pp. 10-11). Castaing's original folios available from the Guildhall Library and Jastram (1981, pp. 164-188) to 4 decimal places. For the period 1700-1717 the Bank's buying price was adopted since no market prices were quoted for these years in Castaing's.

[3] Jastram (1981, pp. 164-188)

[4] Jastram (1981, pp. 164-188)

[5] Jastram (1981, pp. 164-188); Shrigley (1935, table at end of book) quotes market gold:silver ratios from 1687-1932, actual gold prices from 1870-1932, actual silver prices from 1833-1933; source for both Jastram & Shrigley is Sharps, Pixley (Pixley & Abell).

[6] LBMA silver price data is from London Silver Market Fixing Ltd.

3. Price Series, Missing Values, Type of Mean, Index Compilation

Other than the construction of gold and silver price indices, we can construct a suitable index for English commodity prices between 1259-1560, to tie-in with existing indices constructed thereafter, as discussed below. The primary source for actual prices is Thorold Rogers (Note 3) (1866-1892). In order to assure breadth of coverage, the following groupings, established by the International Scientific Committee on Price History for the study of historical prices (Note 4), have been adopted (table 3):

Table 3. Grouping of articles for price history

I	Grain and Other Crops	XI	Light, Fuels, etc.
II	Grain Products	XII	Textiles
III	Livestock, Meat and Poultry	XIII	Hides and Skins, etc.
IV	Dairy Products, Fats, etc.	XIV	Building Materials
V	Fish	XV	Metals
VI	Vegetables	XVI	Chemicals and Miscellaneous
VII	Fruit	XVII	Other Articles of Common Use
VIII	Sugar, Spices, etc.		
IX	Miscellaneous Foods		
X	Drinks		

Our analysis accordingly compiled a number of price series that reflected both a credible width and depth to English prices involving 31 items reflected in all 17 groups (listed in table 4 below).

In order to avoid distortion of the overall price index, a minor problem arose regarding the methodology of determining missing values. Our general precedent for estimating missing values being derived from available values of other products are Pamuk (2002) and Clark (2004): "In cases where the prices of one or more of these items were not available for a given year, missing values were estimated by an algorithm that applied regression techniques to the available values" (Pamuk, 2002, p. 297). "...Where individual price quotes were missing, the index was interpolated using the prices of other products" (Clark 2004, p. 46). For a more detailed methodology of interpolation and extrapolation our precedent is Allen (2001), "...There were many gaps in the underlying price series. Generally, these were filled by interpolation. As a result, year-to-year fluctuations in the price level are damped, but the general trends and relative levels...are preserved" (Allen 2001, p. 420), and also Abel (1980),

In years when there are oat prices but none for rye, the three preceding and the three following rye prices are expressed as a percentage of the corresponding oat prices. Subsequently, the oat price in question is multiplied by the index number thus obtained, and the resulting value inserted into the series for the year in which the price of rye is missing. If the price of rye in the years 1,2,3,4,5,6,7,8, etc. is called A,B,C,D,E,F,G,H, etc. and the oat prices a,b,c,d,e,f,g,h, etc., the missing rye price E in year 5 can be determined by the following equation.

$$\frac{B+C+D+F+G+H}{b+c+d+f+g+h}\cdot e = E$$

The rye price obtained by this method is put between brackets in [the] table. (p. 301).

Whilst Abel's equation provides for a more responsive regression-like technique, where a more careful analysis is ultimately desired during periods of marked inflation or deflation, we have therefore adapted a more sensitive formula by limiting the averaging of available values to one year, or in the case of longer periods of missing values, the indexing of the current over the preceding year. Of course, nothing can better an original observation, but we found that these revised techniques work well to nonetheless generate a more realistic movement in prices. The ability to index values from other items is facilitated with a larger collection of price series.

The only remaining issue was to establish from which other price series missing values were to be computed, and this was a subjective, albeit logical, exercise in comparison. Estimated values derived from associated relationships between arable, pasture, meat, fish, dairy, other farm products, drink, wood, fuel, candles, textiles, light industry, with sources of data, are ultimately captured together with observed price data, and our indicative guide on this was Allen (2001, App.1, pp. 435-441). Average annual prices were decimalized from original observations quoted, for example in £, *s*, and *d*, in order to facilitate the calculation of missing values, being typically derived from a related genus.

With respect to the construction of index numbers, in considering a stochastic approach to measuring inflation and the purchasing power of money, analysis is required on what type of index number to adopt, and what mathematic average to apply. Fisher examined index numbers in *The Purchasing Power of Money* (1911) and in *The Making of Index Numbers* (1922). In assessing what index number was best, he concluded that, "if the simple weighting does not happen to be too erratic, the geometric is the best formula" (Fisher, 1922, p. 212). Fisher went on to specify the "ideal" formula, for use in his quantity theory of money and equation of exchange, MV=PT, where T is the volume of trade as represented by Q or the quantity of goods and services purchased by prices (P). An index number of P implies an index number of T, or an index number of trade (in the form of

quantities of goods and services), thus $P_1T_1 = \sum P_1Q_1$ and so Fisher's "ideal" formula (Fisher, 1911, p. 418; 1922, pp. 197, 241-2) echoes Walsh's (1901, p. 429) geometric cross (mean) of the Laspèyre (with base year quantities as weights) and Paasche (with current year quantities as weights) formulae, or $\sqrt{(LP)}$ as represented in the following equations for prices (1.0) and for quantities (2.0).

for prices (price index) $$\sqrt{\frac{\sum P_1Q_0}{\sum P_0Q_0}\cdot\frac{\sum P_1Q_1}{\sum P_0Q_1}} \quad (1)$$

for quantities (quantity index) $$\sqrt{\frac{\sum Q_1P_0}{\sum Q_0P_0}\cdot\frac{\sum Q_1P_1}{\sum Q_0P_1}} \quad (2)$$

However, our analysis involves compiling historical prices without consumption data necessary for a standard of weighting. The unweighted arithmetic ratio-of-aggregates ($\sum P_1/\sum P_0$) type of index has a heavy inherent bias (Jastram, 1977, p. 68). The best measure for the average ratio of change in prices is the geometric mean (Mitchell, 1938, p. 76), and an unbiased simple index will in practice result only in small differences in comparison with a carefully constructed weighted index (Fisher, 1922, p. 445). Instead of taking the arithmetic mean by adding a set of price ratios together and dividing *n* into the result, we can construct a simple geometric mean of a set of price-ratios by multiplying them together and taking the *n*th root of their product, with *n* being the number of commodities included (3.0),

$$\sqrt[n]{\frac{P_1}{P_0}\cdot\frac{P_1}{P_0}\cdots} \quad (3)$$

This is also known as the Jevons Index (Jevons, 1883, p. 332), and is identical to the unweighted geometric mean prices (4.0) (ILO-PPI, 2004, p. 217).

$$P_J = \Pi\left(\frac{P_1}{P_0}\right)^{1/n} = \frac{\Pi(P_1)^{1/n}}{\Pi(P_0)^{1/n}} \quad (4)$$

Mitchell in *The Making and Using of Index Numbers* (1938) attributes three advantages to the adoption of a geometric mean:

First, unlike the arithmetic mean, [the geometric mean] is not in danger of distortion from the asymmetrical distribution of price fluctuations…If, for example, one commodity rose tenfold in price and another commodity fell to one-tenth of the old price, the arithmetic mean would show and average rise of 505 per cent (1,000+10) / 2, while the geometric mean would show no change in the average, since $\sqrt{(1{,}000x10)} = 100$ …The second merit claimed for the geometric mean is that they can be shifted from one base period to the other without producing results that seem to be inconsistent…A third advantage of the geometric means is that they are likely to be nearer the modes of distributions, which they represent than are arithmetic means (pp. 69-71).

We can adopt the geometric type of index from the 13th to the mid 19th century, and link up with similar other well-organized indices from the end of the 18th century that capture not just agricultural prices, but also manufacturing goods associated with the industrial revolution, and the development of an increasingly urbanized and industrialized economy together with an increasing service component, requiring a more detailed index construction from the mid 19th century. By relying on compilations of prices data or indices published directly from their authors or official publications, and providing full disclosure as to where and how the data was obtained and compiled, we may ascertain the reliability and credibility of the underlying source material. In this regard, table 4 presents a chronology for the compilation of English prices, that builds on the methodology of Jastram, by applying the same approach he took for the period 1560-1790 in constructing a geometric index of wholesale commodities from Beveridge's data (Note 5), and construct a similar geometric index based on Rogers' data, for an earlier period from 1259-1560. At the other end of the spectrum, we can extend the overall index from 1979 to 2009 with updated producer price index (PPI) data from the Office of National Statistics.

Table 4. Compilations of English commodity prices, 1259-2009

Source	Period	Time Base or Currency	Price Measure
Rogers (1866-92)[1]	1259-1560	*s*, *d*	contract, wholesale
Jastram-Beveridge Index[2]	1560-1790	1930	wholesale
Gayer-Rostow-Schwartz Index[3]	1790-1850	1821-1825	wholesale
Sauerbeck-*Statist* Index[4]	1850-1965	1867-77	wholesale
Central Statistical Office WPI[5]	1965-1979	1930	wholesale
Office of National Statistics PPI[6]	1979-2009	2005	wholesale

Notes: [1] Rogers (1866-1892) compiled price data from 1259-1793

[2] Jastram (1977, pp. 30-33), Beveridge (1965) provided price data from 1550-1830 and commodity price-ratios, which were individually on a base average of 1720-1744=100 (Beveridge, 1965, pp. 682-741, and folding pages). Jastram's index, of up to 72 commodities, was of the geometric type with the base year at 1930, since the Board of Trade once used 1930 as a base year (Jastram, 1977, pp. 72, 203). Jastram-Beveridge data was used until 1790 although for 1692-1702, a price index by Li (1963, p. 9) of weekly prices of 13 commodities from Houghton was adopted in lieu of Jastram.

[3] BHS (1962, p. 470), Jastram (1977, pp. 190-193). The Jastram-Beveridge Index was chained to the geometric Gayer-Rostow-Schwartz Index (1953) of 76 commodities, by linking-up in the overlap year of 1790 though division, and it too was of the geometric type, for the period 1790-1850.

[4] BHS (1962, p. 474), BHS (1971, p. 187), Jastram (1977, pp. 194-198). The Gayer-Rostow-Schwartz Index is spliced into the Sauerbeck-*Statist* Index (1886), for the period of 1850-1965, which is a simple arithmetic index of 45 prices series for 38 commodities. The Board of Trade also produced a weighted arithmetic wholesale price index from 1871-1955, but instead the Sauerbeck-*Statist* Index is preferred since it was published from 1846-1965.

[5] BHS (1971, p. 187), Jastram (1981, pp. 196-199). No data during WWII with the CSO's Index Number of Wholesale Price but continues from 1946-1979. Instead of adopting revised ONS PPI data from 1931-2007 in Jastram (2009, pp. 283-296), the Sauerbeck-*Statist* Index was continued until 1965 and chained with the original CSO index in Jastram (1981) from 1965-1979.

[6] The Central Statistics Office was merged into the Office for National Statistics in 1996, and the Index Number of Wholesale Price was renamed the Producers Price Output Series (PPI) in 1978. The ONS PPI was linked to the CSO WPI from 1979-2009. The CSO/ONS adopt the Laspèyres arithmetic quantity-weighted index.

Statistical analysis involves an overall population rather than a sample of gold, silver and price data, in order to achieve an actual rather than a probable outcome. The correlation coefficient for a population is applied when measuring the strength of dependence between two variables, such as, correlating the nominal PG and CP over the entire period of analysis to determine the impact of the diminution of monetary value upon commodity prices. Correlation does not reveal causality, and another way of assessing performance is to present a summary analysis of long term stability and short term volatility on prices thereby examining the related monetary systems and rank their performance (Mueller, 2010, pp. 329-331, 441). Recognizing this says as much for the performance of the relevant monetary authorities as for the medium of exchange itself, we may adopt two measures of comparison: (1) long term price stability measured by the average absolute annual change in the index for wholesale prices over the periods mentioned, and (2) short term volatility, measured by the standard deviation of annual wholesale price changes during those periods, derived from the population standard deviation (5.0),

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} \tag{5}$$

Weighing stability and volatility equally, we can then present a stability rank for each monetary system and also provide some additional commentary. Ultimately, by statistically determining a full population of commodity prices in real terms, in terms of gold and silver, we will achieve the desired analysis in explaining actual causality in the relationship between a loss of intrinsic value and higher nominal commodity prices.

4. Findings

In the preceding section we have carefully provided a suitable methodology for the construction of indices for the prices of gold (PG), silver (PS) and commodity prices (CP). Additionally, we will present our findings involving the PPG, the PPS, the British pound adjusted by wholesale commodities (PPBw) to reflect the purchasing power of money (PPM), and the pound as a unit of account adjusted by the price of gold (GBPg) and the price of silver (GBPs). We will then present wholesale commodity prices expressed in terms of gold (CPgc) and silver (CPsc), in order to determine the reason for the devaluation of the GBP as a unit of account, whether as specie or as *fiat* money. Finally, we will interpret our findings in the context of a monetary theory of value, and relate real prices with the theory of value in exchange. The PG, CP and PPG are presented in figure 1, and the PS, CP and PPS are presented in figure 2. Clearly, in both figures, we may immediately observe that the PPG

holds its store of value over the long term. We may also observe the positive relationship between gold and prices, and the correlation coefficient between PG and CP is 0.93. The PG (or PS) is a hedge against commodity price deflation when the currency is expressed as a fixed weight of precious metal, but when the currency is not fixed and is free to discover its rate of exchange with a fixed weight of precious metal, such as under the *fiat* standard, then PG (or PS) is a hedge against price inflation.

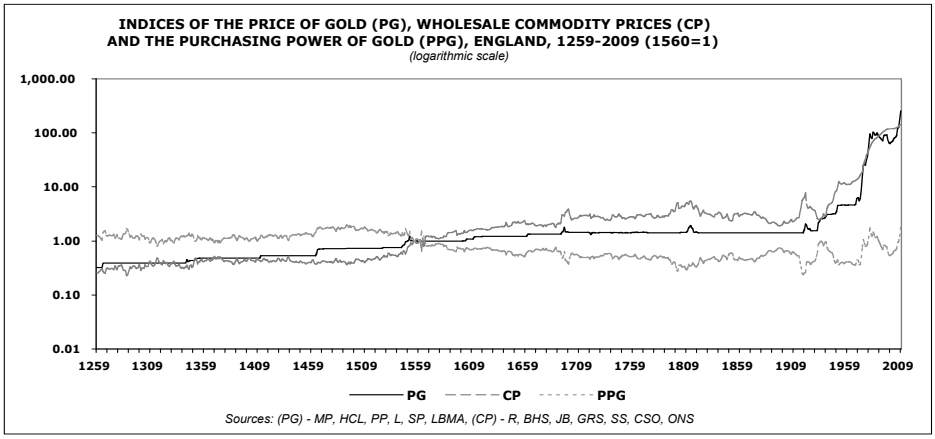

Figure 1. Indices of the Price of gold, wholesale commodity prices, and the purchasing power of gold, England, 1259-2009

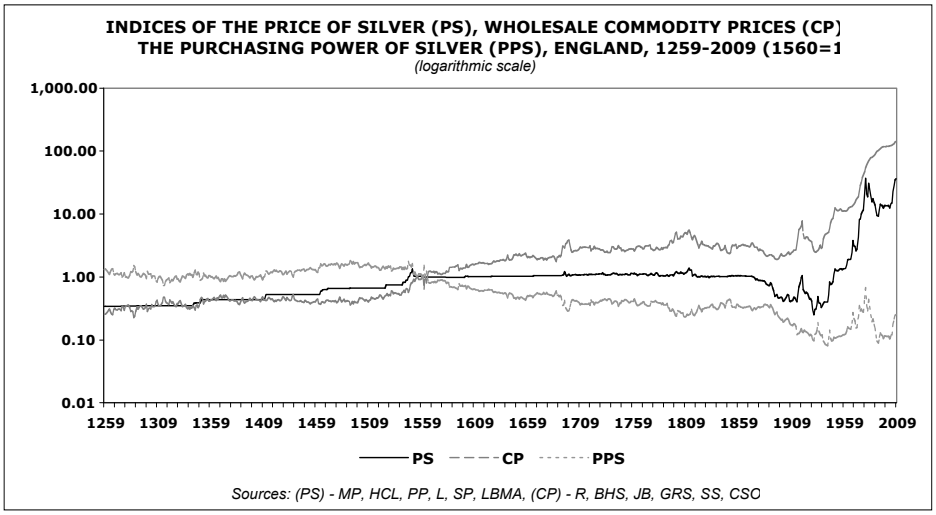

Figure 2. Indices of the price of silver, wholesale commodity prices, and the purchasing power of silver, England, 1259-2009

If we moved the base reference year from 1560 to 1259, without creating any distortion given that we have adopted the geometric mean, co-movement is very close prior the Great Debasement (1542-1551), and equally if we move the base reference year to say 1930, the same close movement is apparent under the gold standard. In other words, devaluation is not the exclusive preserve of *fiat* money, but manifestly occurred as a result of debasement by reducing the gold and silver content in coinage during the reigns of Henry VIII and Edward IV and referred to as the Great Debasement. Hence, our choice of 1560 for the base reference year in figures 1 and 2 is to retain the structure of the co-movement between prices, precious metals and their purchasing power. However, we need to adjust the GBP as a unit of account both in terms of wholesale commodity prices and in terms of both gold and silver, in order to better evaluate the value and purchasing power of money in England over the long term. Accordingly, in figure 3 we present the purchasing power of gold (top line), the value (middle) and the purchasing power of the pound (bottom) over the long term, with the base reference year at 1259.

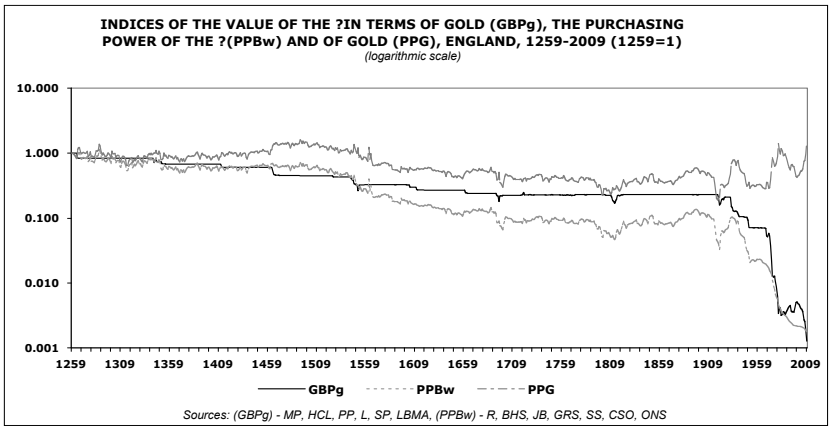

Figure 3. Indices of the value of the GBP in terms of gold, the purchasing power of the British Pound, and the purchasing power of gold, England, 1259-2009

As England moved off the gold standard (1931) and the gold exchange standard (1971), the loss of value and purchasing power is very evident post 1971, with the GBP seemingly falling off a monetary cliff, in terms of value (GBPg) and purchasing power (PPBw). The reciprocal of the PPBw is nominal inflation (CP), being wholesale commodity prices expressed in pounds. The GBPg is identical to the index of the market value of the pound expressed in grams of pure gold and thus represents the intrinsic value and gold content (GC) of the pound. The reciprocal of GC is the index of the price of gold (PG). We conclude from figure 3 that the loss in the value of the pound has affected its loss in purchasing power. Meanwhile, we also present our findings in connection with silver in figure 4. England was essentially on a silver standard before it moved on to a *de facto* gold standard in 1717 and a *de jure* gold standard in 1816. Moreover, following the de-monetization of silver in the U.S. in 1873, the international price of silver subsequently declined, and thus we cannot perhaps read too much into the value of the pound when adjusted for silver (GBPs) when the medium of exchange was operating under a gold or *fiat* standard, but we can be more complimentary about silver prior the Great Debasement (1542-1551), given the prevailing monetary system was specifically a monometallic silver commodity standard, and revealed that it was no less stable than the *de facto* gold standard that existed after 1717.

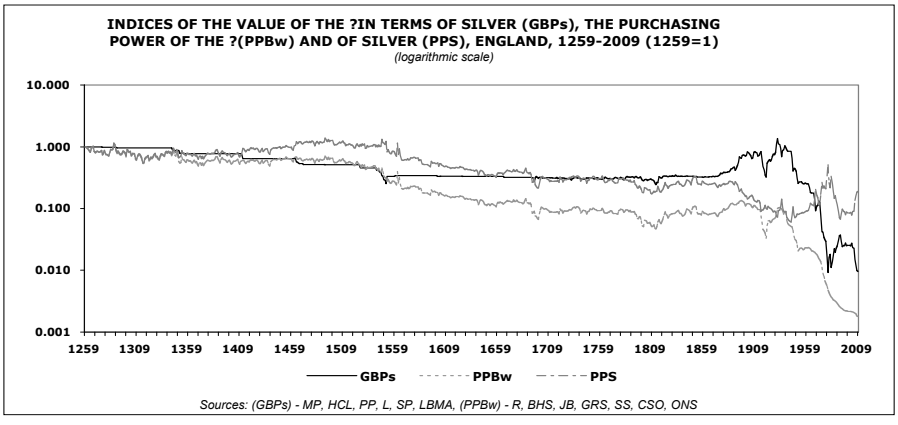

Figure 4. Indices of the value of the GBP in terms of silver, the purchasing power of the British Pound, and the purchasing power of silver, England, 1259-2009

Notwithstanding, the affects of the Great Debasement, the gold standard and finally the de-monetization of silver, the PPS over the long term remains reasonably constant, and to appreciate the implications of this more clearly, we now turn to exploring the relationships between nominal and real prices. To facilitate our analysis, we present the index of nominal wholesale commodity prices in figure 5.

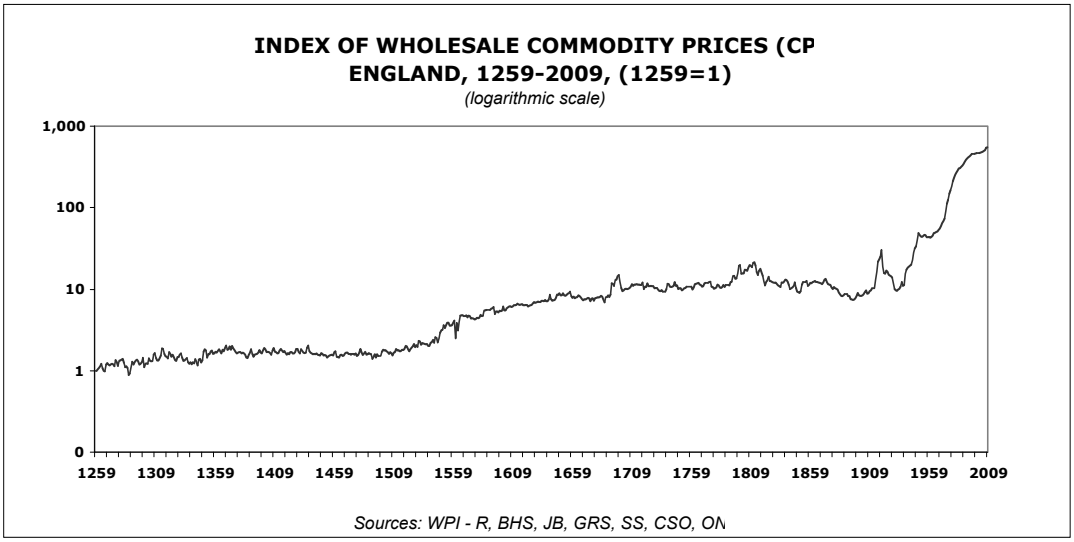

Figure 5. Index of wholesale commodity prices, England, 1259-2009

In figure 5, we notice that from 1259-2009, over a period of 750 years, nominal prices in England, expressed in pounds increased about 550 times. With the index at 1.00 in 1259, by the outbreak of WWI in 1914 it had risen to 10; off the gold standard after WWI in 1920 it tripled to 30 before declining to 15 on resumption of the gold standard in 1925; upon England's final exit from the post-war gold standard it was back at 10; and off the gold standard after WWII in 1945 it had doubled to 20; and upon the collapse of the gold exchange standard in 1971 it stood at 64; but without any recourse to gold, it rose to 550 by 2009. In order to determine the extent of devaluation, we need to express commodity prices in terms of gold (or silver) and obtain real prices. We know that the reciprocal of the PG, being the index of the market value of the unit of account for a fixed weight of gold, or the money value of gold, is the GC, being the index of the market value of gold in grams of pure gold per unit of account, or the gold value of money (the intrinsic value of a unit of account, such as the pound). To express prices in terms of gold, we multiply the index of commodity prices (CP) by the index of the gold value of money (GC), hence, CPgc = CP x GC. Similarly, to obtain real prices in terms of silver, CPsc = CP x SC. We present CPgc in figure 6 and CPsc in figure 7.

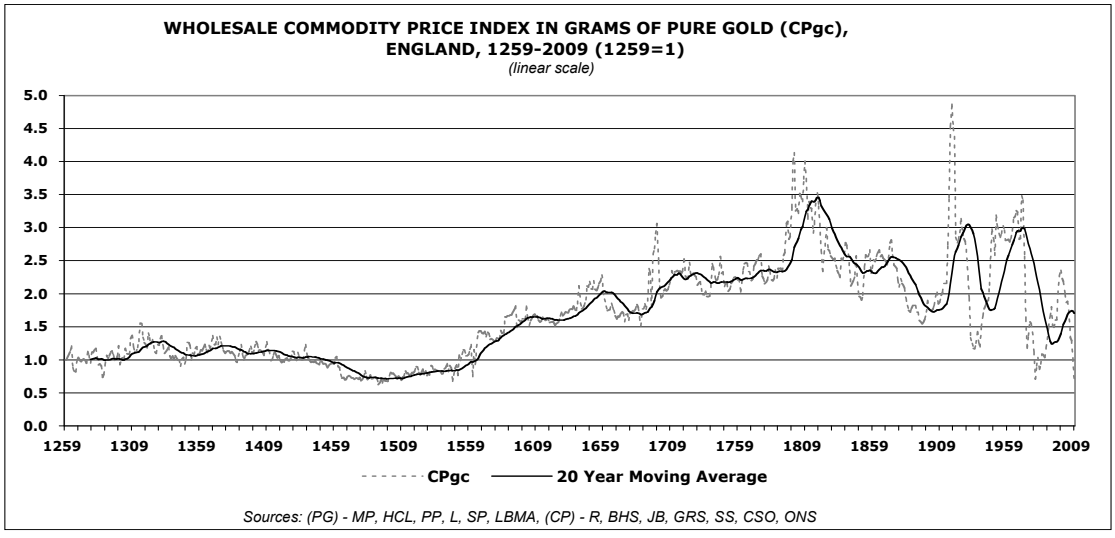

Figure 6. Commodity prices expressed in terms of gold, England, 1259-2009

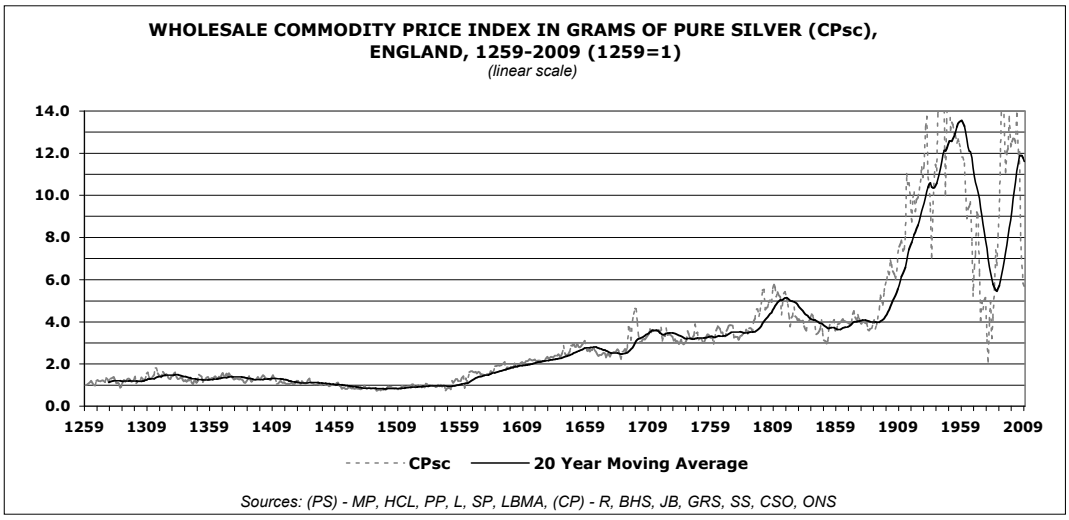

Figure 7. Commodity prices expressed in terms of silver, England, 1259-2009

When we express nominal CP in bullion equivalent prices, in gold (CPgc), we note that over the same period and utilizing a 20 year moving average, it is quite remarkable that prices stayed within the relatively narrow range of 1.0 to 3.5 for gold and whilst there were medium term movements, these occurred around a long-term trend that rose only modestly, hence debasement or devaluation was the most important determinant of English prices over the long-term. For silver (CPsc) the 20 year moving average range was 1.0 to 3.6 up to 1717 before England went onto a *de facto* gold standard, rising to 5.0 in 1816 when England went on the gold standard *de jure*, before deteriorating to 13.5 after the silver was de-monetized in 1873 and *fiat* money imposed itself in the 20th century – that is still a lot better than 550 in nominal terms. What is very impressive is just how stable silver was prior to the Great Debasement during a silver commodity standard, when prices remained within a very narrow range of 1.0 to 1.4 and gold remained within 1.0 to 1.2 implying that the silver coinage in circulation was deteriorating faster than the nominal price of gold.

We complete our analysis, by presenting in figures 8 and 9, the bullion equivalents of prices in gold (CPgc) and silver (CPsc), so that CPgc = CP x GC, and CPsc = CP x SC. Their reciprocal, as with PPM = 1/P, expresses the PPG or PPS, so that PPG = 1/CPsc, and the PPS = 1/CPsc.

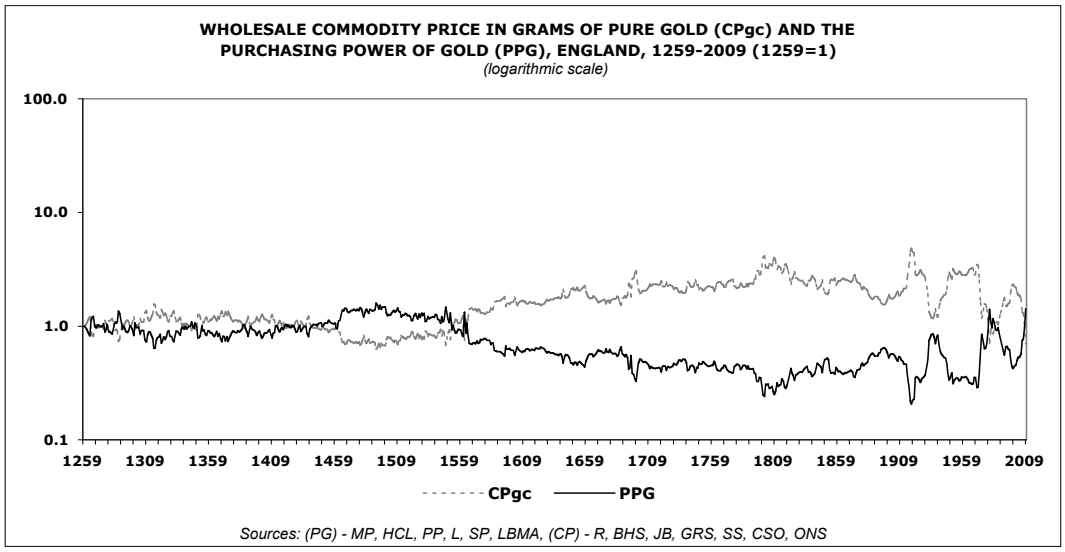

Figure 8. Commodity prices expressed in terms of gold and the purchasing power of gold, England, 1259-2009

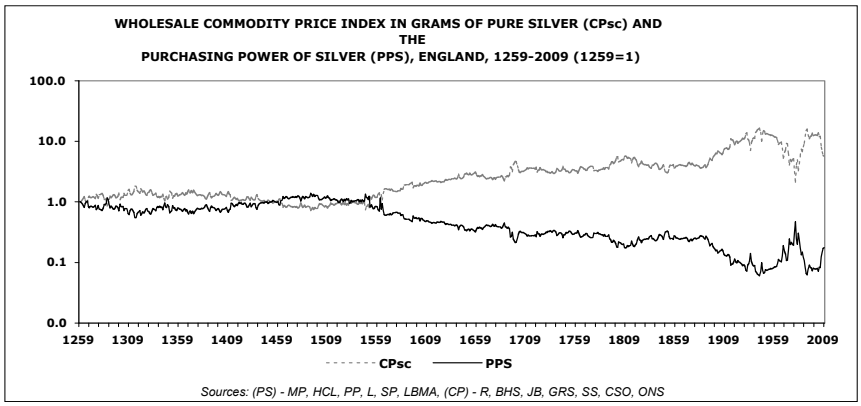

Figure 9. Commodity prices expressed in terms of silver and the purchasing power of silver, England, 1259-2009

In other words, CPpg or CPgc are real prices that revolve around a long-term trend that increases only modestly, but revolves around a constant of 1.00, had the VM been maintained, rising and falling with the natural supply and demand of commodities, even when we consider the subsequent structural economic adjustments in trade that took place as a result of serial monetary distortion. By clearly determining that the increase in nominal prices was caused by debasement and devaluation, we can say that the reduction in the value of money, as a result of an increase in the excessive supply of money in relation to demand resulted in an increase in the price level, hence price inflation is the effect and not the cause. This takes into account, both the quality and quantity of money, for it takes into account value as well as demand and not just supply, as opposed to the quantity theory, which largely ignores both value and demand, in favour of a reliance based upon the supply of money alone. Hence, quantity theorists would encourage monetary policy to target inflation by altering the quantity of money, given that they argue that there is a predictable relationship between the supply of money (M) and prices (P), where velocity (V) is constant and real output (Y) is given, such that MV = PY, as derived from Irving Fisher's equation of exchange (1911). Pigou's Cambridge approach (1917) and Freidman's monetarist re-statement (1956) are variants on the same theme, since they hold that the money demand function, being the reciprocal of V, is stable.

Furthermore, a monetary theory of value is also distinct from the mercantilist purchasing power theory, which has evolved into the effective demand of Keynes. The common thread that runs through mercantilism is the notion that, the authorities should undertake an active role in the intervention and manipulation of money, to facilitate a favourable balance of payments in international trade, that will draw precious metal (money) into, and thereby stimulate, the domestic economy. The increase in the quantity of money would increase purchasing power and increasing the demand for labour and production. Since investment fluctuates with the interest rate, a low interest rate will increase employment: and *in lieu* of an easy money policy for private investment, then direct government deficit-spending would guarantee full employment (Hahn, 2007, pp. 107, 139, 166). Keynesians would encourage monetary policy to alter interest rates in order to manage the quantity or supply of money. However, Keynes' admission that, "the primary effect of a change in the quantity of money on the quantity of effective demand is through its influence on the rate of interest" (Keynes, 2007, p. 298), would imply that, "by effective demand Keynes seems to mean little more than total monetary demand; therefore doubling the quantity of money, say, directly doubles the effective demand because the two terms practically mean the same thing" (Hazlitt, 2007, p. 299). In reality, we have a simple quantity theory buried within Keynesian economics. Our empirical data shows that absent of backing by a precious metal that would anchor *fiat* money to intrinsic value, the classical quantity theory and the Keynesian purchasing power theory, have both been responsible for influencing monetary policy that has led to the same macroeconomic result under the *fiat* standard since 1971, as observed in figures 3 and 4: an exponential decay in the value of money, due to excessive debt and money creation in relation to demand, the effect of which has led to an exponential increase in nominal prices, and when corrected for this loss of value, real prices are low and constant.

Our analysis equally applies to the more notable periods involving higher prices of precious metals and commodities during the Great Debasement (1542-1551), and during the Bank Restriction Period (1797-1821), when England went off the gold standard for 24 years, due to the Bank of England suspending the redemption of bank notes for gold coins. During the Great Debasement, the PS increased by 64% from 1542-1551, and immediately following 1551, the average CP for the five years from 1552-1556, also increased by 64%. With

differences in domestic and foreign bimetallic ratios, Gresham's Law saw gold exported and silver imported for the domestic production of debased silver coins (Gould, 1970, p. 30). Thus, we have a decrease in the value of money (reflected in a higher PS), as a result of an excessive increase in the supply of debased silver coinage, in relation to demand, the effect of which was an increase in prices.

During the Bank Restriction Period (1797-1821), the un-backed issuance of paper money and the subsequent high price of gold, was condemned by the Bullion Committee Report in 1810, as cited by Cannan (1925).

There is at present an excess in the paper circulation of this country, of which the most unequivocal symptom is the very high price of bullion… that this excess is to be ascribed to the want of a sufficient check and control in the issues of paper from the Bank of England; and originally, to the suspension of cash payments, which removed the natural and true control (p. 66).

Although Ricardo would never advise a government to restore a currency to par that had depreciated in value by 30% (Ricardo, 1951, pp. 71-74), the gold standard was established *de jure* in 1816 (whilst payments were still suspended), and the old parity was chosen rather than a new parity reflecting a higher market price during the suspension, such that the PG fell from £5.35 in 1815 to the original mint price of £3.89375 (£3 17*s* 10.5*d*) in 1821, a decline of 27% that increased the value of the pound and reduced prices. Here, we have an increase in the value of money, as a result of a decline in the volume of paper money, in relation to demand, the effect of which was a decline in prices.

Our findings have gone much further than merely presenting the correlation between the price of bullion and the price of commodities (whether over the short or long term). Whilst the correlation between the PG and CP in England between 1259-2009 is 0.93, this certainly indicates that a decrease in the value of money (reflected in a higher price of gold) is strongly correlated with higher nominal prices over the long term, but it does not however reveal a great deal regarding causality, or indeed, how to resolve the loss of value in the medium of exchange and the impact upon prices. The findings have explained with empirical evidence and through statistics, both the impact and adjustment needed with regard to the value of money and its purchasing power and the associated effect upon the general price level. Having expressed prices in real terms in terms of gold and silver, when multiplying real prices by the PPG or PPS we obtain unity: CPgc x PPG (or CPsc x PPS) = 1. This confirms that price inflation or deflation, are purely a monetary phenomenon, and any diminution of value is proportional to the increase in nominal prices. With a stable currency, real prices (CPgc, CPsc) and real money (PPG, PPS) may vary in the short term, but revolve around a long-term secular trend that is constant. When we apply the criteria of long-term price stability and short-term volatility (table 5), we notice a highly stable international gold standard on one hand, and a largely unstable inter-war gold-exchange standard on the other.

Table 5. Wholesale price index, England: Long-term stability and short-term volatility

Period	Monetary System	Long-Term Stability	Short-Term Volatility	Stability Rank	Comments
1260-1509	domestic silver commodity standard (upto the reign of Henry VIII)	0.5%	4.8%	3	silver commodity standard
1509-1717	domestic silver commodity standard (includes Great Debasement 1542-1551 & Great Recoinage 1696-1699)	1.3%	6.8%	4	silver commodity standard
1717-1821	domestic gold commodity standard (*de facto* from 1717; includes Bank restriction period 1797-1821)	0.3%	4.9%	2	fractional reserve gold standard
1821-1914	domestic & international gold standard (*de jure* from 1816)	-0.2%	4.1%	1	fractional reserve gold standard
1914-1944	inter-war gold standard (U.K. off gold standard 1914-1925 and from 1931)	3.2%	10.6%	7	less than 25% on a gold standard: early 1920s inflation & 1930s deflation
1944-1971	Bretton Woods gold-dollar standard	4.8%	6.4%	5	fractional reserve gold exchange standard
1971-2009	international *fiat* paper standard	6.1%	6.0%	6	fractional reserve debt as money

With regard to the international gold standard, there was a long term secular decline in prices following the de-monetization of silver, and absent of debasement, the domestic silver commodity standards would have

performed better. With regard to the inter-war gold-exchange standard, England was only on the gold standard for less than 25% of the time during this period. Volatility was more obvious during the breakdown of monetary order during the 20th century and the worst performing standard in terms of long-term stability was the exponential decay of the purchasing power of the modern *fiat* paper standard following an annual increase in prices of about 6.1% from 1971, which may be contrasted with adjusting nominal prices for the value of money in terms of gold (CPgc) throughout the entire period from 1259-2009, with an average annual change of only 0.4%, and thus proves to be highly stable over the long term.

5. Conclusion

By examining the value of a currency in terms of its' rate of exchange with gold or silver, not only are we able to detect the underlying effectiveness of its' purchasing power, but we also obtain a very clear sense of its' worth as a measure and store of value. By carefully constructing indices for the prices of gold, silver and commodities in England over the long term, our findings have demonstrated that the purchasing power of gold and silver are stable over the long term. We also found that debasement and devaluation have been the primary cause in the decline of the value and purchasing power of money (the pound), the effect of which was an increase in nominal prices. Therefore, prices increase inversely with the bullion content of currency, or in proportion to the rate of debasement or devaluation. By correcting the loss of the value of money, and expressing the prices in bullion at the rate of intrinsic decay, we discover not only constant prices expressed in either gold or silver, but through its reciprocal, we also discover a constant purchasing power of gold or silver.

As mentioned in the introduction, there is a difference between the value of money and what money can purchase at any given point in time. Changes in the purchasing power of money can originate from the supply and demand of money, or from the supply and demand of commodities. Inflation and deflation are purely monetary phenomena, and price changes due to monetary distortions are distinct from non-monetary reasons. Value in exchange is measured in terms of prices. The price of a commodity is affected by the underlying value of money (VM). The price of a commodity may be expressed as the ratio of the supply and demand of that commodity, and the demand and supply of money. The price of a commodity is thus the ratio of two values, each determined by its' own respective supply and demand. Debasement and devaluation involves a decline in the VM, caused by an excessive supply of money in relation to demand, the effect of which is an increase in the price level.

$$\text{Price of a commodity} = \frac{\dfrac{\text{Demand for a commodity}}{\text{Supply of a commodity}}}{\dfrac{\text{Demand for money}}{\text{Supply of money}}} \tag{6}$$

When the VM reflected in the denominator in (6.0) is constant (VM = 1) then the value of the numerator would be constant over the long term. Indeed, it is worth recalling for "a currency, to be perfect, [it] should be absolutely invariable in value" (Ricardo, 1816, pp. 13-14). The management of the value and purchasing power of money implies an ability to provide stable prices, and yet prices are supposed to change, in order to efficiently transmit information and organize an economy. In terms of monetary policy, we should not target stable prices (which have increased exponentially under the *fiat* standard), by devaluing money and its purchasing power, but we should target a stable currency, absent of government intervention and manipulation, which in turn implies a stable purchasing power and thus stable prices. Moreover, wealth is transferred to the issuer as a result of the over-issuance of currency, since wealth is confiscated through inflation: "the decrease in purchasing power incurred by holders of money due to inflation imparts gains to the issuers of money" (Reubling, 1975, p. 22). Well before his appointment as Chairman of the Federal Reserve, as an economist, Alan Greenspan (1966) mused over a gold standard, equating it with economic freedom, although his sentiments equally apply to a gold or silver commodity standard, in the absence of which,

There is no way to protect savings from confiscation through inflation. There is no safe store of value…no way for the owners of wealth to protect themselves…This is the shabby secret…Deficit spending is simply a scheme for the confiscation of wealth. Gold [or silver] stands in the way of this insidious process. It stands as a protector of property rights.

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Notes

Note 1. William Beveridge (1879-1963) was an English economist, whom compiled a collection of prices series for nearly 170 commodities in his *Prices and Wages in England from the Twelfth to the Nineteenth Century*, from about 1550-1830 and was originally published in 1939.

Note 2. The currency was £1 = 20 shillings (*s*), and 1*s* = 12 pennies (*d*), hence £1 = 240*d*. The tower pound = 7,200 wheat grains, 1 tower lb = 12 tower ozs, 1 tower oz = 600 wheat grains, and 1 tower pennyweight (pwt or dwt) = 30 wheat grains. Hence 1 tower lb = 240 dwt (7,200 / 30). The troy pound = 5,760 barley grains, 1 troy lb

= 12 troy ozs, 1 troy oz = 480 barley grains and 1 troy dwt = 24 barley grains. Hence 1 troy lb = 240 dwt (5,760 / 24). The tower lb was 15/16 lighter than the troy lb: thus, 1 tower lb of 7,200 tower grains = 5,400 troy grains, and 1 tower oz = 450 troy grains and 1 tower dwt = 22.5 troy grains. Since, 1 barley grain = 0.06479891g, then 1 troy oz = 31.1034768 grams or 1g = 0.0321507 troy ozs, so that 1kg = 32.1507 troy ozs and I MT = 32,150.7 troy ozs.

Note 3. Thorold Rogers (1823-1890) was an English economist whom compiled prices of commodities from 1259-1793 in *A History of Agriculture and Prices in England from 1259 to 1793*, originally published 1866–1892.

Note 4. Beveridge (1965, p. lx), *cf.* Jastram (1977, p. 62).

Note 5. The Jastram-Beveridge price index covered (for example in 1700) up to 16 categories and 72 commodities.