Resources Policy 54 (2017) 53–57

Contents lists available at ScienceDirect

Resources Policy

journal homepage: www.elsevier.com/locate/resourpol

Does gold act as a hedge against inflation in the UK? Evidence from a fractional cointegration approach over 1257 to 2016[☆]

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ARTICLE INFO

JEL classification:
C32
E31
E44
G15
Q02

Keywords:
Inflation
Gold price
Hedging
Fractional cointegration
Long memory

ABSTRACT

This paper examines the inflation hedging ability of gold in the UK based on a fractional integration and co-integration framework. This gives more flexibility as it does not restrict the order of integration between zero and 1. Annual time series data covering 1257–2016 were used. We conducted both full sample and sub-sample analysis. Using the full sample, the findings shows that gold and retail price index (RPI) are both I(1). However, based on the sub-sample analyses, gold is I(1) for most sub-periods while RPI is mean reverting ($d < 1$) for most periods. However, both series exhibit the same degree of integration, I(1), during the last sub-sample, specifically between 1903 and 2016. We also find the existence of cointegration between gold and RPI but this is exclusively due to the data from the last century. It is therefore concluded that gold provides protection against inflation since its value would be maintained in the presence of inflation.

1. Introduction

The value of investment portfolios often get eroded by inflation. This poses a risk to investors. Therefore investors would prefer to buy assets whose values remain the same or increase with increase in inflation. One of such assets often considered is gold. There are some features of gold that make it attractive and unique relative to other commodities namely its durability, universal acceptability and authentication, transportability, its role as a store of value, positively skewed returns (Worthington and Pahlavani, 2007; Lucey, 2011) and purchasing power (Wang and Lee, 2011). Gold differs from other mineral commodities in terms of both price and production behaviour. For instance, during the 2008 financial crisis, the price of gold increased by 6% while many key mineral prices fell and other equities plunged by around 40% (Shafiee and Topal, 2010).

Following the cessation of Bretton Woods in 1971, a freely floating period of gold price was initiated. Similar to most commodities, gold price is determined by its demand and supply. The supply of gold is stable and relatively inelastic. This has been attributed to the challenging extraction process, tediousness of creation of new mines and passive keeping of stocks of gold by Central Banks irrespective of the patterns of the real gold price (Aizenman and Inoue, 2012; Beckmanna and Czudaj, 2013). Two components of demand for gold have been identified in the literature namely the use and the asset demand (Ghosh et al., 2004; Levin and Wright, 2006). The use demand is related to the direct use of gold for producing jewellery, coins, electrical components, medals, among others. The use demand is mainly affected by the business cycle, specifically by the purchasing power of firms and households. However, due to the appealing features of gold during crisis and recessions, the asset demand could act counter-cyclical (Beckmanna and Czudaj, 2013). The asset demand emphasises the use of gold as an investment by individuals, governments and fund managers to hedge inflation, recession and other forms of uncertainty (Aye et al., 2016). According to Wang et al. (2011), investors purchase gold to hedge against any economic, political, or currency crises, for diversification as well as financial arbitrage purposes.

This paper study investigates whether gold serves as a hedge against UK inflation. This is necessary because any evidence of the inflation hedge effectiveness of gold could assist investors in reducing losses arising from inflation as well as in making better decisions about their asset portfolio. This could also help the government to improve public finance as it gradually cover its gold reserve or accumulate more gold at low price variation (Wang et al., 2011). Two different hypotheses have been used in the literature to explain the relationship between expected

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[☆] We would like to thank an anonymous referee for many helpful comments. However, any remaining errors are solely ours.

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http://dx.doi.org/10.1016/j.resourpol.2017.09.001
Received 7 July 2017; Received in revised form 1 September 2017; Accepted 1 September 2017
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inflation and gold prices namely the expected inflation effect and the carrying cost hypothesis (Blose, 2010; Beckmanna and Czudaj, 2013). The first hypothesis argues that changes in expected inflation will cause immediate changes in gold prices. This is called the expected inflation effect hypothesis. This is because upward revisions in expected inflation spur investors to purchase gold as a hedge against the expected decline in money or for speculating the associated increase gold price (Blose, 2010). The second hypothesis, relates to the Fisher effect which argues that higher expected inflation will cause higher interest rates, consequently causing a higher cost of carry for gold investment, thereby offsetting any speculative profit from investing in gold over the inflationary period. Thus, the cost of carrying hypothesis argues changes in expected inflation will not cause a change in the price of gold.

Some empirical studies have been conducted to assess the effectiveness of gold as a hedge against inflation as evidenced in the literature section. The results from these studies have so far been inclusive. Moreover, results vary depending on the market being considered, the time period examined and method employed. Using the fractional integration/cointegration framework, we contribute to the literature on whether gold acts as hedge for UK inflation, by using an unique data set on gold prices and general price level covering the annual period of 1257–2016. The advantage of this long span of data is that it allows us to study the evolution of the gold market and the price-structure of UK economy, by going as far back as possible in history. We are not aware of any studies on gold inflation hedge ability that employ the fractional methods. The approach accounts for long memory behaviour often found in most financial and economic time series. It allows one to simultaneously and endogenously determine the order of integration without a priori restricting the order between zero and one. This flexibility makes the fractional framework employed in this paper more flexible than conventional integration-cointegration methods.

The rest of the paper is organized as follows: section two reviews the literature on previous empirical studies. The data and empirical model are presented in section three. In section four, the results and discussion are presented, while section five concludes.

2. Literature review

Although the role of gold as a hedge has been examined for the case of inflation, national currencies, stocks and bond markets, the review here focuses on its role as an inflation hedge. The empirical conclusion as to whether gold is a hedge against inflation is mixed. For instance, Wang et al. (2011) examined the inflation hedge ability of gold in the short and long run using US and Japan annual data during January 1971 to January 2010 period. Analysis based on threshold cointegration and error correction models suggest gold's inflation hedging ability differ from time to time and from one market to the other. Specifically, it was found that in the short run, while gold acts as effective inflation hedge during high momentum period especially in the US and partially in Japan, the contrary is the case during low momentum period where it failed to play the hedging role in both countries. In the long run gold was unable to respond to changes in the consumer price index due to price rigidity.

Using annual data on the US economy from 1933 to 2013, and a battery of cointegration tests including an interrupted nonlinear cointegration model, Aye et al. (2016) concluded that the empirical evidence of gold as an effective hedge against inflation is mixed. Their study shows that while the standard tests find no evidence of the inflation hedge role of gold, the nonlinear model find a temporary role. Beckmann and Czudaj (2013) test the gold inflation hedge hypothesis using data for the USA, the UK, the Euro Area, and Japan and Markov switching vector error correction model (MS-VECM) approach for a sample period ranging from January 1970 to December 2011. They find that gold partially acts as hedge for future inflation in the long run with the ability being stronger for the USA and the UK relative to Japan and the Euro Area. Also gold's hedging ability depends on the time horizon considered and the two regimes represent different states of the economy with one accounting for turbulence and the other normal times.

Adrangi et al. (2003) find that the correlation between gold prices and expected inflation is positive. They conclude that a gold investment may be a reliable inflation hedge in both the short-run and the long-run. Ghosh et al. (2004) use monthly U.S. data covering from 1976 to 1999. Results based on cointegration regression techniques show that the gold price rises over time at the general rate of inflation and hence is an effective hedge against inflation. Using cointegration and VECM techniques with data from 1976 to 2005, Levin and Wright (2006) find that gold acts as an inflation hedge for US inflation and inflation volatility as well as those of Turkey, India, Indonesia, Saudi Arabia, and China.

Using a modified cointegration method which allows for instabilities in the long run relationship and USA monthly data from 1945 to 2006 and from 1973 to 2006, Worthington and Pahlavani (2007) provide evidence in favour of a cointegrating relationship between the price of gold and inflation in both sample periods and thus, conclude that a gold investment can serve as an effective inflationary hedge. McCown and Zimmerman (2006) find a significant relationship between measures of inflation and gold prices while Tully and Lucey (2007) using a power GARCH approach, do not find a significant relationship between inflation and gold. Mahdavi and Zhou (1997) examine the extent to which gold and other commodity prices are leading indicators of inflation using data from 1958 to 1994. Results based on cointegration and vector error correction model (VECM) indicate that gold's contribution to inflationary predictions is not statistically significant.

Long et al. (2013) investigate the inflation-hedging ability of gold in Vietnam using data from 2001 to 2011. They find that gold provides a complete hedge against both the ex post and ex ante inflation. They also find that gold return is positively related to unexpected inflation, and a support in favour of the Fisher hypothesis that nominal gold returns move in a one-for-one correspondence with expected inflation. Hoang et al. (2016) examine the role of gold as a hedge against inflation based on monthly gold prices in China, India, Japan, France, the UK and the USA from1955 to 2015. Employing the nonlinear autoregressive distributed lags (NARDL) model they find that gold has no hedging ability for inflation in the long run in all the countries. However, gold hedges against inflation in the short run only in the UK, USA, and India. Using both time invariant and a time-varying cointegration framework and data from 1791 to 2010, Bampinas and Panagiotidis (2016) investigate the long-run inflation hedging ability of gold and silver prices for the UK and the US. Their results show that in the long run, gold can fully hedge against alternative measures of CPI namely the headline, expected and core CPI and the inflation hedging ability of gold is higher in the US relative to the UK.

The foregoing clearly shows that the inflation hedging ability of gold has not been investigated using the fractional approach despite the advantages of this method. Thus, we fill this gap in the literature by using a long span of historical data for the UK covering over eight centuries of data.

3. Methodology

As earlier mentioned in the manuscript, we focus on fractional integration and cointegration techniques. The main advantage of these approaches is that it is more flexible than the standard methods that simply consider integer degrees of differentiation. In particular, an I(d) process is defined as

$$(1 - L)^d x_t = u_t, \qquad t = 0, \pm 1, \ldots, \tag{1}$$

where L is the lag operator, that is, $Lx_t = x_{t-1}$, and u_t is supposed to be integrated of order 0 or short memory, in the sense that the infinite sum of the autocovariance must be finite. In this context, we allow the differencing parameter d to be any real value, including thus fractional

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