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IS GOLD A HEDGE, SAFE HAVEN OR DIVERSIFIER IN KOREA?

EMPIRICAL ANALYSIS OF GOLD, SOCIALLY RESPONSIBLE INVESTMENT AND CONVENTIONAL INVESTMENT

WEI RONG ANG [1], OLAF WEBER [2]
[1] Ronin Institute, United States
[2] School for Environment, Enterprise and Development, University of Waterloo

***Abstract**: This paper examines whether gold is a hedge or a diversifier for socially responsible and conventional investment in Korea. To answer this question, daily returns between January 2006 and December 2015 were analyzed. This time span included the implementation of the Korean Green New Deal. The autoregressive distributed lag method was used to analyze the daily returns for socially responsible investment, conventional investment, and gold. The results suggest that gold is a strong diversifier, but a weak hedge, for socially responsible investment and conventional investment in Korea. For the sub-period, including the 2008 financial crisis, no evidence of gold being a safe haven was found. Furthermore, the study found that neither negative nor positive shocks have a significant impact on the volatility of the Dow Jones Socially Responsible Investment Index Korea. However, positive shocks contribute to volatility in the first sub-period between 2006 and 2010, and negative shocks contribute to volatility in the second sub-period between 2001 and end of 2015.*

***Keywords**: Gold, Korea, Socially Responsible Investment, Korea Green New Deal, Hedge, Diversifier*

***JEL Classification**: G11, P34, G14*

Introduction

The objective of this paper is to study whether gold is a hedge, a safe haven, or a diversifier for Socially Responsible Investment (SRI) and conventional investment in Korea. It contributes to the literature in that it is the first paper that studies the hedge, safe haven and diversifier properties of gold in Korea, as well as being the first study to investigate whether gold can be a hedge, a safe haven or a diversifier for SRI in Korea.

Gold has been used to hedge for inflation and other financial risks in the past (Baur and Lucey, 2010). In 550 BC, King Croesus of Lydia was the first king to allow (his) people to use gold coins in daily activities and transactions.[1] Since then, gold coins have been used widely; and in the 19th century the gold standard act was implemented to prevent bimetallism, making gold the standard

[1] http://www.gold.org/history-and-facts/gold-money

to guarantee the value of currencies.[2] Currently, the United States (US) is the largest gold holding body in the world, owning 8.133.5 tonnes as of March 2016, followed by Germany, and the International Monetary Fund (IMF). Holding 104.4 tonnes of gold, Korea ranks 34th with regard to gold ownership[3]. On the one hand, this shows the importance of gold in our monetary system, and on the other hand, it symbolizes the economic stability of a particular country or other entity.

As mentioned by Baur and McDermott (2010), Lucey and O'Connor (2017), and Wu and Chiu (2017), gold is often regarded as a safe haven asset that has the ability to maintain its value particularly during economic downturns. A study by Sherman (1982), for instance, showed that during the 1980s that were characterized by high inflation, sluggish growth and economic uncertainty, gold tended to be less volatile than did other assets. Therefore, investors and asset managers tend to include gold in their investment portfolio, and particularly during times of financial turmoil, to safeguard overall portfolio value. Many studies, such as Hood and Malik's (2013), Ghazali et al.'s (2015), and Iqbal's (2017), have tested whether gold can be a hedge asset, a safe haven, or a diversifier during times of financial turmoil.

A hedge that is negatively correlated with stocks, or a safe haven that is negatively correlated with stocks during extreme stock market declines, can be a property that investors might use in different periods to maximize return or to minimize losses. A diversifier is an asset that correlates positively with another asset or portfolio. Similar to a hedge, a diversifier does not have the ability to reduce losses in extreme adverse market conditions because of its correlation with other assets (Ghazali et al., 2015).

As mentioned by Sparkes and Cowton (2004), SRI is closely linked to Corporate Social Performance (CSP). Moreover, Oh et al. (2011) found that Korean companies that are highly rated with regard to CSP, are mainly owned by foreign institution and investors. This demonstrates that not only domestic but also international investors consider CSP in their investment decisions. Konar and Cohen (2001) suggest that the intangible value of the firm positively correlates to environmental performance. Because the Korean government actively promotes socially responsible investment in the country, SRI assets increase significantly. Consequently, Korean SRI has accumulated to US$8 billion in 2013[4] from US$2 billion in 2011[5].

This study includes both SRI and conventional investment to analyze the relationship between gold, and SRI as well as conventional investments. Korea is used as the case country because it implemented the Korean Green New Deal in January 2009. Consequently, Korea invested intensively in renewable energy, energy-efficient buildings, low-carbon vehicles, as well as in water and waste management to promote sustainability[6]. Moreover, the Korean Green New Deal budgeted an amount of US$30.5 billion for environmental issues. Furthermore, the Korean government aims to increase the usage of renewable energy from five percent in 2011 to 11 per cent by 2030[7]. This policy intends to reduce environmental problems in Korea and to green the country's economy.

[2] http://www.politico.com/story/2013/03/this-day-in-politics-088821
[3] http://www.gold.org/statistics#group2
[4] http://english.yonhapnews.co.kr/business/2015/02/03/0501000000AEN20150203002600320.html?6088ccb0
[5] http://www.bsr.org/reports/Asia_SRI_Roundtable_Summary_Transcript.pdf
[6] http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=556&ArticleID=6035&l=en
[7] http://www.unescap.org/sites/default/files/Full-report.pdf

The rest of the paper is organized as follows. Section II centers on the literature review. Section III explains the data. Section IV describes the methodology. Section V reports and discusses the empirical findings. Section VI presents the conclusions.

Literature Review

Baur and McDermott (2010) studied the role of gold in 13 countries and found that gold is neither a hedge nor a safe haven for Australia, Canada, Japan, and large emerging markets such as the BRIC countries. They found, however, that it is both, a hedge and a safe haven for major European stock markets and the US. Baur and Lucey (2010) suggested that gold is a hedge against stocks and a safe haven during times of financial turmoil for the US, the UK, and Germany. In contrast, Anand and Madhogaria (2012) did not find any evidence for gold being a safe haven asset for India, China, the US, UK, Germany, and Japan. A further study by Joy (2011) found that gold is a good hedging asset but a poor safe haven for the US dollar, based on data between January 1986 and August 2008. Ghazali et al. (2015) analyzed the role of gold in Malaysia and found that gold is not a major hedge or a safe haven, particularly during downturns of the stock market. Analyzing data between November 1995 and November 2010, Hood and Malik (2013) found that gold serves as a hedge and a weak safe haven for the US stock market. Moreover, Ciner et al. (2013) discovered that gold can be a safe haven against currency risks in the US and the UK. In addition, gold can be an effective safe haven against the volatility of the US dollar (Reboredo, 2013).

Dee et al. (2013), however, did not find that gold is able to hedge stock volatility and inflation in China. A study by Beckmann et al. (2015) indicated that gold is both a hedge and a safe haven for 18 financial markets and five regional indices. Focusing on the Gulf markets of Bahrain, Kuwait, Oman, UAE, Saudi Arabia, and Qatar, Mensi et al. (2016) found that Gold is a strong hedge and a safe haven for these markets. Van Hoang et al. (2016) explored whether gold can be used as an inflation hedge in China, France, India, the UK, and the US, and found that gold is not an inflation hedge in the long run, but that it is a hedge against inflation in the UK, the US, and India in the short run.

Smiech and Papiez (2016) found that gold could be a hedging instrument for stocks even during normal market conditions. Thus, Iqbal's (2017) data demonstrated that gold is a safe haven against exchange rate risk in Pakistan, India, and the US, even though the hedging ability was not that strong in these countries. Liu et al. (2016) even suggested that the US dollar was better than gold as a hedge asset during normal market conditions. Nevertheless, both the US dollar and gold can serve as safe haven asset during times of financial market turmoil according to their study. However, though the hedging ability has been analyzed for many countries, we did not find any studies pertaining to Korea.

In the past, most of the studies on SRI in the Asia-Pacific region, such as Ang and Lean's (2013a) and Lean et al.'s (2014), focused on country and regional level performance of SRI. Furthermore, studies on SRI performance suggest that their performance is similar to conventional investments (Ang, 2015; Ang et al., 2014; Friede, Busch, and Bassen, 2015; Lean et al., 2015; Weber and Ang, 2016). Finally, assets invested in SRI have been increasing globally, and also institutional investors, as in the case of the pension fund, have begun to take social and environmental indicators into account for their investment decisions (Principles for Responsible Investment, 2016). Therefore, a study that analyzes ways to hedge risks of SRI in a growing Asian market is important.

Data

We analyzed daily returns between January 2006 and December. SRI data was taken from the price series of the Dow Jones Sustainability Index Korea (DJSIK) from Dow Jones' website[8] . Other financial data for the Korean stock market benchmark indexes, such as the Korea Composite Stock Price Index [KOSPI], KOSPI 200, KOSPI 100, and KOSPI 50 were gathered from Google Finance.

In line with Ang (2015), we used KOSPI LargeCap, KOSPI MidCap, and KOSPI SmallCap from Google Finance to conduct the robustness analysis. The gold price was obtained from the World Gold Council that was also used by Wang et al. (2011), and Le and Chang (2012). We then further split the sample period into two sub-periods from January 2006 to December 2010, and from January 2011 to December 2015. The first sub-period included the 2008 financial crisis.

Methodology

This paper adopted Capie et al.'s (2005) model of autoregressive distributed lags (ARDL) as presented in the following function:

$$r_{g,t} = \alpha_0 + \alpha_1 \sum_{i=1}^{k} r_{g,t-i} + \beta_1 \sum_{j=0}^{l} r_{s,t-j} + \varepsilon_t$$

where $r_{g,t}$ denotes gold return at time t.

The returns were calculated through a regression with constant α_0 and the lagged returns. The contemporaneous and lagged stock market shocks were captured by the variable r_s. The model selection follows a general estimation process that starts with a shorter lag length and then increases the length of lags by one if the lowest lag is not statistically significant. The lag lengths k and l were used to capture the evolution of the gold return over time. The parameters to be estimated were α_0, α_1 and β_1.

In accordance with Capie et al. (2005), we assumed that the gold price depends linearly on the current and past change in the DJSIK or Korean stock market benchmark indexes respectively, and on the past change in the gold price itself. The residuals of the regression estimation show strong evidence of time having an influence on conditional error variances. Therefore, the conditional error variances are modelled by a threshold-asymmetric GARCH (1,1) model.

To test the ability of gold to be a hedge, the parameter β_1 has been used. If β_1 is negative or zero, gold is a hedge for the Korean SRI and conventional benchmarks since they are negatively correlated or uncorrelated to gold. If β_1 is negative or zero during the financial crisis, gold is a safe haven for the SRI and conventional equity investments. According to the definition, a diversifier is an asset that correlates positively with other assets or portfolios. Therefore, if β_1 is positive, gold is a diversifier for the selected equity investments.

[8] http://www.sustainability-indices.com/

In line with other authors (Baur, 2012; Ghazali et al., 2013; Malik, 2013; Ghazali et al., 2015), we used a threshold-asymmetric GARCH (1,1) to model residuals from ordinary least square (OLS) estimation.

$$h_t = \alpha_1 + \alpha_2 \varepsilon_{t-1} + \alpha_3 d_{t-1} \varepsilon_{t-1}^2 + \alpha_4 h_{t-1}$$

Furthermore, α_3 is the measure for the impact of positive and negative shocks on gold return. If α_3 is negative, positive shocks increase the volatility of gold return more than negative shocks, and vice versa.

Results

Figure 1 illustrates the time series of the gold price, DJSIK, and KOSPI. At first glance, the gold price shows an upward trend between 2006 and 2011 and a downward trend after 2011. Nevertheless, DJSIK's and KOSPI's returns show an increasing trend from 2006 until 2008. However, their returns decrease in 2008 because of the financial crisis. Since then, all indexes have been recovering.

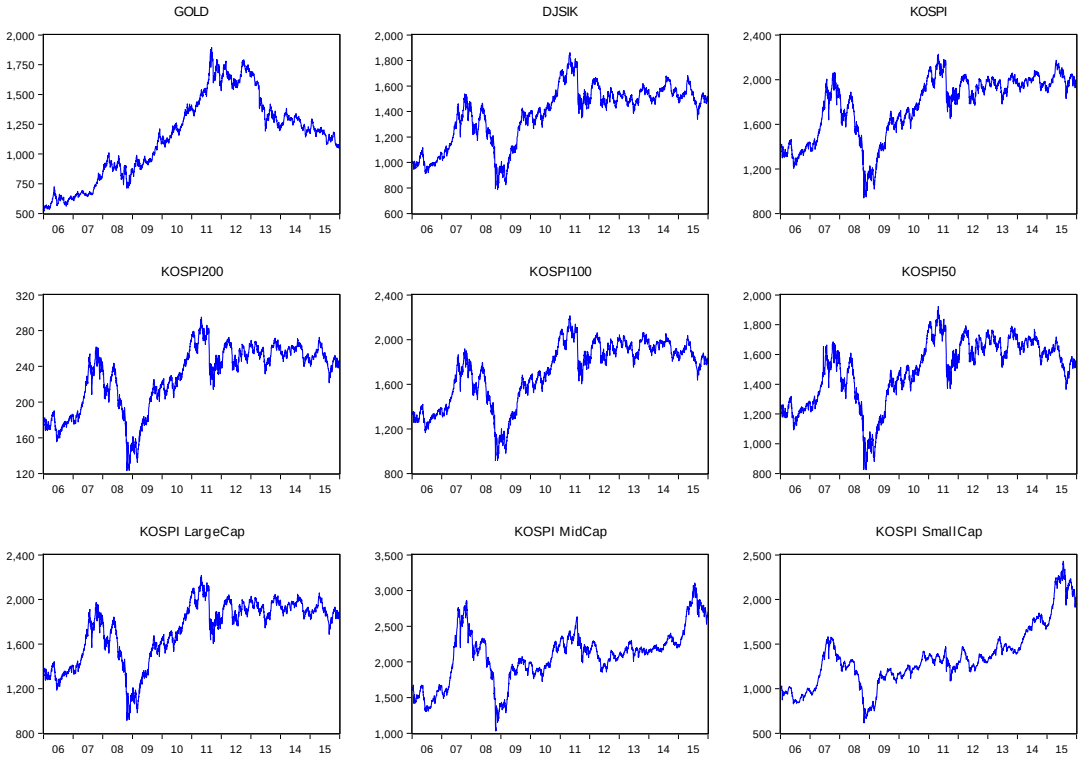

Figure1: Time Series of Gold's Price, DJSIK and KOSPI Series Indexes

Table 1 presents the descriptive statistics of gold, DJSIK and all the KOSPI series indexes for the full time period and the two sub-periods. At first glance, the mean return of gold is the highest (0.0003) and about the same as the mean return of KOSPI SmallCap. However, gold is the investment with the second lowest risk (0.0125), measured by the standard deviation of the daily return, after KOSPI Small for the full sample period. Nevertheless, during the first sub-period, the mean return of gold is the highest (0.0008) compared to all the indexes. DJSIK ranked second (0.0004) during the first sub-period. In addition, gold is the investment with the second lowest risk after KOSPI Small for the first sub-period.

During the second sub-period, gold has the lowest return but the second highest risk after KOSPI 50. The returns series of gold and the indexes suggest negative skewness and excess kurtosis, meaning that their probability distributions are skewed to the left and show a leptokurtic behavior with the tails being fatter than those of the corresponding normal distribution. The Jarque – Bera test for gold and the indexes ($p < 0.0001$) for normality confirm the non-normality of the distributions.

Table 1: Descriptive Statistics

Panel A: Descriptive Statistics for Year 2006 to 2015

Indexes	GOLD	DJSIK	KOSPI	KOSPI200	KOSPI100	KOSPI50	KOSPI LargeCap	KOSPI MidCap	KOSPI SmallCap
Mean	0.0003	0.0001	0.0001	0.0001	0.0001	7.74E-05	0.0001	0.0002	0.0003
Standard Deviation	0.0125	0.0136	0.0132	0.0136	0.0137	0.0142	0.0136	0.0135	0.0117
Skewness	-0.4160	-0.3288	-0.5710	-0.4187	-0.3818	-0.1514	-0.4549	-1.0737	-1.7223
Kurtosis	7.723831	9.9796	12.1431	11.0043	10.7906	13.6399	11.418	13.7265	16.6915
Jarque-Bera	2501.0180	5342.7240	9229.3400	7041.0130	6661.1630	12316.5200	7794.1780	13009.0500	21668.0100
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel B: Descriptive Statistics for Year 2006 to 2010

Indexes	GOLD	DJSIK	KOSPI	KOSPI200	KOSPI100	KOSPI50	KOSPI LargeCap	KOSPI MidCap	KOSPI SmallCap
Mean	0.0008	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
Standard Deviation	0.0139	0.0159	0.0156	0.0160	0.0160	0.0167	0.0160	0.0166	0.0134
Skewness	-0.2614	-0.3760	-0.6017	-0.4646	-0.4348	-0.1668	-0.5026	-1.0275	-1.7266

Kurtosis	6.1712	8.982395	10.8222	10.0879	10.00922	12.92845	10.42048	11.28843	16.1958
Jarque-Bera	561.6797	1976.7820	3405.7860	2778.6480	2712.52500	5366.0200	3049.0240	3965.0770	10116.6700
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Panel C: Descriptive Statistics for Year 2011 to 2015

Indexes	GOLD	DJSIK	KOSPI	KOSPI200	KOSPI100	KOSPI50	KOSPI LargeCap	KOSPI MidCap	KOSPI SmallCap
Mean	-0.0002	-9.60E-05	-3.43E-05	-9.25E-05	-0.0001	-0.0001	-8.04E-05	0.0001	0.0003
Standard Deviation	0.0110	0.0107	0.0101	0.0107	0.0108	0.0112	0.0107	0.0094	0.0098
Skewness	-0.7897	-0.1873	-0.3603	-0.2441	-0.2028	-0.1316	-0.2566	-0.7270	-1.4853
Kurtosis	10.3154	7.7590	7.7675	7.3437	7.1424	7.0328	7.5742	6.4427	11.7912
Jarque-Bera	3043.1810	1238.1480	1263.1800	1038.0780	941.2870	887.4224	1151.1410	758.8198	4678.5870
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 2 presents the estimations of the ARDL model for January 2006 to December 2015. During the sample period, the correlation between gold returns on the one hand, and DJSIK and KOSPI indexes on the other hand, is positive, providing evidence that gold is not an alternative investment in Korea. The $r_{s,t}$ of DJSIK, for instance, is 0.1248 (positive and significant at 1% level) signifying that the relationship between gold returns and DJSIK is positive. Hence, gold cannot be an alternative investment for DJSIK. Since the correlation is positive, however, gold can be a diversifier for the Korean indexes, including DJSIK. The contemporaneous and the lagged effects results are insignificant with negative coefficients. The $r_{s,t-1}$ of DJSIK, for instance, is -0.0087 (negative and insignificant). Consequently, we omitted the variable for the OLS estimation, suggesting that gold is a weak hedge. Since all α_3 are negative but insignificant, we conclude that neither positive nor negative news add higher volatility to the return.

To check the results for robustness, we excluded the period of the global financial crisis in 2008 to eliminate the bias due to the crisis effect. The same finding resulted, however, supporting the positive relationship between gold returns on the one hand, and DJSIK and KOSPI returns on the other hand (see Table 3). Likewise, the $r_{s,t}$ of DJSIK is 0.1436 (positive and significant at 1% level), indicating that gold is not an alternative investment.

Table 2: ARDL model for January 2006 to December 2015

Panel A: Full Sample Period								
Mean Equation					Variance Equation			
Indexes	α_0	$r_{g,t-1}$	$r_{s,t}$	$r_{s,t-1}$	α_1	$\alpha_2\varepsilon_{t-1}^2$	$\alpha_3 d_{t-1}\varepsilon_{t-1}^2$	$\alpha_4 h_{t-1}$
DJSIK	0.0003	0.0065	0.1248***	-0.0087	1.94E-06***	0.0506***	-0.0083	0.9409***
	(0.2075)	(0.7734)	(0.0000)	(0.6162)	(0.0000)	(0.0000)	(0.2424)	(0.0000)
KOPSI	0.0003	0.0054	0.1352***	-0.0121	1.96E-06***	0.0506***	-0.0086	0.9409***
	(0.2110)	(0.8117)	(0.0000)	(0.5125)	(0.0000)	(0.0000)	(0.1879)	(0.0000)
KOPSI200	0.0003	0.0065	0.1272****	-0.0136	1.96E-06***	0.0500***	-0.0081	0.9411***
	(0.1988)	(0.7751)	(0.0000)	(0.4418)	(0.0000)	(0.0000)	(0.2502)	(0.0000)
KOSPI100	0.0003	0.0067	0.1248***	-0.0142	1.97E-06***	0.0498***	-0.0078	0.9411***
	(0.1956)	(0.7683)	(0.0000)	(0.4190)	(0.0000)	(0.0000)	(0.2631)	(0.0000)
KOSPI50	0.0003	0.0069	0.1025***	-0.0056	1.97E-06***	0.0484***	-0.0062	0.9416***
	(0.1897)	(0.7624)	(0.0000)	(0.7333)	(0.0000)	(0.0000)	(0.3648)	(0.0000)
Panel B: Robustness Analysis								
KOSPI LargeCap	0.0003	0.0067	0.1307***	-0.0151	1.96E-06***	0.0502***	-0.0085	0.9411***
	(0.1997)	(0.7666)	(0.0000)	(0.3941)	(0.0000)	(0.0000)	(0.1866)	(0.0000)
KOSPI MidCap	0.0002	0.0041	0.1090***	-0.0075	1.97E-06***	0.0501***	-0.0043	0.9392***
	(0.2626)	(0.8559)	(0.0000)	(0.6919)	(0.0000)	(0.0000)	(0.5277)	(0.0000)
KOSPI SmallCap	0.0002	0.0024	0.1054***	-0.0186	1.94E-06***	0.0488***	-0.0045	0.9412***
	(0.2609)	(0.9154)	(0.0000)	(0.3529)	(0.0000)	(0.0000)	(0.5710)	(0.0000)

Note: *** significant at 1%

Table 3: ARDL model for January 2006 to December 2015 (excluding 16 September 2008 to 30 May 2009)

Panel A: Full Sample Period								
Mean Equation					Variance Equation			
Indexes	α_0	$r_{g,t-1}$	$r_{s,t}$	$r_{s,t-1}$	α_1	$\alpha_2\varepsilon_{t-1}^2$	$\alpha_3 d_{t-1}\varepsilon_{t-1}^2$	$\alpha_4 h_{t-1}$
DJSIK	0.0002	0.0128	0.1436***	-0.0154	2.54E-06***	0.0243***	0.0187**	0.9450***
	(0.3145)	(0.5876)	(0.0000)	(0.4078)	(0.0000)	(0.0000)	(0.0295)	(0.0000)
KOPSI	0.0002	0.0122	0.1538***	-0.0208	2.14E-06****	0.0465***	-0.0114*	0.9433***
	(0.3216)	(0.6040)	(0.0000)	(0.2984)	(0.0000)	(0.0000)	(0.0960)	(0.0000)
KOPSI200	0.0002	0.0132	0.1446***	-0.0216	2.15E-06***	0.0460***	-0.0110	0.9434***
	(0.3044	(0.5759)	(0.0000)	(0.2582)	(0.0000)	(0.0000)	(0.1064)	(0.0000)
KOSPI100	0.0002	0.0134	0.1419***	-0.0221	2.16E-06***	0.0459***	-0.0108	0.9434***
	(0.2989)	(0.5694)	(0.0000)	(0.2419)	(0.0000)	(0.0000)	(0.1120)	(0.0000)
KOSPI50	0.0002	0.0136	0.1155***	-0.0101	2.18E-06***	0.0445***	-0.0090	0.9438***
	(0.2884)	(0.5671)	(0.0000)	(0.5578)	(0.0000)	(0.0000)	(0.1708)	(0.0000)
Panel B: Robustness Analysis								
KOSPI LargeCap	0.0002	0.0136	0.1487***	-0.0239	2.14E-06***	0.0462***	-0.0113*	0.9435***
	(0.3067)	(0.5654)	(0.0000)	(0.2129)	(0.0000)	(0.0000)	(0.0987)	(0.0000)
KOSPI MidCap	0.0002	0.0116	0.1219***	-0.0145	2.19E-06***	0.0462***	-0.0067	0.9410
	(0.3846)	(0.6258)	(0.0000)	(0.4805)	(0.0000)	(0.0000)	(0.3108)	(0.0000)
KOSPI SmallCap	0.0002	0.0092	0.1156***	-0.0279	2.25E-06***	0.0450***	-0.0055	0.9411***
	(0.3671)	(0.6989)	(0.0000)	(0.1980)	(0.0000)	(0.0000)	(0.3893)	(0.0000)

Note: *** significant at 1%

Table 4 presents the results of the ARDL model for the period between January 2006 and December 2010. We found that the relationship between the gold returns and DJSIK and KOSPI indexes returns are positive and provide Korean investors with a weak hedge, but not a safe haven during the sub-period that includes the 2008 financial crisis. Moreover, we noticed that positive news contributes more volatility to the returns of DJSIK and KOSPI than does negative news. For instance, α_3 of DJSIK is -0.0412 ($p < .001$) implying that positive news contributes more volatility to the DJSIK than does negative news. Even though the financial crisis happened in 2008, the Korean government implemented the Green New Deal in January 2009 to stimulate sustainable economic growth. Hence, the positive news created volatility in the first sub-period.

Table 4: ARDL model for January 2006 to December 2010

Panel A: First Sub-Period

	Mean Equation				Variance Equation			
Indexes	α_0	$r_{g,t-1}$	$r_{s,t}$	$r_{s,t-1}$	α_1	$\alpha_2\varepsilon_{t-1}^2$	$\alpha_3 d_{t-1}\varepsilon_{t-1}^2$	$\alpha_4 h_{t-1}$
DJSIK	0.0009	-0.0034	0.1362***	-0.0020	8.95E-07*	0.0727***	-0.0412***	0.9449***
	(0.0035)	(0.9112)	(0.0000)	(0.9302)	(0.0576)	(0.0000)	(0.0014)	(0.0000)
KOPSI	0.0009	-0.0053	0.1440***	-0.0005	8.94E-07*	0.0722***	-0.0413***	0.9454***
	(0.0032)	(0.8618)	(0.0000)	(0.9843)	(0.0588)	(0.0000)	(0.0012)	(0.0000)
KOPSI200	0.0009***	-0.0043	0.1392***	-0.0030	8.90E-07*	0.0725***	-0.0416***	0.9454***
	(0.0031)	(0.8877)	(0.0000)	(0.8979)	(0.0597)	(0.0000)	(0.0011)	(0.0000)
KOSPI100	0.0009***	-0.0042	0.1389***	-0.0035	8.87E-07*	0.0726***	-0.0418***	0.9454***
	(0.0030)	(0.8886)	(0.0000)	(0.8798)	(0.0606)	(0.0000)	(0.0011)	(0.0000)
KOSPI50	0.0010***	-0.0030	0.1096***	0.0098	8.79E-07*	0.0713***	-0.0401***	0.9459***
	(0.0025)	(0.9214)	(0.0000)	(0.6409)	(0.0682)	(0.0000)	(0.0016)	(0.0000)

Panel B: Robustness Analysis								
KOSPI LargeCap	0.0009***	-0.0047	0.1408***	-0.0034	8.82E-07*	0.0726***	-0.0419***	0.9455***
	(0.0030)	(0.8767)	(0.0000)	(0.8827)	(0.0611)	(0.0000)	(0.0011)	(0.0000)
KOSPI MidCap	0.0009***	-0.0017	0.1131***	0.0014	9.77E-07*	0.0694***	-0.0362***	0.9450***
	(0.0037)	(0.9639)	(0.0000)	(0.9501)	(0.0503)	(0.0000)	(0.0041)	(0.0000)
KOSPI SmallCap	0.0009***	-0.0015	0.1208***	-0.0054	8.26E-07*	0.0686***	-0.0385***	0.9484***
	(0.0035)	(0.9603)	(0.0000)	(0.8441)	(0.0883)	(0.0000)	(0.0016)	(0.0000)

Note: ***,* significant at 1% and 10%

Table 5 presents the ARDL model for the period between January 2011 and December 2015. Consistent with the result in Table 2, the relationship between gold returns on the one side, and DJSIK KOSPI indexes returns on the other side, suggest that gold is a strong diversifier for these indexes because the model found significantly negative coefficients. This result demonstrates that gold can be a hedge in the second sub-period. Nevertheless, the result differs from Table 3 because it suggests that negative news contributes more volatility to the returns than does positive news during the second sub-period.

Table 5: ARDL model for January 2011 to December 2015

Second Sub-Period	Mean Equation				Variance Equation			
Indexes	α_0	$r_{g,t-1}$	$r_{s,t}$	$r_{s,t-1}$	α_1	$\alpha_2\varepsilon_{t-1}^2$	$\alpha_3 d_{t-1}\varepsilon_{t-1}^2$	$\alpha_4 h_{t-1}$
DJSIK	-0.0003	-0.0037	0.0882***	-0.0442	2.54E-06***	0.0243***	0.0187**	0.9450***
	(0.3547)	(0.9120)	(0.0003)	(0.1181)	(0.0000)	(0.0000)	(0.0295)	(0.0000)
KOPSI	-0.0003	0.0038	0.1014***	-0.0525*	2.61E-06***	0.0248***	0.0184**	0.9440***
	(0.3488)	(0.9101)	(0.0001)	(0.0672)	(0.0000)	(0.0000	(0.0302)	(0.0000)
KOPSI200	-0.0003	0.0045	0.0926***	-0.0505*	2.59E-06***	0.0241***	0.0188**	0.9446***
	(0.3533)	(0.8954)	(0.0001)	(0.0649)	(0.0000)	(0.0000)	(0.0266)	(0.0000)

Second Sub-Period	Mean Equation				Variance Equation			
Indexes	α_0	$r_{g,t-1}$	$r_{s,t}$	$r_{s,t-1}$	α_1	$\alpha_2\varepsilon_{t-1}^2$	$\alpha_3 d_{t-1}\varepsilon_{t-1}^2$	$\alpha_4 h_{t-1}$
KOSPI100	-0.0003	0.0044	0.0884***	-0.0502*	2.59E-06***	0.0278***	0.0192**	0.9448***
	(0.3714)	(0.8957)	(0.0002)	(0.0635)	(0.0000)	(0.0000)	(0.0227)	(0.0000)
KOSPI50	-0.0003	0.0043	0.0778***	-0.0477*	2.58E-06***	0.0230***	0.0200**	0.9453***
	(0.3464)	(0.8973)	(0.0009)	(0.0714)	(0.0000)	(0.0000)	(0.0174)	(0.0000)
Panel B: Robustness Analysis								
KOSPI LargeCap	-0.0003	0.0054	0.0986***	-0.0537**	2.59E-06***	0.0242***	0.0184**	0.9447***
	(0.3548)	(0.8728)	(0.0001)	(0.0495)	(0.0000)	(0.0000)	(0.0317)	(0.0000)
KOSPI MidCap	-0.0003	-0.0012	0.0788***	-0.0366	2.66E-06***	0.0266***	0.0215***	0.9406***
	(0.3086)	(0.9710)	(0.0037)	(0.2384)	(0.0000)	(0.0000)	(0.0054)	(0.0000)
KOSPI SmallCap	-0.0003	-0.0030	0.0671***	-0.0461*	2.67E-06***	0.0242***	0.0222***	0.9422***
	(0.3316)	(0.9293)	(0.0121)	(0.0972)	(0.0000)	(0.0000)	(0.0026)	(0.0000)

Note: ***,**, * significant at 1%, 5% and 10%

Conclusion

We analyzed whether gold is a hedge, a safe haven, or a diversifier for socially responsible investment and conventional investment in Korea. We used daily returns of gold, BJSIK and different KOSPI indexes between January 2006 and December 2015. The data included the implementation period of the Korean Green New Deal and the 2008 financial crisis. To analyze the data, we used an ARDL model.

Our results suggest that gold is a weak hedge and a diversifier but not a safe haven for both SRI and conventional investments. This result differs from Baur and McDermott's (2010) as well as Beckmann et al.'s (2015) finding that gold is both a hedge and a safe haven. The implementation of the Korean Green New Deal in January 2009 might have influenced our results because this policy aims to stimulate the economy to grow in a sustainable manner. This positive news influenced the negative fluctuation that was expected to occur in the stock market during this time.

Splitting the time series into two five-year sub-periods lead to the result that gold is a weak safe haven in the first sub-period, including the financial crisis. This finding is in contrast to Coudert and Raymond's (2011) who found gold to be a hedge during times of downturn. Our result suggests, however, that gold is a hedge in the second sub-period.

The results of this analysis show that gold can act as a weak hedge, a weak safe haven, and as a diversifer in Korea in different sub-periods. This is an important finding because Korea is one of the fastest growing and developing countries in Asia and part of the Organisation for Economic Co-operation and Development (OECD) that strives to improve the economic and social well-being of people around the world. In other words, the Korean economy is fast growing and stable enough to withstand external shocks that could be detrimental to the economy.

Furthermore, in line with Baur (2012), our study suggests that neither negative nor positive shocks have greater impacts on the volatility of the SRI index for the full sample period. While positive shocks contributed more to the volatility in the first sub-period, negative shocks contributed more to the volatility in the second phase. This finding is consistent with Aggarwal et al. (1999) who found the volatility of emerging markets increases whenever there are social, political, and economic events.

Finally, the findings of this paper provide a noteworthy practical implication for investors. We suggest that investors consider including gold in their portfolio, particularly during times of financial crisis for both SRI and conventional investment.

References

Agarwal, R., Inclan, C. and Leal, R. (1999). Volatility in Emerging Stock Markets. Journal of Financial and Quantitative Analysis, 34(01), 33-55

Anand, R. and Madhogaria, S. (2012). Is Gold A 'Safe-Haven'?-An Econometric Analysis. Procedia Economics and Finance, 1, 24-33.

Ang, W. R. (2015). Sustainable Investment In Korea Does Not Catch A Cold When The United States Sneezes. Journal of Sustainable Finance and Investment, 5(1-2), 16-26.

Ang, W. R., Gregoriou, G. N., and Lean, H. H. (2014). Market-Timing Skills of Socially Responsible Investment Fund Managers: The Case of North America versus Europe. Journal of Asset Management, 15(6), 366-377.

Ang, W.R. and Lean, H.H., (2013). Socially Responsible Investing Funds in Asia Pacific. In Emerging Markets and Financial Resilience (169-190). Palgrave Macmillan UK.

Baur, D.G. (2012). Asymmetric Volatility in the Gold Market. The Journal of Alternative Investment, 14(4), 26-38.

Baur, D. G., and Lucey, B. M. (2010). Is Gold A Hedge Or A Safe Haven? An Analysis of Stocks, Bonds and Gold. Financial Review, 45(2), 217-229.

Baur, D.G. and McDermott, T.K. (2010). Is Gold a Safe Haven? International Evidence. Journal of Banking and Finance, 34(8), 1886-1898.

Beckmann, J., Berger, T. and Czudaj, R. (2015). Does Gold Act as a Hedge or a Safe Haven for Stocks? A Smooth Transition Approach. Economic Modelling, 48, 16-24.

Capie, F., Mills, T. C., and Wood, G. (2005). Gold as a Hedge against the Dollar. Journal of International Financial Markets, Institutions and Money, 15(4), 343-352.

Ciner, C., Gurdgiev, C. and Lucey, B.M. (2013). Hedges and Safe Havens: An Examination of Stocks, Bonds, Gold, Oil And Exchange Rates. International Review of Financial Analysis, 29, 202-211.

Coudert, V. and Raymond, H. (2011). Gold and Financial Assets: Are There Any Safe Havens in Bear Markets. Economics Bulletin, 31(2), 1613-1622.

Dee, J., Li, L. and Zheng, Z. (2013). Is Gold a Hedge or a Safe Haven? Evidence from Inflation and Stock Market. International Journal of Development and Sustainability, 2(1), 1-16.

Friede, G., Busch, T., and Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. Journal of Sustainable Finance and Investment, 5(4), 210-233. doi:10.1080/20430795.2015.1118917

Ghazali, M.F., Lean, H.H. and Bahari, Z. (2015). Shariah Compliant Gold Investment In Malaysia: Hedge or Safe Haven? Pacific-Basin Finance Journal, 34, 192-204.

Ghazali, M.F., Lean, H.H. and Bahari, Z. (2013). Is Gold a Hedge or a Safe Haven? An Empirical Evidence of Gold and Stocks in Malaysia. International Journal of Business and Society, 14(3), 428-443.

Hood, M. and Malik, F., (2013). Is Gold the Best Hedge and a Safe Haven under Changing Stock Market Volatility? Review of Financial Economics, 22(2), 47-52.

Iqbal, J., (2017). Does Gold Hedge Stock Market, Inflation and Exchange Rate Risks? An Econometric Investigation. International Review of Economics and Finance, 48, 1-17.

Jones, A.T. and Sackley, W.H., (2016). An Uncertain Suggestion for Gold-Pricing Models: The Effect of Economic Policy Uncertainty on Gold Prices. Journal of Economics and Finance, 40(2), 367-379.

Joy, M. (2011). Gold and the US Dollar: Hedge or Haven? Finance Research Letters, 8(3), 120-131.

Konar, S. and Cohen, M.A. (2001). Does the Market Value Environmental Performance? Review of economics and statistics, 83(2), 281-289.

Le, T.H. and Chang, Y. (2012). Oil Price Shocks and Gold Returns. International Economics, 131, 71-103.

Lean, H.H., Ang, W.R., and Smyth, R. (2015). Performance and Performance Persistence of Socially Responsible Investment Funds in Europe and North America. The North American Journal of Economics and Finance, 34, 254-266.

Lean, H. H., Ang, W. R., and Smyth, R. (2014). Performance Persistence of Socially Responsible Investment Funds in the Asia Pacific Region (Vol. 2, 377-392). G. Gregoriou, and D. Lee (Eds.). Oxford: Academic Press Inc.

Liu, C.S., Chang, M.S., Wu, X. and Chui, C.M., (2016). Hedges or Safe Havens—Revisiting the Role of Gold and USD against Stock: A Multivariate Extended Skew-T Copula Approach. Quantitative Finance, 16(11),1763-1789.

Lucey, B. and O'Connor, F. (2017). Are gold bugs coherent? Applied Economics Letters, 24(2), 90-94.

Malik, F. (2011). Estimating the Impact of Good News on Stock Market Volatility. Applied Financial Economics, 21(8), pp.545-554.

Oh, W.Y., Chang, Y.K. and Martynov, A. (2011). The Effect of Ownership Structure on Corporate Social Responsibility: Empirical Evidence from Korea. Journal of Business Ethics, 104(2), 283-297.

Prinicples for Responsible Investment. (2016). Annual Report 2016 (pp. 75). London: Prinicples for Responsible Investment.

Reboredo, J.C. (2013). Is Gold a Safe Haven or a Hedge for the US Dollar? Implications for Risk Management. Journal of Banking and Finance, 37(8), 2665-2676.

Sherman, E.J. (1982). Gold: A Conservative, Prudent Diversifier. The Journal of Portfolio Management, 8(3), 21-27.

Śmiech, S. and Papież, M. (2017). In Search of Hedges and Safe Havens: Revisiting the Relations between Gold and Oil in the Rolling Regression Framework. Finance Research Letters, 20, 238-244.

Sparkes, R. and Cowton, C.J., (2004). The Maturing of Socially Responsible Investment: A Review of the Developing Link with Corporate Social Responsibility. Journal of Business Ethics, 52(1), 45-57.

Van Hoang, T.H., Lahiani, A. and Heller, D., 2016. Is gold a hedge against inflation? New evidence from a nonlinear ARDL approach. Economic Modelling, 54, 54-66.

Wang, K.M., Lee, Y.M. and Thi, T.B.N. (2011). Time and Place Where Gold Acts as an Inflation Hedge: An Application of Long-Run and Short-Run Threshold Model. Economic Modelling, 28(3), 806-819.

Weber, O. and Ang, W. R. (2016). The Performance, Volatility, Persistence and Downside Risk Characteristics of Sustainable Investments in Emerging Markets. ACRN Oxford Journal of Finance and Risk Perspectives, 5(2), 1-12.

Wu, C.C. and Chiu, J. (2017). Economic Evaluation of Asymmetric and Price Range Information in Gold and General Financial Markets. Journal of International Money and Finance, 74, 53-68.