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Is gold an inflation-hedge? Evidence from an interrupted Markov-switching cointegration model

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ABSTRACT

This paper investigates the inflation hedging role of gold price after controlling for the prices of other investment assets. We use annual data on the U.S. economy spanning from 1833 to 2013. We employ a recently developed flexible nonlinear approach that allows for potential 'interruption' in the long run equilibrium relationship in which the equilibrium term dynamics is modelled as an AR(1) depending upon an unobserved state process that is a stationary first-order Markov chain in two states, stationarity and non-stationarity. While, a battery of standard cointegration tests without and with breaks could not find evidence to support the inflation hedging role of gold, results from the flexible nonlinear approach indicate the existence of temporary cointegration between gold price and inflation during 1864, 1919, 1932, 1934, 1976, 1980 and 1982. The interruptions in the long-run relationship at different time periods seem to be associated with the different structural changes that affected the gold market.

1. Introduction

Gold is usually considered an important asset by most investors, policy makers and academics due to a number of benefits accruing from it. This includes its role as an investment asset[1], as a store of value, diversification benefit, financial arbitrage, political unrest, currency risk (i.e hedge against exchange-rate risk for investors with dollar holdings since gold is priced in dollars), potential safe haven or hedge against inflation (Chua and Woodward, 1982; Harmston, 1998; Worthington and Pahlavani, 2007; Baur and Lucey, 2010, Wang et al., 2011; Dee et al., 2013; Long et al., 2013). Gold is always on high demand for jewellery, coins, bars and by many industries, such as electronics, space, as well as medical technology (Wang et al., 2011). Gold has characteristics that make it unique from other commodities: is durable, relatively transportable, universally acceptable and easily authenticated (Worthington and Pahlavani, 2007). Gold's positively skewed returns might also provide it safe-haven properties (Lucey, 2011). Although its role as a store of value in the monetary system diminished after the collapse of the Bretton Woods system in 1973, it is retained in many Asian countries and continues to hold a significant symbolic value even in countries where it plays lesser monetary role. These benefits notwithstanding, gold is being viewed by some as a "barbarous relic" with no modern role to play or "just another commodity" that rarely adds value in an investment strategy (Ranson and Wainright, 2005).

The main characteristics of gold are closely linked to their supply and demand factors. Generally, the supply of gold is relatively inelastic and stable owing to the tediousness of establishment of new mines, difficult extraction process, passive keeping of stocks of gold by Central Banks irrespective of the patterns of the real gold price (Aizenman and Inoue, 2012; Beckmann and Czudaj, 2013). However, the demand for gold is rapidly changing in

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[1] Gold is particularly considered an investment instrument or option for a number of reasons: It can easily be converted to cash (liquidity), maintains its value over time as a commodity largely due to its fixed quantity unlike fiat currency that can easily be printed by the authorities, an inflationary hedge, portfolio for diversification and hence risk reduction, its usefulness in the production of important products such as jewellery and electronics among others. There are a number of investment vehicles for gold. These include purchasing gold directly in form of Gold bars, bullion or coins, shares in gold mining companies, Derivatives such as gold forwards, futures and options, Gold accounts including unallocated and allocated as well as investment in an accumulation plan, Gold certificates and Gold Exchange-traded products (ETPs) such as exchange-traded funds (ETFs), exchange-traded notes (ETNs), and closed-end funds (CEFs) which are traded like shares on the major stock exchanges (HSBC, 2015; Smith, 2015; Wikipedia, 2015).

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response to global economic occurrences. Baur and McDermott (2010) separated the total demand for gold into three categories: demand for jewellery, demand for industrial and dental, and investment demand whereas Ghosh et al. (2004) simply divided it into two: the "use demand", where gold is used directly for producing jewellery, medals, coins, electrical components, among others and the "asset demand", where it is used by governments, fund managers and individuals as an investment to hedge inflation and other forms of uncertainty.

A key interest of long term investors is to protect their wealth against both expected and unexpected inflation; hence they are often concerned with maintaining the purchasing power of investment assets over time consistent with the Fisher (1896) hypothesis which was expanded by Fama and Schwert (1977). The aim of this study is to examine the hedging function of gold. When an asset co-moves with inflation, it can be viewed as an inflation hedge (Dee et al., 2013). Alternatively, a hedge is defined as an asset that is uncorrelated or negatively correlated with another asset or portfolio on average while a safe haven is defined as an asset that is uncorrelated or negatively correlated with another asset or portfolio in times of market stress or turmoil (Baur and Lucey, 2010; Baur and McDermott, 2010). The gold return-inflation relationship reflects the extent to which gold is popular in the economy relative to the fiat money and other investment assets (Chua and Woodward, 1982). Wang et al. (2011) also noted that the effectiveness of gold as a good hedge for both ex ante and post ante inflation depends on the economic conditions or characteristics of each country (Wang, et al., 2011). In this regard this study investigates whether gold price acts as a hedge to inflation for the case of USA.

The popular belief is that gold price tends to increase with the general price level hence providing a hedge against total inflation (Wang et al., 2011; Dempster and Artigas, 2010). Theoretically, an increase in expected inflation will force investors to purchase gold, to either hedge against the expected decline in the value of money or speculate due to the associated rise of the price of gold. The resulting higher demand will lead to increasing gold price in time of the increasing inflation expectations (Beckmann and Czudaj, 2013). Therefore, knowledge regarding future inflation will enable investors to gain excess revenues by buying and selling gold in spot and futures markets in anticipation of prospective market adjustments. Consequently, the price of gold price would act as a leading indicator of inflation making gold an instrument for hedging against future inflation (Beckmann and Czudaj, 2013).

Empirically, a number of researchers have investigated the hedging or safe haven role of gold. However, the results are mixed and hence inconclusive. Mahdavi and Zhou (1997) test the performance of gold and commodity prices as leading indicators of inflation with cointegration and vector error correction model (VECM) using the Johansen framework for a quarterly sample period that ranges from 1970 to 1994 and conclude that consumer prices and the price of gold are not cointegrated. Their findings are consistent with those of Garner (1995) and Cecchetti et al. (2000) who were also unable to empirically support the usefulness of the gold price as leading indicator for inflation. Adrangi et al. (2003) find that gold prices are positively correlated with expected inflation and conclude that a gold investment may be a reliable inflation hedge in both the short-run and the long-run. Levin and Wright (2006) analyze the short-run and long-run determinants of the gold price for the USA over a sample period from 1976 to 2005. They identify a stable long-run relationship between the gold price and the price level. Based on the traditional VECM they also provide evidence that the change in the gold price is positively related to the change in inflation, inflation volatility, and credit risk while its relationship with the U.S. dollar trade weighted exchange rate and the gold lease rate is negative.

In an empirical study based on monthly data covering September 1994 to December 2005 period for 14 countries: Australia, Canada, the European Union, New Zealand, Sweden, the United Kingdom, Japan, Mexico, Norway, the USA, Brazil, China, India, and Israel, Tkacz (2007) conclude that the gold price contains significant information for future inflation in several countries, especially those with formal inflation targets. Using a modified cointegration framework that allow for instabilities in the long run relationship for two sub-periods: 1945–2006 and 1973–2006, Worthington and Pahlavani (2007) find evidence in favour of a cointegrating relationship between the price of gold and inflation in both sample periods, thus concluding that gold can serve as an effective hedge for inflation. However, Blose (2010) using the U.S. data covering the period 1988–2008, finds no relationship between nominal gold returns and expected inflation.

Baur and Lucey (2010) study the relationship between U.S., U.K. and German stock and bond returns and gold returns to investigate gold as a hedge and a safe haven. They estimated regressions based on both full sample and subsample and find that gold is a hedge against stocks on average and a safe haven in extreme stock market conditions with the later property being short-lived. Wang et al. (2011) analyze the short-run and long-run inflation hedging effectiveness of gold in the USA and Japan using monthly data spanning from January 1971 to January 2010. They conduct the linear cointegration test proposed by Engle and Granger (1987) as well as the nonlinear threshold cointegration test suggested by Enders and Siklos (2001) and show that in low momentum regimes gold is unable to hedge against inflation in both the USA and Japan, however, in high momentum regimes, a gold investment is able to hedge against inflation in the USA, and partially hedge against inflation in Japan.

Dee et al. (2013) examine the hedging role of gold for stock and inflation in China mainland market. Using quantile regression and binary probit model, they find that gold cannot always hedge stock and inflation risk for short-term investors, while it is a good hedge for stock or inflation in the long term. However, they could not find evidence of its safe haven properties in the China market. Beckmann and Czudaj (2013) examine inflation hedging ability of gold using data for the USA, the UK, the Euro Area, and Japan covering from January 1970 to December 2011. They allow for nonlinearity by using Markov switching vector error correction model (MS-VECM) and also discriminate between long-run and time-varying short-run dynamics. They find that gold is partially able to hedge future inflation in the long-run with stronger ability for the USA and the UK compared to Japan and the Euro Area. They also conclude that the role of gold as an inflation hedge essentially depends on the time horizon and that one regime roughly corresponds to normal times while the other approximately accounts for turbulent times.

From the foregoing, it is obvious that the hedging function of gold is inconclusive. Results differ depending on methodology, sample period as well as country. Majority of the studies are based on the conventional cointegration tests and vector error correction models which assume that the parameters are constant over time. This assumption may be too restrictive as in reality gold price and inflation may fluctuate due to business cycles that may lead to nonlinearity in the relationship. The only studies that accounted for temporary or permanent, smooth or dramatic shifts in the gold price-inflation relationship are Wang et al. (2011) using threshold cointegration and Beckmann and Czudaj (2013) using Markov-