Gold in a portfolio: Why, when, and where?

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Gold in a portfolio: Why, when, and where?

ABSTRACT

In this paper, we assess the safe-haven, hedging, and diversifying properties of gold for investors located in various countries and under various economic scenarios. Specifically, we focus on G7 countries plus China and India over the 20-year period ranging from 2000 to 2020. Our empirical results show that gold is a safe haven in five out of nine countries, namely Canada, Germany, Italy, the UK and the US. We also show that the benefits of gold depend on the existing market environment as proxied by market volatility and interest rates dynamics. Overall, our results show that gold is relevant for strategic asset allocation as it may offer investors in some countries protection against significant equity market corrections. Our empirical analyses are also relevant for tactical asset allocation as we show that the safe-haven properties of gold are time-varying and may depend upon volatility state and interest rates dynamics.

Over the last two decades, stock markets around the world have experienced various episodes of extreme turbulence such as the collapse of the dot-com bubble in 2000 or the global financial crisis of 2007-2008 during which the MSCI world index fell by almost 60%. Recently, the outbreak of the COVID-19 pandemic also spread to the world's stock markets, with the MSCI world index dropping nearly 34% between February 2020 and March 2020 when many countries imposed lockdowns. Such stressful episodes lead investors to seek alternatives to the stock market and gold is often touted as being one of these alternatives. Recent trends tend to confirm this tendency. Indeed, according to the World Gold Council (2022), the "annual bar and coin investment jumped 31% to 1,180t in Q4 2021, aided by record high volumes in the US and Germany". Such interest by investors is in line with the belief that gold can play a protective role in a context of uncertainty. That being said, while the financial media often refer to gold as a safe haven, studies investigating the safe haven properties of gold are rather scarce. Notable exceptions are Baur and Lucey [2010] and Baur and McDermott [2010] who study the safe-haven and hedging properties of gold until 2005 and 2009, respectively. Both studies indicate that gold can act as both a hedge and a safe-haven depending on market conditions and investor locations. A safe haven is usually defined as an asset exhibiting a negative correlation with another asset in times of market stress. Two related but different notions are the concepts of hedging assets (hedges) and diversifying assets (diversifiers). A hedge is defined as an asset exhibiting a negative correlation with another asset *on average* (but not necessarily in times of market stress), while a diversifier simply refers to an asset featuring a less-than-perfect correlation with another asset. In that respect, a negative correlation between two asset's returns on average would indicate hedging characteristics but not necessarily safe-haven properties. To qualify as a safe-haven, the diversifying properties of an asset have to materialize when they are needed the most, i.e., in periods of market decline. These characteristics are not mutually exclusive and an asset can be both a hedge and safe-haven. Given the unique characteristics of the past decade in terms of market conditions (i.e., unprecedented monetary policy, very low interest rates and inflation) as well as the occurrence of several episodes of market stress culminating with the recent COVID-19 crisis, reassessing gold investment properties is of particular importance to investors and market participants.

The purpose of this article is to assess the safe-haven, hedging, and diversifying properties of gold for investors located in various countries and under various economic scenarios. Specifically, we focus on G7 countries plus China and India –as these two countries are the world's largest consumers of gold [McGlone, 2015]– over the 20-year period ranging from 2000 to 2020. Our results show that Gold works as a hedge for the stock market in India and in Italy, and as a safe haven for stocks in Canada, Germany, Italy, the UK and the US. These findings imply that gold, in times of market decline, provide investors with compensation for losses caused by negative stock returns through positive gold returns. We complement our main analysis by studying the properties of gold under different environments and find that gold plays a different role in calm and stress periods. During stress periods, gold serves the role of a hedge and/or a safe haven in Canada, France, Germany, India, Italy, the UK and the US, while results are much less clear in calm periods. We also find that gold properties vary depending on interest rates dynamics. Specifically, in periods of flattening yield curves, gold acts as a hedge and/or a safe haven in France, Germany, India, Italy, the UK and the US, while results are less significant during periods of steepening yield curves. In addition, we show that the benefits of gold for local investors are not simply due to exchange rate variations but rather to gold price dynamics. Our results have interesting implications in terms of asset allocation. Beyond showing that gold has interesting properties for strategic asset allocation, we offer

interesting perspectives for tactical asset allocation as well by showing that the protection offered by gold against significant equity market declines depends on the prevailing economic environment.

BACKGROUND

Various studies have attempted to analyze the role of gold in hedging against risks in stock markets but there seems to be no consensus amongst empirical works. Baur and Lucey [2010] show that gold is a hedge against stocks in the US and UK but that the result do not hold in the German market. They also find that gold is a safe haven for stocks for a limited period of approximately fifteen trading days. Following this, Baur and McDermott [2010] conduct a similar analysis in G7 countries, BRICs, Switzerland, and Australia but obtain mixed results. While gold serves as both a hedge and a safe haven for stock markets in the major European countries and in the US, no such relation is found for Australia, Japan, Canada, and BRIC countries.

Other studies confirm the safe haven property of gold in the US (e.g., Junttila et al. [2018], and Triki and Maatoug [2021]), in China (Chen and Wang [2017]), in Turkey (Tursoy and Faisal [2018]), and in some emerging markets (e.g., Wen and Cheng [2018]). A few studies confirm the hedging property of gold which helps investors hedge against risks in the stock market in the US, the UK and Japan (Choudhry et al. [2015], and He et al. [2018]). Additionally, Ali et al. [2020] show that gold is both a safe haven and a hedge in many European countries. However, other studies find opposite conclusions. For example, Shahzad et al. [2017] find that gold does not appear to be a hedge and diversifier when markets are under stress and that gold does not seem to be a safe haven for a stock portfolio. In the same vein, Drake [2021] finds that the negative relationship between gold returns and stock returns is not obvious and did not support the hedging role of gold during the COVID-19 market correction. These conflicting results likely indicate that the benefits of gold for a stock portfolio are country-specific and are dependent upon market conditions.

DATA

To analyze the safe-haven, hedging, and diversifying properties of gold, we use a sample of nine countries comprising the G7 countries (Canada, France, Germany, Italy, Japan, the UK, and the US) plus China and India. All stock price series correspond to MSCI equity indexes (with dividends reinvested) and are retrieved from Datastream. We also retrieve gold prices from Datastream and convert them into local currencies using corresponding exchange rates. The aim is to proxy for a gold investment for local investors.

All series are at the daily frequency and the period studied ranges from January 1, 2000 to July 31, 2020. Daily frequency allows us to track extreme negative returns that would not be observable on a weekly basis. This period covers three major crises (i.e., the dot-com bubble crisis, the global financial crisis, and the COVID-19 crisis) with many stalls in the equity markets, thereby offering an adequate sample for empirical investigation.

EMPIRICAL ANALYSIS

Methodology

We base our work on the methodology developed by Baur and Lucey (2010) and specify the following model, which is used to investigate the specific link between gold and stock returns in normal conditions as well as in times of financial turmoil.

$$r_{gold,t} = a + b_1 r_{stock,t} + b_2 r_{stock,t} D(q_{10\%}) + b_3 r_{stock,t} D(q_{5\%}) + b_4 r_{stock,t} D(q_{1\%}) + \varepsilon_t \quad (1)$$

In this regression equation, $r_{gold,t}$ and $r_{stock,t}$ are gold returns, stock returns at time t. $D(q_{\%})$ are dummy variables which are added to investigate the relationship between gold and stock returns in times of falling stock markets. All dummies are estimated simultaneously so that the b parameters can be viewed as vectors. When stock returns are smaller than the *q%* quantile of the return distribution, $D(q_{\%})$ will take the value of one, and zero otherwise. The chosen quantiles are 10%, 5% and 1%.

The average effect of stock returns on gold returns is measured by the coefficient b_1. If b_1 is negative and significantly different from zero, it indicates that gold returns rise on average when stock returns drop, evidencing the role of gold as a hedge for stocks. On the other hand, if b_1 is positive but lower than 1, it means that stock returns move in the same direction as gold returns, on average, showing the role of gold as a diversifier for stock portfolios.

In falling stock markets, the total effect of stock return changes on gold returns is calculated as the sum of all coefficient estimates up to the given quantile. To illustrate, in times of negative shock, the total effect of stocks on gold returns at the 5% quantile would be the sum of b_1, b_2 and b_3, assuming all these coefficients are statistically significant. Equation (1) is first run for the entire period using a GARCH (1,1) process to account for the conditional heteroskedasticity in stock returns [Baur and Lucey, 2010; Capie et al., 2005]. Doing so leads to a time-varying distribution of errors, which is compatible with the leptokurtic distribution of stock returns.

Summary statistics

Preliminary analysis of our sample data is shown in Exhibit 1. Each of the return series consists of 5,370 data points. The daily returns of both gold and stock are positive on average. The unconditional volatility of returns is measured by standard deviation. The standard deviation of daily gold returns is comprised between 1.01% and 1.1% while it ranges from 1.2% to 1.8% for daily stock returns. This means that an investment in gold, converted in local currencies, represents on average a lower level of risk than an investment in domestic stocks. We also note that while gold prices can experience significant daily declines, they are of a lower magnitude compared with equity markets (with the exception of Japan).

EXHIBIT 1
Summary statistics

	Obs.	Mean (%)	Max (%)	Min (%)	Std. Dev. (%)
Gold returns					
Canada	5,370	0.040	11.148	-7.403	1.053
China	5,370	0.038	10.757	-8.567	1.066
France	5,370	0.038	10.466	-7.955	1.012
Germany	5,370	0.038	10.466	-7.955	1.012
India	5,370	0.052	9.813	-8.446	1.083
Italy	5,370	0.038	10.466	-7.955	1.012
Japan	5,370	0.043	9.482	-10.012	1.091
UK	5,370	0.046	13.992	-8.149	1.062
US	5,370	0.042	10.951	-8.496	1.071
Stock returns					
Canada	5,370	0.029	12.703	-12.296	1.188
China	5,370	0.041	15.032	-11.937	1.702
France	5,370	0.023	24.022	-19.014	1.561
Germany	5,370	0.025	30.169	-23.292	1.666
India	5,370	0.049	17.848	-12.727	1.466
Italy	5,370	0.016	47.179	-34.598	1.837
Japan	5,370	0.014	12.360	-9.223	1.354
UK	5,370	0.019	13.784	-11.802	1.272
US	5,370	0.030	11.675	-12.118	1.236

Full-sample analysis

Exhibit 2 presents the results for the model in Equation (1). The coefficient estimates for the average effect of stocks on gold are 0.076 for Canada, 0.017 for China, -0.051 for India, -0.017 for Italy, 0.076 for Japan and 0.025 for the UK. All these estimates are statistically significant at conventional levels. These estimates imply that gold is a hedge for stocks in India and Italy but not in the other countries.

For extreme negative stock returns, the coefficient estimates are negative for the 10% quantile in Canada and the US, negative for the 5% quantile in Italy and the UK, and negative for the 1% quantile in Canada, Germany, Japan and the US. The overall effect for any quantile is given by the sum of all coefficient estimates that are statistically significant up to the chosen quantile. For example, the overall effect for the 1% quantile in the US is -0.196 (-0.097 – 0.099). This number implies that in situations where stock markets exhibit extreme negative returns (in the 1% quantile), the gold price increases in the US. This shows that gold is a safe haven for stocks in the US and implies that investors who hold gold in times of stress receive compensation for losses caused by negative stock returns through positive gold returns. Other countries in which gold appears to act as a safe haven for stocks are Canada, Germany, Italy and the UK.

EXHIBIT 2
Estimation results

	b_1	p-value	b_2	p-value	b_3	p-value	b_4	p-value	Role of gold
Canada	**0.076**	**0.000**	**-0.078**	**0.042**	-0.022	0.539	**-0.052**	**0.029**	safe haven
China	**0.017**	**0.055**	0.004	0.883	-0.024	0.388	**0.057**	**0.026**	
France	0.002	0.861	-0.008	0.741	-0.003	0.922	-0.011	0.543	
Germany	-0.005	0.597	0.025	0.304	0.009	0.700	**-0.066**	**0.000**	safe haven
India	**-0.051**	**0.000**	-0.045	0.124	0.032	0.294	0.032	0.229	hedge
Italy	**-0.017**	**0.062**	**0.044**	**0.070**	**-0.057**	**0.021**	-0.018	0.232	hedge, safe haven
Japan	**0.076**	**0.000**	-0.007	0.842	**0.084**	**0.009**	**-0.045**	**0.022**	
UK	**0.025**	**0.036**	0.030	0.395	**-0.112**	**0.001**	**0.048**	**0.012**	safe haven
US	-0.003	0.848	**-0.097**	**0.010**	0.034	0.384	**-0.099**	**0.000**	safe haven

Sub-sample analyses

In this section, we examine whether the results based on the full sample period are also valid in subsamples. The aim is to investigate the time-varying properties of gold as a safe haven. This information is of paramount importance within an asset allocation process, especially given the fact that the benefits of investing in gold have been shown to be time-period dependent [Johnson and Soenen, 1997; Ratner and Klein, 2008]. In a first analysis, we divide the sample in periods of calm and stress based on market volatility in order to determine whether the role of gold is different in these market conditions. Specifically, we divide our sample into two subsamples according to stock volatility. Stress periods include pairs of gold and stock returns when the volatility of stock returns is above the median volatility. Calm periods include pairs of gold and stock returns where the volatility of stock returns is below the median volatility. Results are presented in Exhibit 3 and show that gold plays a different role in calm and stress periods. During stress periods, gold serves the role of a hedge and/or a safe

haven in seven out of nine countries: Canada, France, Germany, India, Italy, the UK and the US. During calm periods, on the other hand, results are not as clear as gold appears to be a safe haven only in France and in the US. The difference in results between the stress and calm periods implies that gold plays a different role depending on stock market volatility and that it features much stronger hedging and safe-haven properties when the stock markets are stressed.

EXHIBIT 3
Estimation results: sub-sample analysis according to volatility state

	b_1	p-value	b_2	p-value	b_3	p-value	b_4	p-value	Role of gold
Stress period									
Canada	**0.056**	**0.002**	0.010	0.818	**-0.153**	**0.001**	0.020	0.464	safe haven
China	**0.027**	**0.006**	-0.033	0.213	0.044	0.146	-0.001	0.976	
France	0.006	0.516	-0.014	0.615	0.027	0.346	**-0.064**	**0.003**	safe haven
Germany	0.002	0.846	**0.082**	**0.003**	**-0.091**	**0.002**	**-0.037**	**0.085**	safe haven
India	**-0.056**	**0.000**	0.009	0.762	0.038	0.313	**-0.062**	**0.085**	hedge, safe haven
Italy	**-0.020**	**0.020**	-0.019	0.483	0.009	0.760	-0.016	0.375	hedge
Japan	**0.076**	**0.000**	**0.060**	**0.085**	-0.001	0.971	-0.002	0.930	
UK	**0.030**	**0.031**	**-0.072**	**0.053**	-0.002	0.951	0.016	0.536	safe haven
US	**-0.026**	**0.099**	-0.027	0.420	-0.041	0.253	**0.069**	**0.048**	hedge
Calm period									
Canada	**0.192**	**0.002**	-0.250	0.180	0.018	0.935	-0.243	0.451	
China	-0.030	0.505	-0.106	0.433	0.018	0.916	-0.313	0.217	
France	-0.009	0.841	0.123	0.351	**-0.285**	**0.097**	-0.082	0.700	safe haven
Germany	-0.032	0.467	0.136	0.256	-0.013	0.938	0.365	0.151	
India	-0.069	0.256	-0.038	0.820	-0.089	0.661	0.243	0.407	
Italy	0.042	0.310	**0.242**	**0.047**	-0.163	0.282	0.192	0.331	
Japan	0.031	0.516	-0.081	0.616	0.272	0.112	-0.259	0.359	
UK	**0.160**	**0.002**	-0.097	0.504	-0.203	0.287	-0.240	0.448	
US	**0.144**	**0.042**	-0.187	0.456	0.389	0.157	**-0.564**	**0.087**	safe haven

In a second analysis, we divide our sample into periods of steepening yield curves and periods of flattening yield curves. The slope of the yield curve has been well documented as a leading

indicator for real economic activity (e.g., Estrella and Hardouvelis [1991]). A flattening of the yield curve may forecast a decrease in future spot interest rates, which is in turn associated with a lower level of real GDP. Insofar as it is considered a predictor of future economic growth, it follows that the steepening/flattening of the yield curve should be associated with environments more or less favorable to gold versus stocks [Ma and Patterson, 2013]. Results are presented in Exhibit 4. During periods of flattening yield curves, gold acts as a hedge and/or a safe haven in France, Germany, India, Italy, the UK and the US. During periods of steepening yield curves, on the other hand, the results are less significant as gold appears to act as a safe haven only in Canada and China, and as a hedge in India.

EXHIBIT 4
Estimation results: sub-sample analysis according to yield curve changes

	b_1	p-value	b_2	p-value	b_3	p-value	b_4	p-value	Role of gold
Flattening yield curve									
Canada	**0.038**	**0.073**	-0.047	0.318	0.047	0.352	0.040	0.388	
China	0.015	0.558	-0.028	0.600	0.085	0.197	0.041	0.529	
France	0.000	0.975	-0.009	0.776	0.039	0.230	**-0.057**	**0.027**	safe haven
Germany	0.000	0.976	0.034	0.232	0.004	0.896	**-0.057**	**0.019**	safe haven
India	**-0.149**	**0.000**	-0.087	0.480	0.008	0.945	**0.130**	**0.046**	hedge
Italy	**-0.022**	**0.061**	**0.079**	**0.018**	**-0.057**	**0.093**	**-0.059**	**0.006**	hedge, safe haven
Japan	**0.077**	**0.000**	0.047	0.241	0.022	0.588	-0.045	0.123	
UK	**0.057**	**0.002**	0.044	0.331	**-0.089**	**0.034**	0.047	0.242	safe haven
US	-0.017	0.428	**-0.101**	**0.047**	-0.014	0.789	**0.073**	**0.035**	safe haven
Steepening yield curve									
Canada	**0.071**	**0.002**	0.003	0.962	-0.031	0.635	**-0.136**	**0.000**	safe haven
China	**0.039**	**0.060**	0.077	0.226	**-0.138**	**0.048**	**0.105**	**0.023**	safe haven
France	0.006	0.650	0.007	0.868	-0.004	0.928	0.045	0.151	
Germany	-0.011	0.452	0.035	0.354	-0.018	0.670	-0.001	0.969	
India	**-0.169**	**0.000**	-0.026	0.772	-0.041	0.659	0.007	0.911	hedge
Italy	-0.011	0.441	-0.005	0.886	-0.012	0.764	0.025	0.327	
Japan	**0.086**	**0.000**	-0.029	0.647	-0.028	0.672	0.034	0.444	
UK	0.015	0.333	0.012	0.820	-0.015	0.794	-0.043	0.246	
US	0.025	0.188	0.058	0.297	-0.078	0.172	-0.001	0.982	

Controlling for the impact of exchange rates

We have focused on the potential benefits of gold for local investors. Obviously, because gold is traded in US dollars, the exchange rate between the US dollar and local currencies may have an important impact on hedging and safe-haven benefits for local investors [Faugère and Van Erlach, 2005]. To determine whether the hedge and safe-haven characteristics we uncovered in our previous analyses are due to gold price dynamics and not to exchange rate changes, we rerun our models assuming a currency-hedged gold exposure. Results for the full sample are presented in Exhibit 5. We see that a currency-hedged investment in gold is a hedge for stocks in France, Germany, Italy and the UK. Our results also show that a currency-hedged investment in gold is a safe haven for stocks in Canada, Germany, India, Italy, the UK, and the US. Overall, our analysis reveals that the hedge and safe-haven properties of gold for local investors are not simply due to exchange rates movements.

EXHIBIT 5
Estimation results for a currency-hedged investment in gold

	b_1	p-value	b_2	p-value	b_3	p-value	b_4	p-value	Role of gold
Canada	**0.069**	**0.000**	0.038	0.340	**-0.069**	**0.060**	0.002	0.923	safe haven
China	**0.022**	**0.022**	0.025	0.357	-0.045	0.113	**0.054**	**0.034**	
France	**-0.072**	**0.000**	-0.002	0.942	0.009	0.720	0.019	0.158	hedge
Germany	**-0.075**	**0.000**	-0.004	0.862	**0.056**	**0.032**	**-0.030**	**0.051**	hedge, safe haven
India	**0.035**	**0.001**	**-0.051**	**0.100**	0.048	0.120	-0.015	0.534	safe haven
Italy	**-0.062**	**0.000**	**0.048**	**0.050**	-0.021	0.443	-0.011	0.520	hedge, safe haven
Japan	-0.018	0.168	-0.010	0.781	0.034	0.359	-0.030	0.249	
UK	**-0.068**	**0.000**	0.052	0.156	**-0.077**	**0.027**	**0.082**	**0.000**	hedge, safe haven
US	-0.003	0.848	**-0.097**	**0.010**	0.034	0.384	**-0.099**	**0.000**	safe haven

As before, we complement these results by conducting sub-sample analyses based on market conditions and yield curve dynamics. Results are reported in Exhibits 6 and 7.

Focusing on stock market volatility states, our results show once more that a currency-hedged investment in gold plays a different role in calm and stress periods. During stress periods, a currency-hedged investment in gold serves the role of a hedge and/or a safe haven in eight out of nine countries: Canada, France, Germany, India, Italy, Japan, the UK and the US. Specifically, safe-haven characteristics materialize in Canada, Germany, India, Italy and Japan. During calm periods, on the other hand, results are more nuanced as a currency-hedged investment in gold appears to be a safe haven only in France and in the US.

During periods of flattening yield curves, a currency-hedged investment in gold acts as a safe haven in, France, Japan, and the US, while acting as a hedge in France, Germany, Italy,

and the UK). During periods of steepening yield curves, as before, the results are less significant as a currency-hedged investment in gold appears to act as a safe haven only in China (while it appears to be a hedge in France, Germany, Italy and the UK).

The difference in results between the stress and calm periods as well as between periods of flattening and steepening yield curve confirms that gold plays a different role depending on market states and that these attributes are not simply the results of exchange rate influences.

EXHIBIT 7
Estimation results for a currency-hedged investment in gold: sub-sample analysis according to volatility state

	b_1	p-value	b_2	p-value	b_3	p-value	b_4	p-value	Role of gold
Stress period									
Canada	**0.077**	**0.000**	**0.086**	**0.056**	**-0.197**	**0.000**	**0.100**	**0.000**	safe haven
China	**0.034**	**0.001**	-0.038	0.169	0.045	0.147	-0.009	0.790	
France	**-0.067**	**0.000**	0.027	0.353	-0.010	0.711	-0.013	0.468	hedge
Germany	**-0.071**	**0.000**	**0.084**	**0.003**	**-0.057**	**0.075**	-0.008	0.678	hedge, safe haven
India	**0.032**	**0.008**	-0.003	0.927	0.040	0.259	**-0.083**	**0.013**	safe haven
Italy	**-0.058**	**0.000**	-0.041	0.158	**0.102**	**0.002**	**-0.045**	**0.035**	hedge, safe haven
Japan	-0.011	0.470	**0.095**	**0.009**	**-0.171**	**0.000**	**0.098**	**0.001**	safe haven
UK	**-0.055**	**0.000**	0.012	0.738	-0.033	0.370	**0.057**	**0.018**	hedge
US	**-0.026**	**0.099**	-0.027	0.420	-0.041	0.253	**0.069**	**0.048**	hedge
Calm period									
Canada	0.101	0.121	-0.086	0.651	-0.113	0.631	-0.029	0.939	
China	-0.043	0.347	-0.102	0.448	0.052	0.759	-0.356	0.174	
France	**-0.146**	**0.003**	0.176	0.228	**-0.387**	**0.028**	-0.054	0.867	hedge, safe haven
Germany	**-0.166**	**0.001**	0.209	0.142	-0.163	0.368	0.300	0.231	hedge
India	-0.001	0.991	0.111	0.514	-0.245	0.238	0.211	0.451	
Italy	-0.066	0.192	**0.221**	**0.076**	-0.090	0.579	0.164	0.490	
Japan	**-0.111**	**0.041**	-0.050	0.777	**0.340**	**0.080**	-0.348	0.297	hedge
UK	-0.068	0.239	-0.022	0.890	-0.167	0.396	-0.096	0.782	
US	**0.144**	**0.042**	-0.187	0.456	0.389	0.157	**-0.564**	**0.087**	safe haven

EXHIBIT 8
Estimation results for a currency-hedged investment in gold: sub-sample analysis according to yield curve changes

	b_1	p-value	b_2	p-value	b_3	p-value	b_4	p-value	Role of gold
Flattening yield curve									
Canada	**0.043**	**0.065**	0.028	0.591	0.059	0.259	-0.046	0.316	
China	0.017	0.527	-0.030	0.581	0.077	0.240	0.040	0.539	
France	**-0.081**	**0.000**	-0.016	0.666	**0.062**	**0.067**	-0.021	0.445	hedge, safe haven
Germany	**-0.056**	**0.000**	-0.027	0.376	0.040	0.169	0.036	0.153	hedge
India	-0.010	0.790	-0.037	0.781	0.052	0.689	0.023	0.669	
Italy	**-0.062**	**0.000**	0.009	0.784	-0.005	0.898	-0.005	0.822	hedge
Japan	-0.013	0.476	0.027	0.556	0.038	0.401	**-0.081**	**0.004**	safe haven
UK	**-0.080**	**0.000**	0.077	0.103	-0.021	0.639	**0.104**	**0.015**	hedge
US	-0.017	0.428	**-0.101**	**0.047**	-0.014	0.789	**0.073**	**0.035**	safe haven
Steepening yield curve									
Canada	**0.081**	**0.000**	0.089	0.151	-0.052	0.426	-0.055	0.132	
China	**0.040**	**0.055**	0.084	0.182	**-0.145**	**0.037**	**0.105**	**0.022**	safe haven
France	**-0.058**	**0.000**	0.024	0.603	0.044	0.382	0.005	0.871	hedge
Germany	**-0.092**	**0.000**	0.061	0.174	-0.025	0.617	-0.045	0.205	hedge
India	-0.038	0.227	-0.023	0.803	-0.026	0.792	**0.114**	**0.088**	
Italy	**-0.050**	**0.000**	**0.081**	**0.042**	-0.041	0.344	-0.010	0.687	hedge
Japan	-0.032	0.166	-0.083	0.229	0.052	0.475	-0.059	0.324	
UK	**-0.045**	**0.015**	0.054	0.338	-0.012	0.847	-0.028	0.422	hedge
US	0.025	0.188	0.058	0.297	-0.078	0.172	-0.001	0.982	

COVID-19 crisis: portfolio analysis

In this section, we complement our previous findings by analyzing the average cumulated returns of gold and stocks for the period of 100 trading days after the extreme negative shock of the Covid-19 crisis. The purpose of this analysis is to illustrate the behavior of gold and stock returns following an extreme shock in the stock market. First, we calculate

the value of the 1% quantile of the stock returns distribution. We then use as a starting point the first day of March 2020 on which stock returns fall below the value of this 1% quantile. Next, we calculate the cumulated stock returns and gold returns for each day after the initial shock. Exhibit 8 shows the cumulated gold and stock returns after that initial extreme negative stock return for Canada, China, France, Germany, India, Italy, Japan, the UK and the US. The plots show that the cumulated gold return is systematically higher than the cumulated stock returns following the initial shock and tends to remain higher for many days. Specifically, in all countries, the cumulated return on gold is still higher than the cumulated stock return 100 days after the initial shock. This indicates that gold may protect investors in times of stock market corrections. The performance differential between gold and stock is more or less pronounced depending on the country being considered, and relates to both equity market dynamics and the change in exchange rate between the US dollar and domestic currencies. While the outperformance of gold is clear in Canada, France, Germany, India, Italy, and the UK, it is more moderate in China, Japan, and the US.

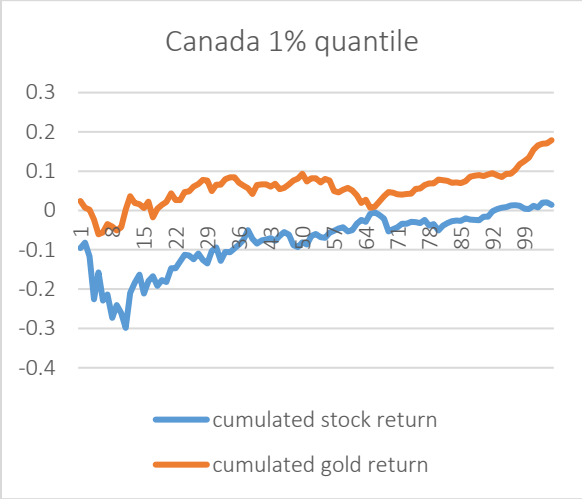
CONCLUSION

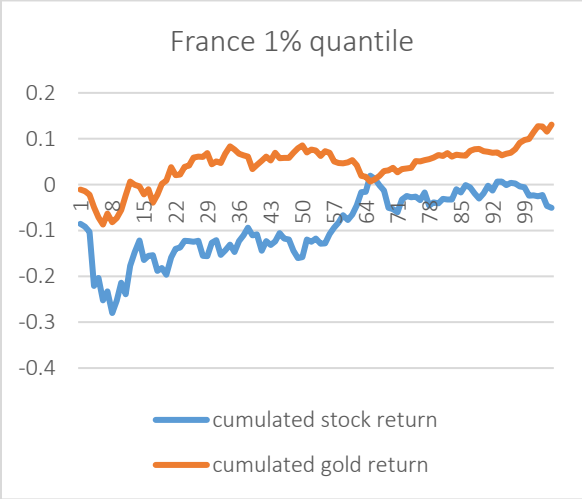
This paper analyzes whether gold works as a safe haven asset for stocks. A safe haven asset is different from a hedge and a diversifier, which provide diversification benefits on average but not necessarily when they are needed the most, i.e., in times of market stress. We revisit the connection between gold and stock markets by employing a methodology based on Baur and Lucey (2010) and extend the analysis by splitting our sample into different market environments. The sampling period runs from January 2000 to July 2020, and includes three major equity market crises.

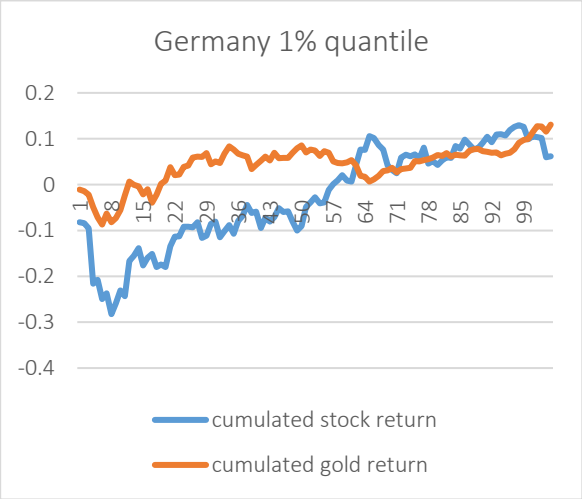
Our empirical results show that gold is a safe haven in six out of eight countries, namely Canada, France, Germany, Italy, the UK and the US. This implies that investors in these countries may benefit from adding an exposure to gold so as to mitigate their stock market risk. We also show that the benefits of gold depend on the existing market environment as proxied by market volatility and interest rates dynamics. Specifically, our study reveals the safe-haven benefits of holding gold during periods of market stress (i.e., above-average volatility) in Canada, France, Germany, Italy, and the UK, while gold appears to be a valid hedge in the US. For France and the US, the safe haven properties of gold also materialize during calm periods (i.e., below-average volatility). Regarding yield curve dynamics, gold exhibits safe-haven properties during periods of flattening yield curve in France, Germany, Italy, the UK and in the US, while such benefits materialize in times of steepening curve in Canada and in China.

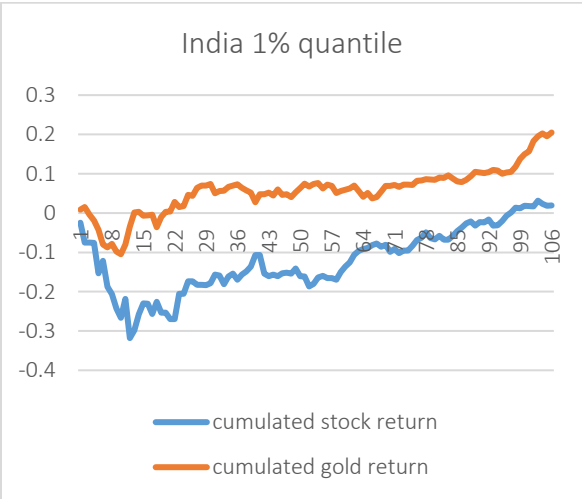
Overall, our results show that gold is relevant for strategic asset allocation as it may offer investors in some countries protection against significant declines in stock markets. Our empirical investigations are also relevant for tactical asset allocation as we show that the safe-haven properties of gold are time-varying and may depend upon volatility state and interest rates dynamics.

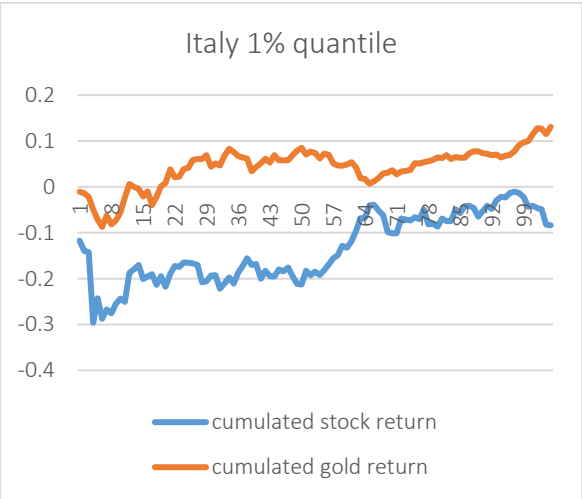
EXHIBIT 8
Portfolio analysis

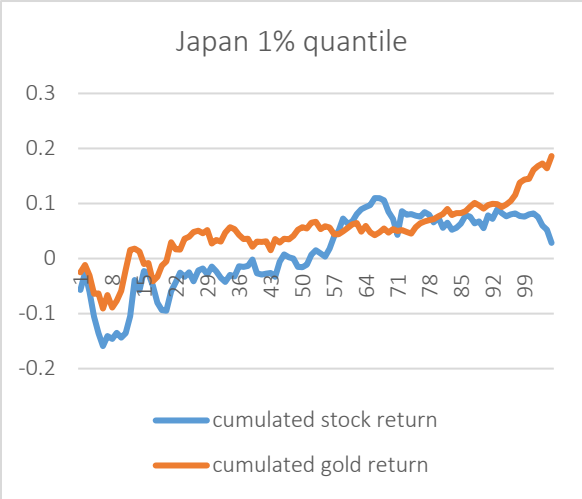


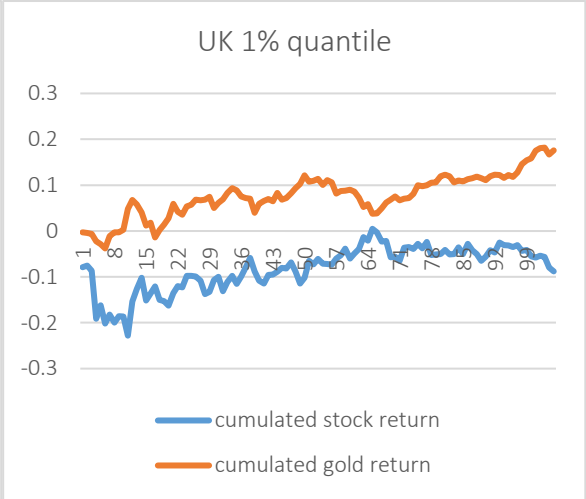


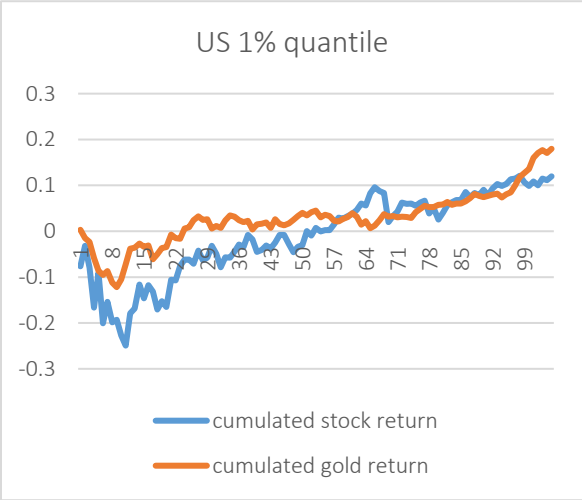












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