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Does gold glitter in the long-run? Gold as a hedge and safe haven across time and investment horizon

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ABSTRACT

During times of market turmoil, investors often seek to mitigate risks associated with traditional investment assets such as equities and debt. The hedging and safe-haven properties of gold are examined in this paper for investors with short- and long-run horizons. Utilizing wavelet analysis, we find that gold acts as a hedge for a variety of international equity and debt markets for horizons of up to one year. The safe haven properties of gold during financial crises are further established, with gold shown to act as a safe haven for equity investors for long-run horizons of up to one year. However, during the economic contractions of the early 1980s gold is found not to act as a safe haven, displaying a positive relationship with equities across a range of horizons.

1. Introduction

Gold has a long history as a store of value, a unit of exchange and of course in jewellery.[1] Gold is also considered an investment asset (Jaffe, 1989; Solt & Swanson, 1981) and its investment potential is linked to its diversification benefits when held with other assets. In particular, both gold and gold stocks have been shown to have low levels of correlation with equity indices, highlighting their role as a diversifier (see, for example, Chua, Sick, & Woodward, 1990; Hillier, Draper, & Faff, 2006). The recent global financial crisis and its aftermath have once again highlighted the importance of safe-haven assets to investors.[2] However, the attribution of hedging and safe haven benefits may be dispersed across different investment horizons, in common with important financial characteristics such as volatility and dependency.

In this paper, we examine whether gold consistently acts as a hedge and safe haven for investors with heterogeneous investment horizons across a variety of international equity and debt markets. The study builds on previous analyses of gold as an investment asset, using wavelets to simultaneously characterize the benefits of gold as a hedge and safe haven asset over both calendar time and investment horizon.[3] Our empirical results offer numerous new and unique insights. Firstly, gold consistently acts as a short-run hedge for all assets studied. While evidence for pockets of longer-run raised positive codependence exists (for horizons greater than one month), gold is found to have a low interdependence with traditional assets on average for horizons of up to one year, highlighting its role as a long-run hedge. Considering times of market turbulence, investors often turn to gold as a store of value. In keeping with this, we next demonstrate that gold consistently acts as a safe haven for equities during *financial crises* for long-run periods of up to one year. In contrast, during the *economic contractions* of the early 1980s gold is found not to act as a safe haven, displaying a positive relationship with equities across a range of horizons.

Our study contributes to the literature in several dimensions, by simultaneously examining the benefits of gold as a hedge and safe haven asset over both calendar time and horizon. Relative to other studies on the hedging and safe haven properties of gold such as Reboredo (2013), Baur and Lucey (2010), Baur and McDermott (2010) and Capie, Mills, and Wood (2005), our study extends the literature in a number of ways. The use of wavelet analysis allows isolation of the localized (in both time and frequency or horizon) dependence between gold and both international equities and bonds. While previous papers

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[1] The world's first coin was most likely minted in Lydia, Asia Minor (present-day Turkey) over 2500 years ago.

[2] After the announcement that Lehman Brothers had filed for chapter 11 bankruptcy protection on September 15th 2008, the S&P 500 equity index dropped in price by 4.6% on that day and by 40% in the six months to follow. In the same time periods, gold increased by 2.9% and 22% respectively, perhaps indicative of hedging activity.

[3] Calendar time refers to a specific point in time (e.g. Black Monday, October 19th, 1987), while investment horizon refers to the anticipated holding period of an asset (e.g. one day, one week, one month).

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have examined aggregated financial data with differing horizon, wavelet analysis simultaneously informs regarding the dynamic calendar time hedging benefits. Further, relative to the extant literature we demonstrate a richer characterization of the hedging and safe haven properties of gold. For example, we highlight instances where gold acts as a short horizon hedge but may briefly display positive codependence with traditional assets at longer horizons. This notwithstanding, we find that gold acts as a hedge for traditional assets on average, for long horizons of up to one year.

The paper is organized as follows. Section 2 briefly outlines the related literature. In Section 3 we describe the methodology, with focus on the continuous wavelet transform. We provide details on the data and summary statistics in Section 4. Empirical findings related to the hedging and safe haven properties of gold are described in Section 5. In Section 6 we provide some concluding remarks.

2. Related literature

Gold has been documented as both a hedge and safe-haven for stocks, bonds and currencies. Baur and Lucey (2010) define a hedge (safe-haven) as an asset that is uncorrelated or negatively correlated with another asset or portfolio on average (in times of market stress or turmoil). They find that gold acts as a safe haven in the short-term for stocks, for periods of up to fifteen days. Baur and McDermott (2010) further establish gold as a short-run safe-haven for European and US equity investors. Distinguishing between weak and strong safe haven properties, they find that gold acts as a strong safe haven for developed markets during the recent global financial crisis.[4] Moreover, Baur and McDermott (2010) examine the hedging properties of gold at different frequencies, demonstrating that gold has hedging and safe-haven properties at daily and weekly horizons, but only acts as a hedge at a monthly horizon. Baur and Glover (2012) further demonstrate that gold acts as a safe haven in the short term, but suggest that safe haven properties may be impacted by increasing levels of speculation in the asset.

A negative relationship between gold and US dollar exchange rates is demonstrated by Capie et al. (2005), with variation in the relationship found over time. Both Ciner, Gurdgiev, and Lucey (2013) and Reboredo (2013) find hedging and safe haven properties for gold with respect to US dollar exchange rate movements. Considering gold as an inflation hedge, Beckmann and Czudaj (2013) show that the inflation hedging properties of gold are a function of investor time horizon. In contrast Erb and Harvey (2013) question the ability of gold to hedge against inflation, both in the short- and long-run. Distinct from other commodities, Roache and Rossi (2009) show that gold is sensitive to macroeconomic news, in particular it has a counter-cyclical reaction to unexpected news.

The diversification properties of a range of alternative commodities have further been considered in detail by the academic community. For example, Belousova and Dorfleitner (2012) demonstrate variation in diversification benefits across a range of individual commodities from the perspective of an equity investor, detailing both risk reduction and return benefits for precious metals. Daskalaki and Skiadopoulos (2011) examine the benefits of commodity diversification when held with traditional assets in an out-of-sample setting, finding risk reduction benefits from gold during the sub-prime crisis period. Contrasting gold with other metals, Agyei-Ampomah, Gounopoulos, and Mazouz (2014) show that industrial metals outperform precious metals, which in turn outperform gold in terms of protecting against losses from sovereign bonds.

The impact of time horizon on the size of the optimal financial hedge ratio and associated hedging performance has been extensively documented. Ederington (1979) demonstrates large differences in the magnitude of the optimal futures hedge ratio and in hedging performance between two and four week hedges. Moreover, various studies find increasing futures hedge ratios and improved performance across a range of contracts moving from short to long horizons (see, for example, Geppert (1995)). The majority of early studies in this area match the sampling frequency of the ex-ante data to the ex-post hedging horizon, informing little as to distinct contributions from different frequencies.

To better understand the impact of distinct hedging horizons on the optimal financial hedge ratio, recent studies have adopted the wavelet transform.[5] The wavelet transform allows for a localised understanding of the contribution of different frequencies (or horizons) to aggregate returns. In the context of financial time series, this is of considerable importance as heterogeneous investors may form portfolios for the short- and long-run. Using wavelets, In and Kim (2006) find a lead–lag relationship between the stock and futures markets, and demonstrate increased hedge ratios and hedging performance at longer time scales. Simultaneously hedging a portfolio of industrial metals using futures contracts, Fernandez (2008) accounts for heterogeneous hedging horizons using wavelets. Conlon and Cotter (2012) use wavelet multiscaling to show that the optimal futures hedge ratio is simultaneously time and frequency dependent. In this paper, we use the continuous wavelet transform to examine the potential for gold to simultaneously act as a hedge and safe haven at both short and long investment horizons. We next describe the technique of wavelet analysis adopted in this paper.

3. Methodology

Wavelet multiscale analysis is a powerful analytical tool which allows the decomposition of a time series over both time and horizon (alternately referred to as frequency or scale throughout the literature). Wavelets are a refinement of the Fourier transform and accommodate non-stationary behaviour in the frequency content of a data series over time. This is particularly useful in the case of financial data, where market shocks can result in localized bursts of intense volatility. The localization properties of the wavelet transformation allow an understanding of the frequency contributions of a time series at any point in time, providing insight into the contribution of distinct frequencies to bounded market shocks.

The continuous wavelet transform is a non-decimated wavelet filter which decomposes a time series using a set of elementary functions (Gençay, Selcuk, & Whitcher, 2001; Rua & Nunes, 2009). Given a time-series $x(t)$ defined over the interval $[-\infty < t < \infty]$, the continuous wavelet transform of $x(t)$ is given by

$$W_{\lambda,\tau} = \int_{-\infty}^{\infty} \psi_{\lambda,\tau}(t) x(t) dt, \tag{1}$$

where $\{W_{\lambda,\tau} : \lambda > 0, -\infty < \tau < \infty\}$ is a set of wavelet coefficients. λ and τ are the scale associated with the transformation and location respectively. $\psi_{\lambda,\tau}(t)$ is a basis function, which is a shifted and translated version of a mother wavelet $\psi(t)$,

$$\psi_{\lambda,\tau}(t) = \frac{1}{\sqrt{\lambda}} \psi^* \left(\frac{t-\tau}{\lambda} \right). \tag{2}$$

ψ^* denotes a complex conjugate and $\frac{1}{\sqrt{\lambda}}$ term denotes a normalization factor which ensures unit variance of the wavelet at each scale. To qualify as a mother wavelet, $\psi_{\lambda,\tau}(t)$ must fulfil a number of criteria,

$$\int_{-\infty}^{\infty} \psi_{\lambda,\tau} dt = 0, \int_{-\infty}^{\infty} \psi_{\lambda,\tau}^2 dt = 1 \tag{3}$$

[4] Baur and McDermott (2010) define a strong safe haven as one which is negatively correlated with a traditional asset, while a weak safe haven is not correlated with the reference asset.

[5] The wavelet transform has been previously applied to an extensive range of problems in finance and economics. Ramsey and Zhang (1997) examine the contributions of different frequencies to the aggregate foreign exchange returns using wavelets, Kim and In (2005) study the frequency dependence between inflation and stock returns, Gençay, Selcuk, and Whitcher (2005) relates the aggregation characteristics of equity systematic risk at varying horizons, Fernandez (2006) finds support for the capital asset pricing model at a medium-term horizon, Conlon and Cotter (2013) investigate downside risk hedging effectiveness at various horizons, while Gençay and Signori (2013) introduce a new family of portmanteau tests using wavelets.

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