A Post-COVID Reassessment of the Autumn Effect in Gold Markets

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Abstract

Seasonality in the gold market is well documented, including the "Autumn Effect" identified by Baur (2013) and revisited during COVID-19 by Bentes et al. (2022). This paper re-examines the effect in light of structural changes introduced by the pandemic—such as Basel III, increased financial market volatility, and renewed flight-to-safety behaviour—which may have altered seasonal dynamics in commodity markets.

Using a seasonal regression model with monthly dummies and post-COVID interaction terms, I find that September and November no longer exhibit significant excess returns, suggesting the Autumn Effect has weakened or disappeared. Instead, positive seasonality appears in Spring, particularly April and May. Asymmetric volatility in gold returns is also observed during this period.

These findings highlight a shift in seasonal return and risk patterns post-COVID, with implications for policymakers and portfolio managers seeking to optimise gold market exposure under evolving macro-financial conditions.

Key Words

Asymmetric Volatility, Autumn Effect, COVID-19, Gold Market, Seasonality

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Abbreviations:

AMH - Adaptive Markets Hypothesis

AIC – Akaike Information Criterion

BCBS – Basel Committee on Banking Supervision

BoE – Bank of England

CBOE – Chicago Board Options Exchange

CFTC – Commodities Futures Trading Commission

CME – Chicago Metals Exchange

COMEX – Commodities Exchange Inc.

COT – Commitment of Traders

CT – Central Time

DJIA – Dow Jones Industrial Average

EFP – Exchange for Physical

EMA – Exponential Moving Average

EPU – Economic Policy Uncertainty

ET – Eastern Time

EM – Emerging Markets

EMEA – Europe, Middle East, and Africa

EUR - Euro

FDIC - Federal Deposit Insurance Commission

FOMC – Federal Open Market Committee

FRED – Federal Reserve Economic Data

GBP – Great British Pound

GSCI – Goldman Sachs Commodity Index

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GEPU – Global Economic Policy Uncertainty

IBA – ICE Benchmark Administration

LBMA – London Bullion Bank Association

LME – London Metals Exchange

MACD – Moving Average Convergence Divergence

MSCI - Morgan Stanley Capital International

NASDAQ – National Association of Security Dealers Automated Quotations

NYSE – New York Stock Exchange

QE – Quantitative Easing

S&P – Standard & Poor's

SGE – Shanghai Gold Exchange

SWIFT - Society for Worldwide Interbank Financial Telecommunications

UAE – United Arab Emirates

USD – United Stated Dollar

WM – World Markets

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Figures:

Tables:

Mathematical abbreviations:

$r_g = daily\ gold\ returns$

$D = dummy\ variable$

$D_{Month} = D_{January}, D_{Febuary,} \dots D_{December}$

$D_{Season} = D_{Autumn,}\ D_{Winter,}\ D_{Spring,}\ D_{Summer}$

$X = matrix\ of\ control\ variables$

$Y = vector$

$e = error$

$\beta_i = parameter\ estimates$

$t = time$

Abstract:

Literature evidently shows seasonality exists in the gold market such as daily, weekly, monthly, and seasonal effects. One such phenomenon is the "Autumn effect" investigated by Baur (2013) and later by Bentes *et al*. (2022) during the COVID 19 crisis. The pandemic has significantly changed the economic factors determining the "Autumn effect". Some of these factors include Basel III, volatility in financial markets and a flight-to-safety due to geo-political events which have all impacted seasonality in commodity markets. Findings show September and November are no longer significant during and since the COVID 19 crisis, and the "Autumn effect" has disappeared. I also find some evidence of positive seasonality in the Spring season and months. Finally, I confirmed the presence of asymmetric volatility in gold returns in Spring. Findings will have implications for policy makers and portfolio managers considering investing in the gold market.

Key Words:

Autumn effect, January effect, Spring effect, Gold, Silver, S&P500, COVID 19, MSCI Emerging Markets Index, MSCI World Markets Index, sell in May and go away effect, WGC, BIS, CBGA, backwardation, contango, COMEX, asymmetric volatility, GARCH, negative Tuesday effect.

1.0 Introduction:

Gold has been used as money for trade throughout human civilisation and been actively traded for over 6,000 years (Green, 2007). Gold has not only been used as money, but as an investment, a store of value, whereby hundreds of papers have been written about it (O'Connor *et al.,* 2015). Records go back to the Roman Empire with the first ever recorded liquidity crisis from coinage debasement (Butcher, 2015). Since, there has been numerous monetary systems using the gold standard since 1971 when U.S. President Nixon severed the gold standard and started an era of fiat currencies (Jones and Podolsky, 2015). This had led to currency debasement by central banks worldwide eroding purchasing power of goods and services by the public (McLeay *et al.,* 2014). Financial crises have happened throughout history (Kindleberger *et al.,* 2005), yet gold has had an ability to withstand and act as a safe haven during uncertainty and a hedge against inflation throughout these crises (see Baur and Lucey, 2010, and Bampinas and Panagiotidis, 2015). More recently, in the two most recent financial crises, the 2008 Global Financial Crisis (Choudhry *et al*., 2015) and the COVID 19 Crisis (Akhtaruzzaman *et al*., 2021), gold did not act as a good hedge or diversifier. It is clear the behavioural characteristics and dynamics of the gold market has changed; hence this paper will investigate the changing seasonal patterns in gold's price.

Gold's reaction to negative financial market events has been extensively investigated in literature (Shrydeh *et al*. 2019; Sheikh *et al*. 2020; Hasan *et al*. 2021; Salisu *et al*. 2021 and Yousaf *et al*. 2021). The financial crisis of 2007-09 resulted in increased investment demand in gold. Subsequently, gold reached all-time highs in 2011, as a result quantitative easing (QE) and turmoil in the equity markets. The main drivers of the price increase were mainly due to fear of further declining stock markets and future inflation expectations (Baur, 2013). More recently, events such as the COVID-19 pandemic and the Russia-Ukraine war has affected the behaviour of gold's price. The COVID-19 crisis has attracted a new wave of attention for gold as a portfolio diversifier due to its safe haven properties, as it's a good hedge against downturns in the market in times of global financial turmoil (Salisu *et al*., 2020 and Shehzad *et al*. 2021). COVID-19 has severely disrupted the functioning of financial and commodity markets (Baur, 2013; Akhtaruzzaman ety al., 2020; Sharif *et al*., 2020; Zhang *et al*., 2020; Gubareva, 2021; Umar, 2022 and Bentes *et al*., 2022). The pandemic has also deeply impacted the gold

market which suffered a 20% decrease in price in the third quarter of 2020 (Dutta *et al*., 2020 and Mensi *et al*. 2020). However, this is opposite to most previous financial crises (see Baur and McDermott, 2010, and Baur and Lucey, 2010), and has been followed by dramatically increased gold prices in the months and years after the pandemic (LBMA, 2025).

Policy makers, investors and resource planners generally track the performance of gold returns as gold affects the economic and financial stability of the global economy (Yousef & Shehadeh, 2020 and Shehzad *et al*., 2021). Understanding the gold seasonal patterns is vitally important as it explains behaviour it's in financial markets and helps investors devise trading strategies during uncertain periods (Corbet *et al*., 2020). Gold return and volatility patterns have been investigated in literature during and since the 2007-08 financial crisis. Baur & McDermott (2010) and Baur (2011) examine gold's role as a safe haven during the periods of global market turbulence. Meanwhile O'Conner *et al*. (2015), Li & Lucey (2017), and He *et al*. (2020) investigate market conditions and possible tail-risk behaviours associated with gold.

More recently, gold's behavioural and seasonal anomalies have been more extensively looked at in Literature. For example, the 'Autumn effect' investigated by Baur (2013). Additionally, volatility dynamics are also mentioned significantly in literature. For example, Chkili *et al*. (2014) and Klein (2017) explore the time-varying volatility of gold. Additionally, Todorova (2017) and Abounoori & Zabol (2020) delve into volatility spillovers between gold and other financial assets.

Shifting patterns in the post-COVID era has increased interest into the robustness of gold's historical behaviour. Baur *et al*. (2021) investigate whether traditional interpretations hold under unprecedented economic stressors of the pandemic. Furthermore, a few papers which have investigated the impact of the pandemic including Yousef & Shehadeh (2020) who investigates the impact of the pandemic on the commodity market including gold. Corbet *et al*., 2020 and Dutta *et al*., 2020 further investigate how investor sentiment and a flight to safety contributed to sharp movements in gold prices. Baur & Hoang (2020) investigate the effect of volatility shocks on gold. Similarly, Mensi *et al*. (2020) assesses the interdependencies between gold and other major assets during the pandemic. A more recent contribution by Bentes *et al*., 2022 analyses volatility spillovers between gold and equity markets.

Another significant strand of literature investigates the relationship of gold and the broader financial markets. Baur (2012) examines gold's interaction with stocks and bonds across economic regimes. This is further explored by Todorova (2017) who assesses volatility spillovers between gold and the equity markets. Kocaarslan *et al*. (2017) extends this analysis by investigating the short and long-run dynamics between gold and the volatility index (VIX). Finally, Hung (2022) explores the asymmetric dependence structure between gold and stock markets during both normal and crisis periods.

1.1 Seasonality

Seasonality refers to regular and predictable patterns which repeat over a specified period, usually within a year. The data, usually time series, is driven and influenced by calendar events (Kwiecien *et al*., 2022). Calendar effects can include events such as weather, holidays, institutional behaviours, economic cycles, and cultural events. For example, in agriculture, crop prices fluctuate due to planting and harvest cycles weather anomalies/extremes can also play a factor (Ginn, 2024). Another example is retail sector where sales spikes in December during the holiday shopping period in the lead up to Christmas and New Year (Butters *et al*., 2025). The holiday season also coincides with the tourism sector where travel increases during the summer months (Zvaigzne et al., 2022). In Finance, changes to institutional behaviours and market sentiment can affect stock markets with seasons known as the "January effect" (Serbu and Trifan, 2024) and Autumn volatility (Tabash *et al.*, 2024). Finally, the study focusses on commodities which coincides with economic cycles and cultural events. For example, gold demand which peaks in the Autumn due to factors such as the Indian wedding and festival seasons (Baur, 2013).

Seasonality manifests itself in various forms depending upon the pattern regularity, statistical behaviour, and stability over time. There are two types of seasonality: deterministic and stochastic. Deterministic seasonality has a fixed and predictable pattern and more common in literature in commodity markets. Typically, deterministic seasonality has a constant magnitude and timing or follows a calendar cycle such as monthly or quarterly, and less so, weekly, and daily. Unless the structure breaks, the seasonality does not change over time. Deterministic seasonality is mainly modelled using seasonal dummies (Lutz and Lutz, 2010). Meanwhile, stochastic seasonality is

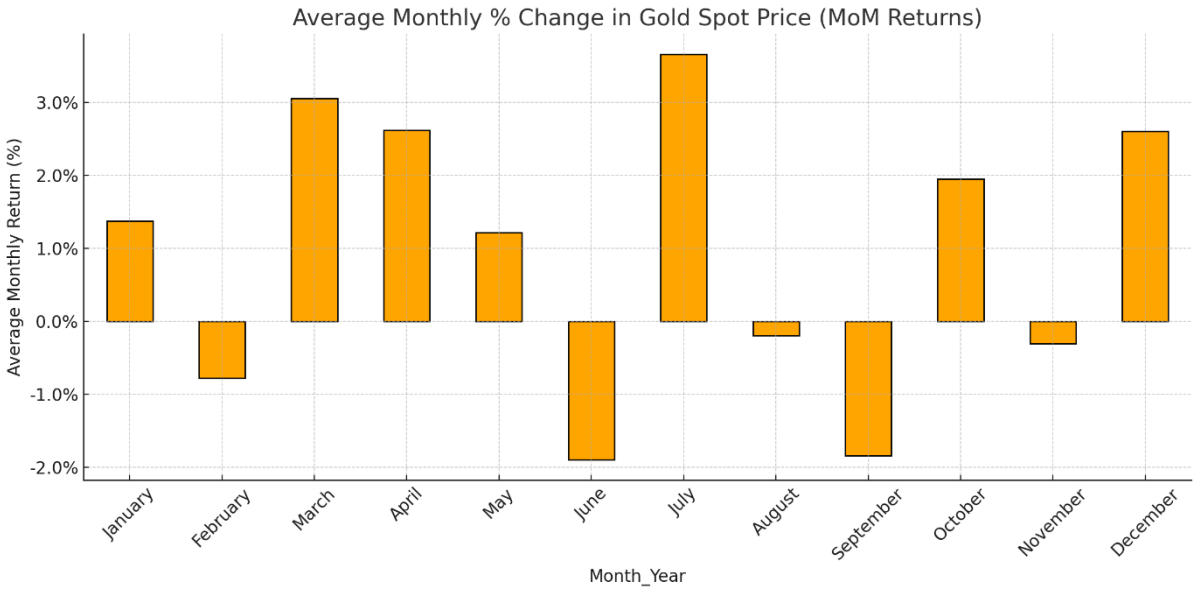
where a seasonal pattern exists, however the shape, magnitude, and timing vary unpredictably over time. This is mainly used in financial and climate data and requires models that can learn or adapt to changing seasonality (Chen *et al.*, 2022).

1.2 The Autumn Effect

Seasonality in financial terms is the phenomenon whereby a recurring pattern emerges in the returns and volatilities of a financial asset over a certain period. Some papers focus on gold seasonality from a stochastic method (see Germansah, 2023, and Shina 2024). However, most papers in this field focus on deterministic seasonality (recent papers include Wang et al., 2018 and Khetan *et al.*, 2024).

Seasonality can also be in the form, but not limited to daily, weekly, monthly, or seasonal patterns including the so-called "Autumn effect", whereby the season of Autumn in which the months of September and November had significantly positive returns (Baur, 2013). Literature on the "Autumn effect" in gold returns and volatility is very limited. Two prominent papers have assessed the "Autumn effect" of gold returns, one of which included COVID-19 crisis effect on the seasonality of the gold returns (Baur, 2013 and Bentes *et al.*, 2022). Baur (2013) concluded the months of September and November in Autumn is when gold exhibits positive and statistically significant returns with asymmetric volatility. However, the graph below illustrates average prices have diverged from being highest in September and November, hence the need for this research:

Figure 1: Average Monthly Price Chance of Gold Per Ounce (2019-2025)



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Source: (Authors Graph)

Factors affecting the 'Autumn effect' have been mainly attributed to various economic, cultural, and behavioural drivers changing in consistency and intensity across time and geography. One of these factors includes the rebalancing of investor portfolios and institutional behaviour as investors tend to rebalance portfolios towards the end of the calendar year. Through this process, investors tend to add gold to their portfolios in the fourth quarter (Diseko *et al*., 2015). Additionally, Autumn has coincided with periods of heightened financial volatility as most equity markets have crashed in the Autumn months such as the panic of 1907 (mid-October) (Johnson, 1908), the great depression (October 29th, 1929) (Calomiris, 1993), Black Monday (October 19th, 1987) (Akata, 2023). During times of market uncertainty, investors flee to safe haven assets (Baur and McDermott, 2010). Additionally, Monetary policy timing including policy announcements and interest rate decisions are often scheduled by central banks towards the second half of the year. These include rate cuts and quantitative easing which gold benefits from (Jermann, 2025). Gold prices are also sensitive to movements in the US dollar and the wider commodities markets. For example, energy prices, the foreign exchange markets, agricultural commodity cycles can all impact gold demand and its timing and size of seasonal effects (Sahoo *et al*., 2024). Finally, media narratives can shape investor sentiment and demand (Zhang *et al*., 2022).

Specifically, Baur (2013) assessed several possible reasons behind this such as central bank reserve changes which traditionally happened in the month of September and jewellery demand from India which is at its highest during summer and Autumn months. In India, the wedding season, Diwali and agricultural cycles of post-harvest income contribute to gold buying, particularly the Autumn months (Schmidbauer and Rösch, 2018). In China, the anticipation of the Lunar New Year prompts accumulation of gold in the preceding Autumn months (Goti, 2024). However, Bentes *et al*. (2022) contradicts this result during the period of the pandemic for both return and volatility finding evidence of positive asymmetric volatility. The author concludes this was due to decaying demand in the third quarter of 2020.

It is also worth noting Baur (2013) and Bentes *et al*. (2022) did not empirically investigate the period after the COVID-19 crisis or the ongoing Russia-Ukraine war. Additionally, Bentes *et al*.'s (2022) study is limited only up until December 2020 failing to capture the

full impact of the COVID-19 crisis; thus it is uncertain whether the decay in the asymmetric volatility of gold in 2020 continues. Bentes *et al's* (2022) study is limited due to the short period of analysis of 1-year questioning the robustness of results. This paper extends analysis done by both Baur (2013) and Bentes *et al* (2022) to investigate whether the Autumn effect returns during the latter part of the COVID pandemic and after. Potential findings will have implications for investors and portfolio managers actively trading gold which could result in unexpected gains or losses.

Based on a review of existing literature, this paper empirically investigates seasonality in gold returns with these research questions:

1. What is the basis of the Autumn effect in gold returns?
2. Has the "Autumn effect" resumed following its hiatus during the COVID-19 crisis?
3. Are there any newly emerging monthly or quarterly specific seasonal patterns in gold returns since the COVID-19 crisis?
4. Since the COVID-19 crisis, does positive asymmetric volatility in gold prices still hold?
5. Does gold still have hedging properties in stock markets outside the U.S. during and since the COVID 19 crisis?

To address the questions on gold's seasonality, I collect daily data on precious metals from the LBMA during and since the COVID-19 crisis. I analyse gold's returns by running regressions with monthly and quarterly (seasonal) dummy variables. Furthermore, analysis is conducted with stock market returns and employ GARCH models with monthly and quarterly (seasonal) dummy variables for analysis of variance.

The next section identifies several new factors which may have shifted gold's seasonal patterns and variance controlling for stock market and foreign exchange conditions. The remainder of the paper comprises of the section 3 for data sources and methodology approaches employed, section 4 of analysis of results, discussion and findings and section 5 for conclusions, key findings, and future research recommendations.

2.0 Literature Review

2.1 Introduction

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A large amount of literature studies gold's behaviour during periods of high volatility and periods of financial uncertainty (for example, Baur & McDermott, 2010). Studies have also focused on the impact of currency changes on gold returns such as Capie *et al*. (2005) and expected and unexpected inflation rates changes (see Blose, 2010). Whilst gold's seasonality is limited in literature, seasonality on stock market returns have extensively been investigated (see Bouman & Jacobsen, 2002; Schwert & William, 2003; Hong & Yu, 2009; Jacobsen & Zhang, 2012; Seif *et al*. 2017 and Merik *et al*. 2023). In contrast, very few studies examined gold's favourable events or seasonal pattern analysis such as the "autumn effect" (see Narguman *et al*. 2021; Baur, 2020; Auer, 2015; Robiyanto *et al*., 2015; Lucey & Tulley, 2006 and Coutts & Sheikh, 2002).

This paper expands Baur's (2013) and Bentes *et al's* (2022) analysis of the "Autumn effect" and seasonal volatility in gold prices. Baur (2013) notes there are periods of high demand related to positive sentiment which are affecting price discovery in the world gold market such as the Indian festive season. Such events are still characterised by hedging against uncertainty and risks as seen in the COVID-19 crisis (see Bentes *et al*., 2022). However, changes to market sentiment moving market prices are not always in response to negative events. Some other papers also analyse the psychological barriers relating to gold's prices to investor sentiment (see Aggarwal & Lucey, 2007). Bentes *et al*. (2022) later found during the initial stages of the COVID-19 crisis, the so-called "autumn effect" vanished and may have slightly inverted thus arguing further research on the key drivers.

Therefore, this paper will add to this limited domain of literature by empirically investigating whether the vanishing of the "autumn effect" continued during the later stages of the pandemic and after and identifying new drivers of this phenomenon. I further contribute to literature by the identification of new seasonal patterns in the gold market. Some of the possible drivers behind gold's shifting seasonality include changes to central bank agreement deadlines, geo-political events, changes to short, Chinese gold demand and rising global inflation rates.

This paper provides a comprehensive up-to-date overview of the drivers of gold demand and seasonality identified by Baur (2013) and Bentes *et al*. (2022).

2.2 Seasonality in Asset Markets

In this section, we explore early seasonal phenomena in literature in the gold market attributing to the Eurodollar interest rate, global economic cycles, and investor behavioural influences. Later, other emerging strands of literature investigates psychological issues linked to gold pricing such as the lunar cycles linked to geographical locations of hemisphere and sunlight hours. Later, the so-called "Autumn effect" was introduced by Baur (2013) with increased demand for gold in the Autumn months. Other papers investigated economic cycles and financial crashes linked to hedging and diversification with gold. Upon this, some papers showed the presence of the "Halloween effect" and "sell in May and go away effect" in stock markets, inversely linked to gold.

2.2.1 Seasonality in Assets and Commodities

Seasonality in asset prices is not uncommon and has been widely researched in literature. For example, there is evidence of persistent daily seasonality in fixed income securities at varying degrees (see Gibbons & Hess, 1981; Flannary & Protopapadakis, 1988; Jordan & Jordan, 1991; Singleton & Wingender, 1994; Kohers & Patel, 1996 and Adrangi & Ghazanfari, 1996). Redman *et al* (1997) found evidence of daily and monthly seasonality in real estate prices. Evidence of daily and weekly patterns have also been found in the gold futures markets (see Ball *et al*. 1982, Ma, 1986; Chang & Kim, 1988; Chamberlain *et al*., 1990 and Johnston *et al*., 1991).

Other authors have analysed daily moments and volatility in equity markets. Aggarwal & Schatzberg (1997) found variations in daily and weekly means, standard deviations, skewness, and kurtosis which were higher in smaller firms and other papers (see Cheung *et al*., 1994; Kramer, 1996 and Tang, 1997). Furthermore, Choudhry (2000) found significant daily seasonal volatility in several equity market indices.

In the 1980's, a few papers analysed daily and monthly the seasonality of commodity prices known as the 'January effect' and the 'negative Monday effect' (see Keim, 1983; Chiang & Tapley, 1983 and Gay & Kim, 1987). Girma & Paulson (1998) found evidence of seasonality in petroleum futures spreads. Milonas & Thomakadis (1997) found daily growth rate in the Dow Jones Spot Commodity Index were subject to the January effect.

2.2.2 Seasonal Phenomenon's in Gold

Gold prices often occur in predictable seasonal patterns, for example, higher returns in the September and November months. There are several factors including economic,

psychological, cultural, and institutional factors which shape gold's seasonality (Baur, 2013).

Early papers investigate this such as Tschoegl (1987) who investigated monthly LME pm gold fixings from 1975 to 1984. Gold returns were analysed under three definitions of seasonality: no month significantly different from the average; cyclical patterns; and particular months where returns are significantly different. The author found evidence of monthly seasonality, however, did not find any stable cyclical pattern nor a January effect. However, weak below average returns were found for September. Overall, there was little/weak evidence to support any seasonal effects in this period. However, gold returns by other authors such as Lilleberg (1980) as aligned with seasonality in Eurodollar interest implying global economic cycles and investor behaviours influence both markets. Specifically, the author analysed 3- and 6-month LIBOR rates between 1975 to 1979. Rates tended to be lower than the trend in the first half of the year and higher than trend in the second half. This suggests with gold's linkage, it contributes to gold's seasonality.

An emerging strand of literature attributes lunar cycles to investor sentiment asset prices including the gold market. A few papers note in a new moon, moods are good, thus leading to positive asset returns (Rotton & Kelly, 1985; Hirshleifer & Shumway, 2003; Dichev & Janes, 2003; Yuan & Zheng, 2006). Calaletti *et al*. (2004) found psychological issues and were significantly linked to gold pricing and trading. A phenomenon called "winter blues" suggests gold demand is related to the amount of sunlight hours. Thus, the more sunlight, the higher the gold demand due to psychological factors of traders. For example, decreased sunlight can demotivate investors, increase difficulty in concentrating, and increase fatigue. The largest equity markets are located in the Northern hemisphere, thus the cycles of sunlight hours throughout the year can produce seasonal patterns in gold. For example, in August, sunlight hours begin to reduce and could be a sign more gold is demanded as a substitute[1]. This is due to a seasonal affective disorder (SAD) which occurs usually in the fall and winter. As investor moods decrease in these months, it leads to risk aversion and lower stock market returns during the period (Kamstra *et al*., 2003).

[1] In the energy sector, commodities exhibit seasonal patterns of demand. However, this is not obvious for gold.

Baur (2013) studied recurring annual events introducing seasonality in gold prices. The author studies monthly gold price data between 1980 and 2010 and found the months of September and November are the only two months with significantly positive changes in gold's price and volatility. The author also notes there are several factors which contribute to this "Autumn effect". Firstly, investors buy gold to hedge against uncertainty in markets. Most global financial crashes have occurred in the months of September and October (for example the stock market crash of October 1987, The Asian financial crash in October 1997 and the Global 2008 financial crisis in September and October 2008). Another reason is hedging against potential stock market losses before they are heavily weighted in stocks. This leads to a possible lowering of demand known as the "Halloween effect" or the "sell in May and go away effect" (Bouman & Jacobsen, 2002 and Jacobsen & Zhang, 2012). The "Halloween effect" or the "sell in May and go away effect" is a market timing strategy which hypothesise stocks have lower performance between late October and early May (see Jacobsen & Visaltanachoti, 2009; Plastun *et al*., 2020 and Lobão & Costa, 2023).

2.2.3 Daily Seasonality in Gold Prices

Literature on daily seasonality and moments in gold and silver is very limited. Earlier papers such as Ball *et al*. (1982) studied gold returns on the LME (1975-79) and found minimal evidence of daily seasonality or the negative Monday effect. Findings were independent of whether the fixings were Monday – Friday am or Monday to Friday pm fixings. Results were slightly more in favour of a negative Tuesday effect. Ma (1986) found contradictory results and investigated pre and post 1981 where significant changes were made to institutional arrangements and settlement procedures. Pre 1981 complimented Ball's (1982) findings of a negative Tuesday effect and additionally found a significantly positive Wednesday effect. However, after 1981, Ma's (1986) the results contradict Ball's paper and find average returns on Monday switches from positive to negative. It is clear when the structure of the gold market changed in 1981, so did the seasonality of the market.

Later papers have found evidence of daily patterns in gold cash (spot) and futures returns such as Lucey & Tully (2006) who suggest a Monday negative effect in gold and silver returns. At the time, this was the first paper to also investigate silver returns in their

analysis. The authors found further evidence of the negative Monday effect across both gold and silver spot and futures markets.

Blose & Gondhalekar (2013) analysed the weekend effect in gold returns from 1975 – 2011 and found gold returns from Friday close to Monday were significantly lower to the rest of the week. However, this result was limited to bear markets. During bull markets, the negative weekend effect disappeared. Further investigation by Auer (2015) analysis from July 1996 to August 2013 showed there was no evidence of "bad luck Fridays" (i.e. Friday 13th's) being significantly more negative than any other Friday.

Hoang *et al*. (2020) investigated seasonality on the Shanghai Gold Exchange from 2002 to 2016. Results showed the presence of a positive Monday effect and positive January effect. However, in bearish periods only, the positive Monday effect was found to be more suitable for risk-seeking investors whilst the positive January effect was found to be more suitable to risk-averse investors. However, when applied to gold futures returns, the results did not hold.

Baur *et al*. (2020) analysed more than 4,000 seasonal, technical, and fundamental timing strategies in the gold market and found some evidence of the ability for economic gains and market timing compared to a benchmark passive buy-and-hold strategy. However, the authors did note the results were subject to biasness from data-snooping in specific periods.

2.2.4 Monthly Seasonality in Gold Prices

Coutts & Sheikh (2002) studied gold equity stocks on the Johannesburg gold stock exchange for seasonality. Between January 1987 and May 1999, the authors found no evidence of the Holiday, January, or Weekend effect on the index.

More recently, Xiao & Maillebuau (2020) studied daily and monthly gold seasonality on the Shanghai Gold Exchange (SGE) between the 2002 and 2016 period. The authors interestingly found evidence of a positive Monday effect and a negative Tuesday effect. Furthermore, a positive January and February effect is observed, and the middle of the year is negative. The authors attribute this seasonality due to economic conditions and economic policy. For example, Qi & Wang (2013) find February, September and November had significantly higher gold returns on the SGE.

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2.3 Specific Drivers of Seasonality in Gold

The next sections mention the impact of changing central bank gold announcement dates away from the Autumn period and the impact of Basel III. Additionally, the paper then covers the Indian gold demand season of the festival and wedding seasons and the recent impact of the COVID 19 crisis. Finally, the paper covers recent geopolitical events impacting the gold market since the global pandemic.

2.3.1 Indian Gold Demand Season

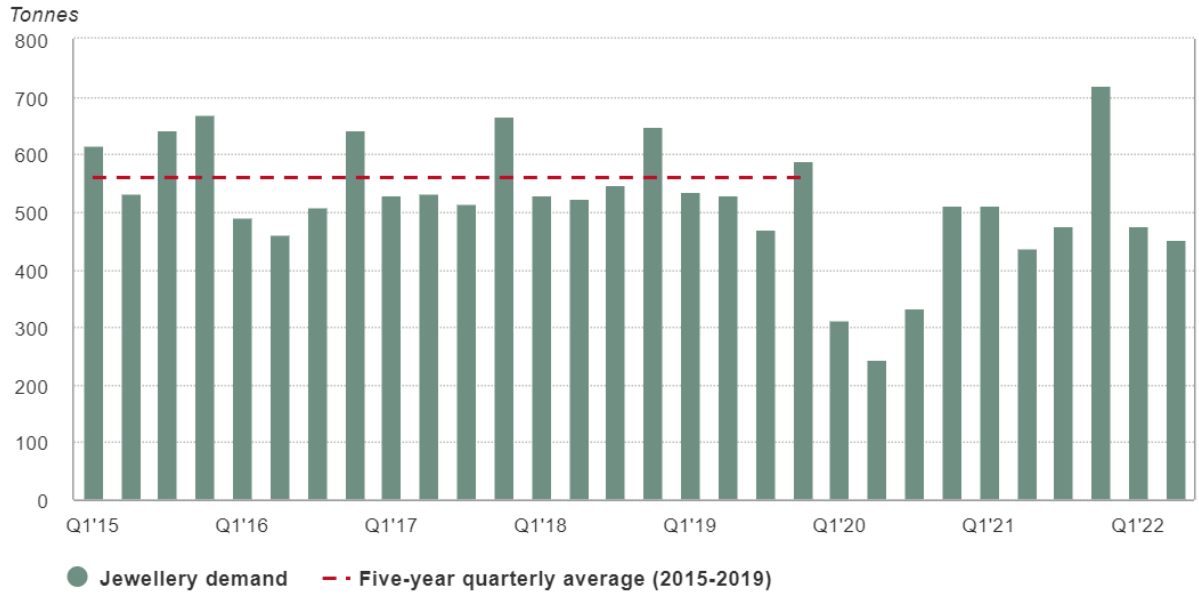
Another significant determinant of seasonality and volatility in gold prices is recurring annual cultural events in India. Baur (2013) notes festival seasons such as the Indian wedding and Christmas seasons cause increased gold demand in jewellery and dominates overall investment demand for gold. For example, in 2001 jewellery demand and investment was 3000 tonnes ($26 billion) and 350 tonnes ($3.1 billion) respectively. Compared to the 2008 global financial crisis, gold jewellery and investment demand was 2300 tonnes ($64 billion) and 1200 tonnes ($33.5 billion) respectively (World Gold Council, 2011).

Recently, recurring annual cultural events such as the Wedding and Christmas seasons have seen significant increases in gold prices due to significant demand in jewellery, especially in India. The World Gold Council tracks the world demand and supply of allocated gold and in most years, India is one of the most significant drivers of gold demand. Overall, the World Gold Council reports total jewellery consumption year-over-year is 4% higher in Q2 2022 compared to Q1 2022 at 453.2 tonnes[2]. However, during the first year of the pandemic, Jewellery demand fell significantly going to as low as 242.86 tonnes in Q2 2020. The average 5-year quarterly demand was 558.92 tonnes between 2015 and 2019, however since the pandemic, most months seem to be below the 5-year average except for Q4 2021 which was the only quarter above the 5-year pre-pandemic average. Furthermore, pre-pandemic between 2015 and 2019, no quarters had a consecutive quarter within the next 3 quarters at a higher level of demand. However, post pandemic since 2020, Q1 2021 exceeded Q4 2020 demand slightly altering the seasonal buying pattern. Also, we can see more variation and change of normal annual

[2] Jewellery | Gold Demand Trends Q2 2022 | World Gold Council – World Gold Council (WGC) report on jewellery demand in Q2 2022 shows gold demand is 4% higher year-over-year (YoY).

patterns in the quarters since 2020 compared to pre-pandemic demand. This is shown in the figure below:

Figure 2: Quarterly Jewellery Demand 2015 - 2022



Source: World Gold Council (2022)

Although the figure shows a significant decline at the start of the pandemic in 2020 and mostly recovering in subsequent years, there are other factors to take into consideration. Firstly, smuggled gold is estimated by the India Gold Policy Centre (IGPC) to be up to 200 tonnes per year[3]. However, the IGPC report only calculates the amount of smuggled gold up until December 2020. Furthermore, since this report, the Indian government has increased the basic import duty on gold from 7.5% to 12.5% in July 2022 according to the World Gold Council[4]. As a result, Indian smuggled gold could be a lot higher than reported.

2.3.2 Central Bank Gold Reserves and Institutional Dynamics

Changes to central bank reserves are likely to happen in September due to agreements such as the Central Bank Agreement defining how much gold can be sold by banks. For

[3] PowerPoint Presentation (iima.ac.in) – Gold Smuggling in India and its effect on Indian bullion Industry. Presented at the India Gold Policy Centre (IGPC)

[4] India's gold import duties hiked | Post by Mukesh Kumar | Gold Focus blog | World Gold Council – Indian government raises import duty on gold from 7.5% to 12.5% in July 2022.

example, the World Gold Council (WGC) show CBGA1[5], CBGA2[6], CBGA3[7] and CBGA4[8] were all implemented in the month of September 1999, 2004, 2009 and 2014 respectively. CBGAs were introduced in response to increasing concern that central bank gold sales were destabilising and driving down the price of gold significantly. In 1999 at the time of CBGA1, central banks held one quarter of the worlds above ground gold (33,000 tonnes) and had a large influence on world markets. In response, 15 European countries signed the first CBGA to limit gold sales to 2,000 tonnes per year and limits on lending gold derivatives over the next 5-years. The signatory banks accounted for over 45% of global gold reserves at the time. This announcement shocked the gold market resulting in a large price spike in the month of September[9].

The most recent requirements imposed on banks globally by the Bank of International Settlements (BIS) is Basel III. This has significant implications for the global gold market due to the Net Stable Funding Ratio (NSFR) requirements of 85% to be held on banks' balance sheets[10]. Due to the impact of the COVID-19 crisis, these requirements were delayed and due to be fully implemented on the 1st of January 2023. Basel III was implemented by the Basel Committee on Banking Supervision (BCBS) to require banks to finance long-term assets with long-term money including unallocated gold to avoid future crisis such as the 2007-08 global financial crisis. Unallocated gold means it is not physically stored, only credited to investors is the most widely traded form of gold. As gold is not being treated as currency, it is subject to NSFR compliance. The LBMA and WGC note several potentially significant implications for the world gold market due to Basel III regulations. These include undermining clearing and settlement, draining liquidity, increased financing costs and reduced central bank operations. Furthermore,

[5] CBGA 1 | Washington Agreement on Gold | World Gold Council – World Gold Council (WGC) article on the first Central Bank Gold Agreement (CBGA1) on 26th September 1999.
[6] The Second Central Bank Gold Agreement | CBGA 2 | World Gold Council – World Gold Council (WGC) article on the first Central Bank Gold Agreement (CBGA2) on 27th September 2004.
[7] The Third Central Bank Gold Agreement | CBGA 3 | World Gold Council – World Gold Council (WGC) article on the first Central Bank Gold Agreement (CBGA3) on 27th September 2009.
[8] The Fourth Central Bank Gold Agreement | CBGA 4 | World Gold Council
[9] Joint statement on gold (europa.eu) – World Gold Council (WGC) article on the first Central Bank Gold Agreement (CBGA4) on 27th September 2014.
[10] Basel III and the Gold Market | World Gold Council – Article on Basel III and the gold market by Andrew Naylor for the World Gold Council (WGC) analysing the impact of the Net Stable Funding Ratio (NSFR) on the gold market.

the WGC and LBMA say this "would fundamentally alter the structure and attractiveness of this market".[11]

2.3.3 Other Macroeconomic and Structural Factors

Additionally, the Russian Central Bank announced on the 25th of March 2022 it would peg the rouble to gold after all Russian banks were banned from the Society for Worldwide Interbank Financial Telecommunications (SWIFT). This is the first time since Bretton Woods in 1971 a currency has been pegged to gold. The rouble is now pegged to the rouble at a rate of 5,000 roubles for 1 gram of gold (Chortane & Pandey, 2022). In the event Russia sells oil for gold in addition to pegging the rouble, this would tighten physical supply in the market contributing to scarcity, backwardation, and increased volatility potentially affecting seasonality in gold prices. Additionally, this is tied to oil flows which may flatten existing seasonal patterns thus fundamentals would shift from cyclical and consumer-led to strategic and trade-driven. In addition, increasing geopolitical events may become noise and may override the traditional drivers with geopolitical and energy trade shocks.

2.4 COVID-19 and Structural Shifts in Seasonality

Bentes *et al*. (2022) analysed the effect of the COVID-19 crisis on gold price seasonality between 20th December 2019 and 21st December 2020. The authors found during the COVID-19 crisis, the traditional pattern or the so called "autumn effect" of significant positive returns in gold's price vanishes and even shows a slight reversal of pattern. The authors suggested this is due to decaying demand in the third quarter of 2020. Both authors found no evidence of seasonal effects in gold volatility however Bentes *et al*. (2022) confirms additionally that there is positive asymmetric volatility in golds return.

It should be noted as mentioned earlier by Lilleberg (1980), that it is possible gold's seasonality can be dependent on seasonality in other markets. For example, there is a well-known anomaly in the stock markets known as the "January effect" where stock market returns are lower in January compared to the rest of the months in the year (Thaler, 1987). More recently, some authors have even observed a shifting to the

[11] NSFR-PRA-Letter-final_signed-20210504.pdf (lbma.org.uk) – Letter sent from the World Gold Council (WGC) and the London Bullion Market Association (LBMA) to the Prudential Regulatory Authority (PRA) assessing the impact of the Net Stable Funding Ratio (NSFR) on the precious metals market.

"November effect" (He and He, 2011). Given Baur's (2013) findings during a similar period, it is important to consider the relationships between gold and other markets inter-linked to the gold market.

Bentes *et al*. (2022) mostly analysed gold's seasonal performance based upon its correlation and volatility spillovers with other markets. Firstly, gold is a valuable safe haven asset with strong links to financial markets which has emerged more since the 2008-09 global financial crisis (see Baur & McDermott, 2010; Baur 2011, 2013; O'Connor *et al*., 2015 and Todorova, 2017). These links have increased in significance during and since the COVID-19 pandemic (see Mensi *et al*. 2020; Abounoori & Zabol, 2020; Yousef & Shehadeh, 2020; Corbet *et al*., 2020; He *et al*., 2020; Dutta *et al*., 2020; Baur *et al*., 2021; Baur & Hoang, 2021; Benlagha & Omari, 2022; Mensi *et al*., 2022). Furthermore, there are correlations between the spot price of gold and gold mining shares (Baur *et al*., 2021). This is because investors have a flight-to-quality sentiment (Gubareva & Borges, 2016) and seek gold for its safe haven attributes (Baur & McDermott, 2010). Additionally, papers have investigated co-volatility spillovers including gold, traditional currencies and even cryptocurrencies under differing economic conditions (Hsu *et al*., 2021 and Shehzad *et al*., 2021c). Baur & Hoang (2021) investigated the correlation between gold and bitcoin to investigate whether gold exhibits bitcoin like behaviour. The authors found near zero correlation between bitcoin and gold thus questioning whether the 'digital gold' name often being given to bitcoin is justified. Salisu *et al*. (2020) found gold is a safe haven and a hedge against the risk of a collapsing oil price and validated the hedging efficiency of gold against crude oil price risks. Umar *et al*. (2021) investigated the linkages between COVID-19 and major financial markets. The authors found the pandemic significantly influenced the precious metals market due to diversifying opportunities and hedging strategies employed. The interrelationships have been extensively researched however, Bentes *et al*. (2022) notes research on gold seasonality is limited and has not been researched during the pandemic.

Baur (2013) and Bentes *et al*. (2022) agree due to such phenomena such as the "Halloween effect", the gold market is significantly correlated with the stock market. Thus, this could explain a significant decline shortly during and following March 2020 at the beginning of lockdown meant lower aggregate demand for gold continuing throughout 2020. This may have contributed to the disappearing or inversion of the

"autumn effect". Furthermore, Al-Awadhi (2020) found the pandemic, specifically growth in total confirmed cases and total confirmed deaths had significant negative effects on stock market returns across all companies on the Shanghai Stock Exchange. Drake (2022) confirms the stock market-gold relationship speculating when real rates of interest fall below zero, investors shift funds to the stock market and gold thus creating a positive relationship. Furthermore, the stock market-gold relationship during the pandemic had a similar relationship to the financial crisis of 2007-09 thus casting doubt on gold as a hedge and portfolio diversifier due to a lack of correlation.

More recently, Germansah *et al.* (2023) used the Geometric Brown Motion to analyse gold derivative prices between December 4th 2012 and December 30th 2022. The paper found January to have the highest probability of predicting a trend of 70% meanwhile February, March, and April had the lowest probability of predicting price movement with only 10%. Potrykus and Augustynowicz (2024) extended Baur's (2013) study analysing seasonality in gold returns between January 20th 1981 and July 29th 2022. The paper found January to have a statistically significant and positive return in gold. Data also showed negative returns in September and November indicating a trend reversal for the "Autumn effect". The paper concluded the emergence of the "Winter effect". The paper explains the shift to the "Winter effect" is caused by the Adaptive Markets Hypothesis (AMH) (Lo, 2004). The AMH is the adaptation of market efficiency over time whereby after financial crashes, the market is at its most efficient and in market bubbles, the market is least efficient. This paper presents a more up to date analysis of seasonality in the gold market with a time frame spanning since the COVID 19 crisis and now to investigate recent events shifting gold's behaviour.

3.0 Data & Analysis

3.1 Introduction

Data on variables is collected to analyse seasonality to answer the key hypothesis questions in the paper. The paper uses daily data of gold, silver, and stock market indices from the LBMA, COMEX, and stock market indices from September 2019 to January 2025. I then discuss the summary statistics to check the quality of data including the mean, ranges, skewness, and kurtosis with visualisation of gold and silver prices. Finally, I

Work in Progress – Do Not Distribute

conduct the methodology with a range of regression and GARCH models with seasonal and monthly dummies.

3.2 Data

Log returns for gold are computed using spot prices (London fixing), COMEX gold futures prices (CME), silver bullion spot prices (London fixing), COMEX silver futures prices (CME), Goldman Sachs Commodity Index (GSCI) returns and GSCI precious metal returns similar to Baur (2013). As specified in Baur's (2013) paper, this will be monthly data for seasonal models and daily data for measuring volatility. The use of monthly data will more naturally capture seasonal effects, reduce noise, and better align with macroeconomic drivers. Meanwhile, the daily data will better capture volatility as it is a high frequency phenomenon, thus greater precision, can capture news events easily, and models such as GARCH assume a short-term memory. The sample covers over 5-years (64-Months) (T = 1,340 daily returns) between the 9th of September 2019 and the 2nd of January 2025. This short period is designed to isolate the effects of the COVID and post-COVID regimes and is not an uncommon period (see Bentes *et al*., 2022). Daily and Monthly returns are calculated using the following equation:

$$r_t = \ln(P_t) - \ln(P_{t-1}) = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

Where:

P_t is the price of gold at time t,

P_{t-1} is the price at the previous time period

r_t is the log return

This will allow us to analyse the trajectory of gold prices in all four gold seasons during and since the COVID-19 pandemic. Additionally, in many empirical studies (such as Baur, 2013; Bentes *et al*., 2022, and Potrykus and Augustynowicz, 2024), specifications are designed to show average returns in each calendar month are statistically different from zero. However, whilst this shows returns are positive or negative in a given month, it does not capture seasonality in a strict sense. This, later in the paper, measure for seasonality by employing a constant term and an omitted monthly dummy (December). This sets a

baseline for all other monthly dummies to be compared against. This is set out in the following regression equation:

$$r_{g,m} = \alpha + \sum_{i=1}^{11} \beta_i D_{i,m} + \varepsilon_m \quad (2)$$

Where:

$r_{g,m}$ is the return on gold at time m

α is the constant term (December baseline)

$D_{i,m}$ are the dummy variables for each remaining month

β_i measures the difference between month i and the base month

ε_m is the error term

It is useful to know when a gold or silver futures contract is trading in contango or backwardation. Therefore, I use daily data to compare the LBMA PM Gold fixed price with the COMEX settled (closing PM) price. For silver, as there is only one daily settled price on the LBMA PM Silver fixed price, I will compare to the COMEX settled (closing PM) price. Additionally, it is useful to include the GSCI & GSCI precious metal returns to compare the performance of gold and silver in the overall precious metals and commodity markets. I also aggregate daily returns into the monthly or seasonal returns for further analysis and simplification, thus, higher frequency intra-day data is not needed.

Table 1: Variable Descriptions (Precious Metals and main Market Indexes)

Variable:	Description:
Gold (Spot)	Daily and monthly Gold Bullion Spot Price (London Fixing) – LBMA (Twice Daily, at 10:30AM and 3:00PM – London UK time)[12]
Gold (Futures)	Daily and monthly COMEX Gold Futures Prices (100 Troy Ounce) NASDAQ: GC:CMX (Sunday 5:00PM – Friday 4:00PM Chicago, U.S., Central Time (CT))[13]

[12] LBMA Gold Price | LBMA – The LBMA Gold Price is the internationally recognised benchmark price for gold. Set twice daily at 10:30AM and 3:00PM London UK time..

[13] Data is collected from Market Watch, Gold Continuous Contract (Ticker symbol: GC00) Download GC00 Data | Gold Continuous Contract Price Data | MarketWatch

Silver (Spot)	Daily and monthly Silver Bullion Spot Price (London Fixing) - LBMA (Once Daily, at 12:00PM – London UK time)[14]
Silver (Futures)	Daily and monthly Silver COMEX Futures Prices (CME) NASDAQ SI:CMX (Sunday 5:00PM – Friday 4:00PM Chicago, U.S., Central Time (CT))[15]
GSCI Index	Daily and monthly Goldman Sachs Commodity Index (Benchmark) (S&P) NASDAQ: GSG (09:30AM – 4:30PM New York, U.S., Eastern Time (ET))[16]
GSCI Precious Metals Index	Daily and monthly Goldman Sachs Commodity Index Precious Metals (Benchmark) (S&P) (09:30AM – 4:30PM New York, U.S., Eastern Time (ET))[17]
MSCI Emerging Stock Markets Index	Daily and monthly Morgan Stanley Capital International Emerging Stock Markets (EM) Index MIEF00000PUS:MSI (08:30AM – 3:00PM, Chicago, U.S., Central Time (CT))[18]
MSCI World Stock Market Index	Morgan Stanley Capital International World Stock Market Index MIWO00000PUS (08:30AM – 3:00PM, Chicago, U.S., Central Time (CT))[19]
S&P500 Composite Index	Standard & Poor's 500 Composite Index INDEXSP: .INX (09:30AM – 4:30PM New York, U.S., Eastern Time (ET))[20]

3.2.1 Descriptive Statistics

Table 2 below shows a statistical description of all variables specified in the above data specification section for comparison purposes.

Table 2: Descriptive Statistics (Monthly)

Variable	N	Mean (x100)	Std. Dev.	Min	Max	Skewness	Kurtosis	ADF P-Value
Gold_Spot	64	0.9024	0.04	-0.0747	0.1055	0.1344	2.5075	0.000
Gold_Futures	64	0.9227	0.04	-0.0697	0.0982	0.2614	2.9151	0.000

[14] LBMA Silver Price | LBMA – LBMA is the source of data for Silver.
[15] Data is collected from the Market Watch, Silver Continuous Contract (Ticker symbol: SI00) SI00 | Silver Continuous Contract Overview | MarketWatch
[16] Daily data is available from investing.com: S&P Goldman Sachs Commodity Index Historical Price Data - Investing.com UK.
[17] Data from S&P GSCI Precious Metals Index Spot price (Ticker symbol: SPGSPM) available from investing.com: GSCI Precious Metal Historical Data - Investing.com
[18] Morgan Stanley Capital International Emerging Stock Markets (EM) Index. Available from MSCI: https://www.msci.com/our-solutions/indexes/emerging-markets
[19] Morgan Stanley Capital International World Stock Market Index Available from MSCI: https://www.msci.com/World
[20] Standard & Poor's 500 Composite Index. Available from S&P: https://www.spglobal.com/spdji/en/indices/equity/sp-500/

Silver_Spot	64	0.8659	0.08	-0.2117	0.2429	0.2471	3.7786	0.000
Silver_Futures	64	0.8870	0.09	-0.1646	0.2701	0.4533	3.3568	0.000
MSCI_Emerging_ Markets	64	0.1846	0.05	-0.2160	0.0936	-1.2259	7.2559	0.000
MSCI_World_Markets	64	0.8292	0.05	-0.1906	0.0608	-2.0067	8.4033	0.000
GSCI_Commodities_Index	64	0.5000	0.08	-0.4004	0.1744	-1.9204	11.9362	0.000
GSCI_Precious_Metals_Index	64	0.9172	0.04	-0.0746	0.1252	0.4060	3.0403	0.000

Table presents summary statistics (observations, mean, standard deviation, minimum, maximum, skewness, and kurtosis) of daily gold spot, gold futures, silver spot, silver futures, GCSI commodities index and the GCSI commodities precious metals index.

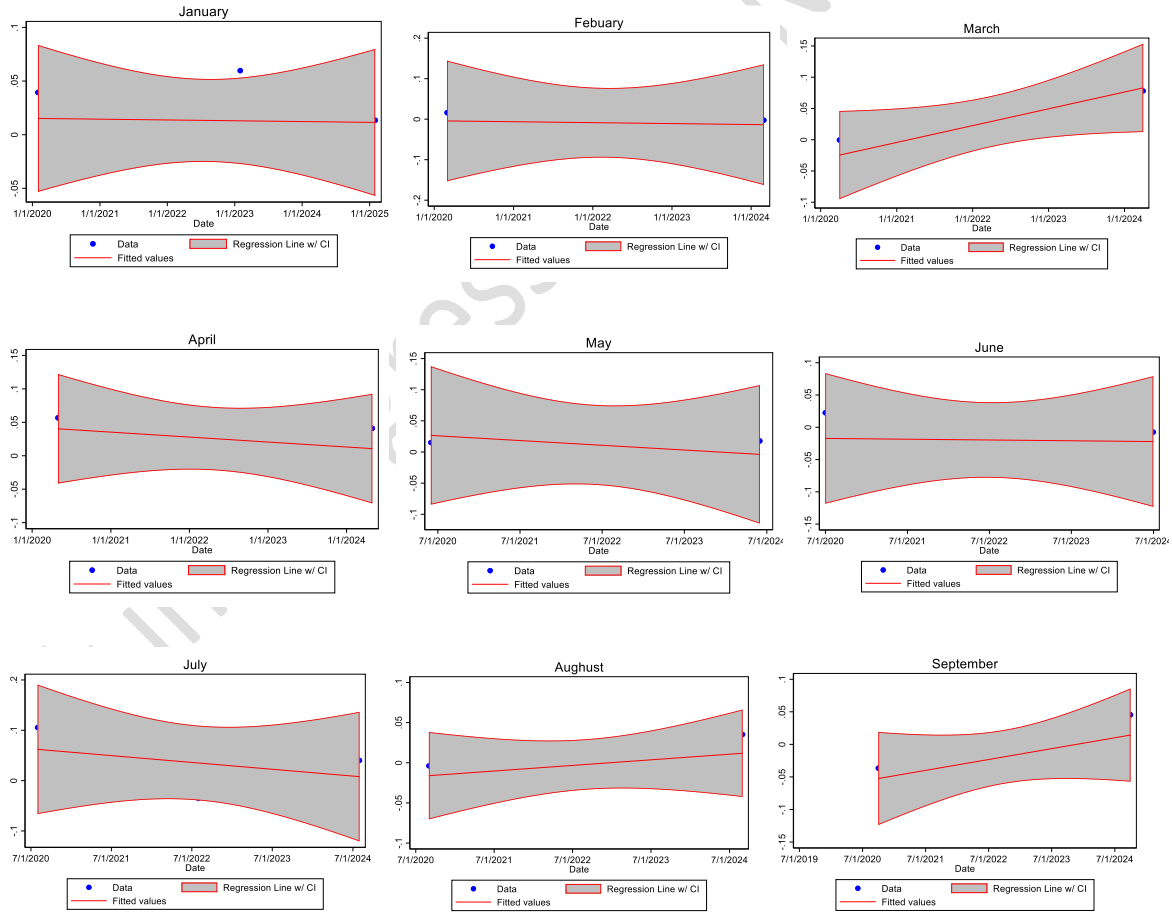
These statistics show the average monthly returns for gold bullion and futures is positive and standard deviations around 0.04 for both. For silver spot, standard deviation is around 0.08 with high maximum and minimums of around -0.21 and 0.24 respectively. It is important to note both the MSCI World and Emerging Markets Indexes have increased by 0.83 and 0.18 respectively, which may have implications on results later. Daily descriptive statistics and plots are available in appendix 1 (Table 3) and plots of monthly and daily descriptive statistics are available in Appendix 2, 3, 4, & 5 (Figures 3, 4, 5, & 6).

Table 4 (Appendix 6) shows the monthly gold spot return mean (x100), standard deviation, minimum, maximum, skewness, and kurtosis over the 5-year sample period. These unconditional results show returns are positive on average in the months of January, March, April, May, July, October, December. July had the highest average daily returns (3.4998) followed by March (2.9139), April (2.5476), December (2.5348), October (1.8985), May (1.1420), and January (1.0133). This contrasts with Baur's (2013) paper who found September and November as the most significant average positive returns, however, similar to Bentes *et al.*'s (2022) paper which found September and November to be negative. The average monthly returns were derived from the returns (x100). Average monthly returns are derived from the average monthly returns with a monthly dummy variable where it is multiplied by the number of trading days in a month which on average is 21 days. Interestingly, standard deviation is highest in February (0.0525) followed by July, March, November, and May. Standard deviation is lowest in August (0.0221) followed by December, October, January, and April. The most significantly positively skewed month is September (1.4196) followed by August, January, May, and October. The most significantly negatively skewed month is June (-0.5544) followed by the only two remaining months, April, and July. Interestingly, three

seasons were found to have positive returns (Winter, Spring, Summer) and was slightly negative in December. The most significantly positive season is the Spring season (2.2012), followed by Winter (1.1017), Summer (0.4394), and Autumn being negative (-0.0343). Given the Autumn season is near zero returns and slightly negative, this is clear evidence of the disappearing of the Autumn effect contrasting Baur's (2013) paper of positive returns in Autumn and supporting Bentes *et al's* (2022) paper of slightly negative returns in Autumn. The season with the highest standard deviation is Summer (0.0421), marginally higher than Autumn (0.0400) followed by Spring (0.0388) and Winter (0.0382) (see Appendix 6). Below are plots of the descriptive statistics:

Figure 7: Descriptive Statistics plots of Unconditional Monthly Gold Spot Returns (January – December) (Monthly)

[Should I exclude due to lack of observations or put in appendices…?]



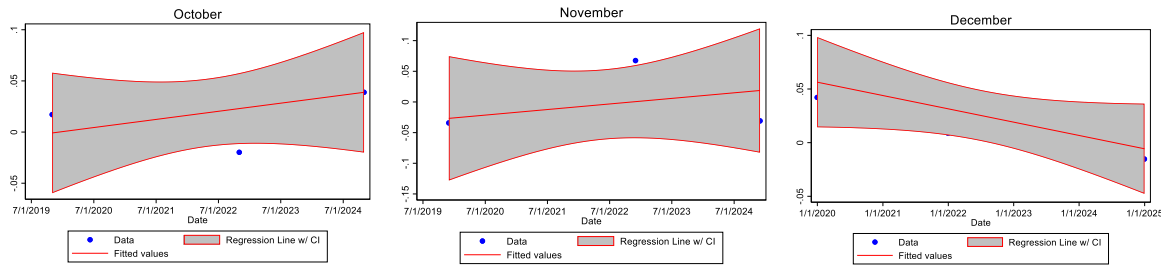
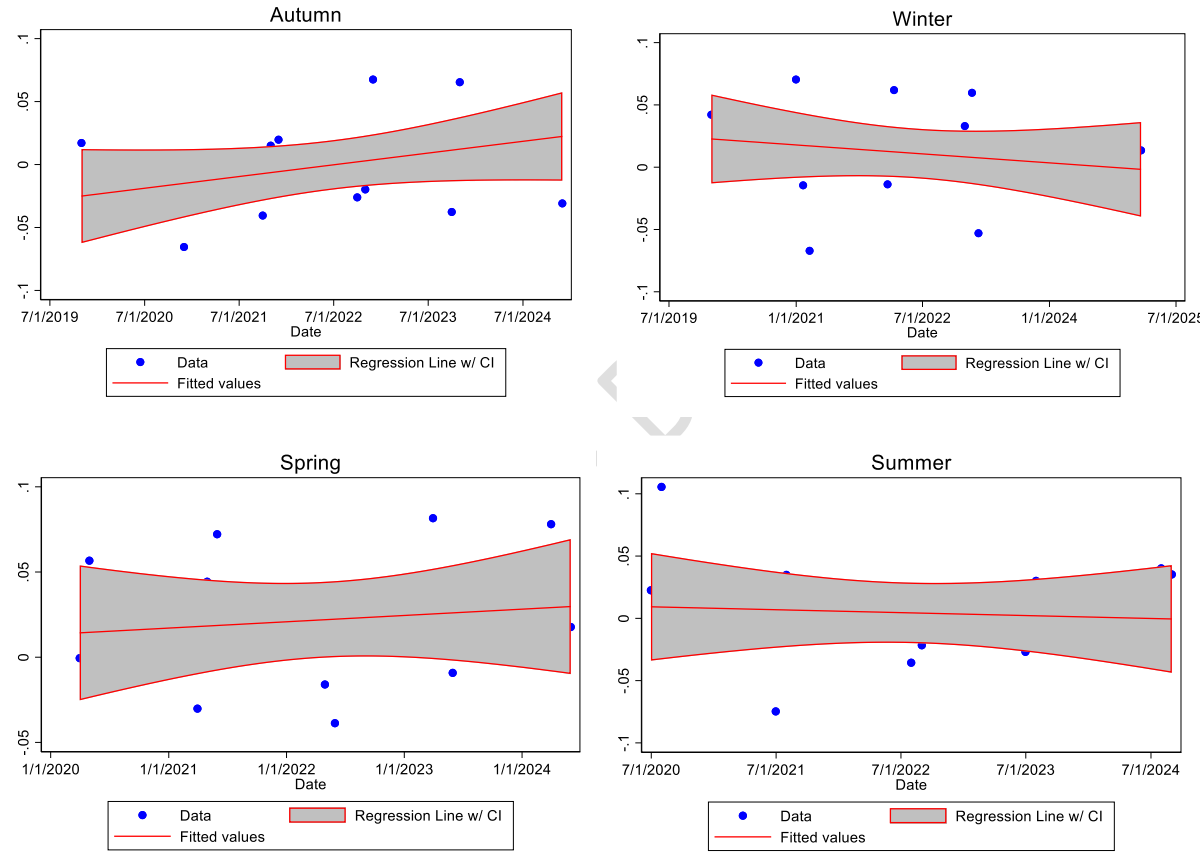


Figure 8: Descriptive Statistics plots of Unconditional Seasonal Gold Spot Returns (January – December) (Monthly)



3.2.2 Overview of Gold and Silver Price Levels and Returns

This section gives an overview of gold and silver price levels and volatility represented in figures 9 and 10. The analysis covers some months leading up to the COVID-19 crisis, the COVID-19 period, and post-COVID-19 for comparison purposes. Figure 9 below shows gold and silver price levels with the COVID-19 period superimposed:

Figure 9: Gold and Silver Price Levels Plot

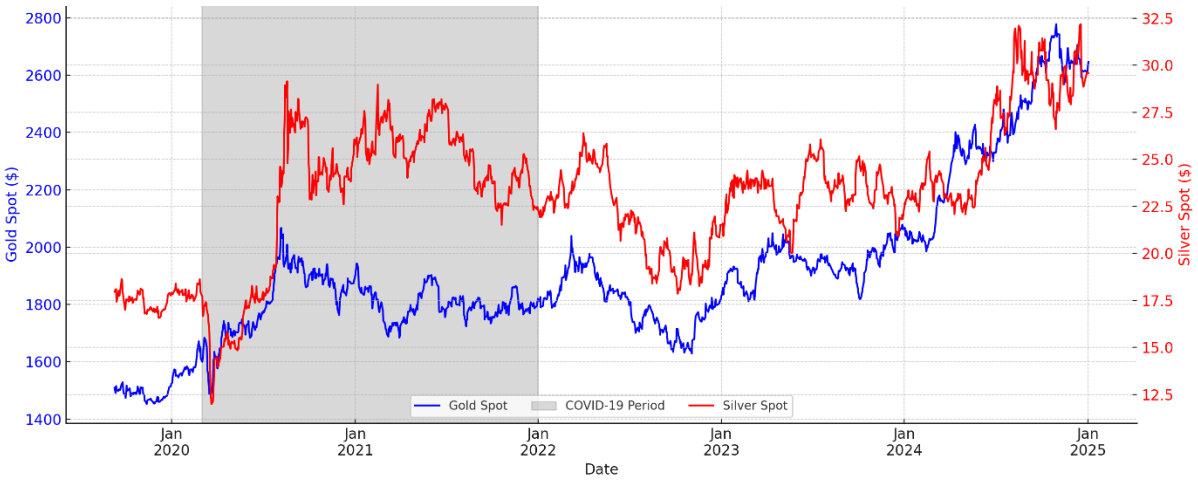


Figure 9 represents gold and silver prices from 2019 – 2025.

Figure 9 shows an initial substantial increase in gold and silver prices, then a gradual decline with moderate volatility with a significant dip and prices and a rebound. Furthermore, gold, and silver prices initially converged on the upward trend, then diverged on downward movements until the end where they both converged again. Escribano & Grangwer (1998) found in bubble and post-bubble periods, gold and silver prices are highly linked, however over time the two markets are becoming more separated. Since 2024, the gold and silver markets have significantly increased.

Figure 10 below has also been added for return comparison of gold and silver. Results show silver to be more variable in returns.

Figure 10: Gold and Silver Returns Plot

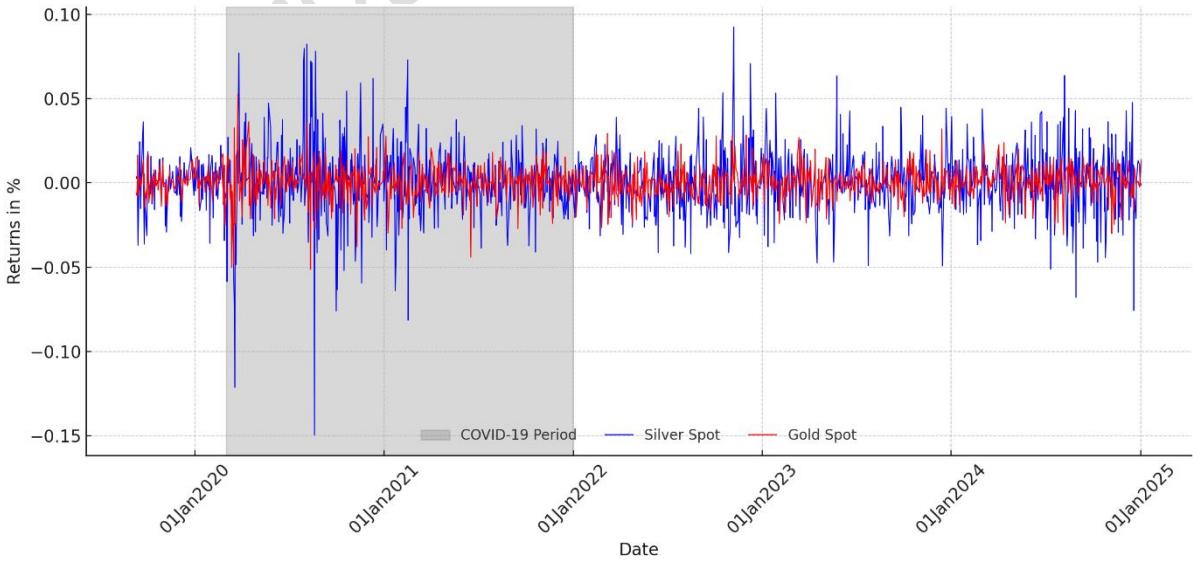


Figure 10 represents gold and silver returns from 2019 – 2025.

Next, I breakdown gold spot returns into months and seasons for further analysis. This is firstly important to answer the research questions and address the research gap whether the Autumn effect has disappeared. This also gives valuable insights into any trends, patterns, and new seasonal anomalies which could have appeared. Furthermore, events of the COVID crisis help explain lower returns. Research on seasonality is limited, thus vital to breakdown into months and seasons to gain greater insight. These results are mixed and somewhat support the hypothesis that there are new seasonal patterns emerging in gold returns.

The next section analyses gold return and variances with regression models controlling for other factors including currency exchanges, stock market volatility and stock market conditions across regions. Firstly, the analysis of returns section specifies the model. Next, this paper analyses monthly regressions with dummy variables to identify months and seasons with significant returns. Additionally, the section analyses volatility through ARCH, Asymmetric ARCH, and GARCH models. Finally, the paper will analyse seasonality using a constant with volatility.

3.3 Analysis of Returns

This section of the paper has two parts. I provide estimation results on gold returns and secondly, I provide estimation on gold variance of returns using a similar methodology of Baur (2013). The results will be compared to Baur's (2013) and Bentes *et al's* (2022) papers whether seasonality of gold returns have shifted during and since the COVID-19 crisis. The regression model is done for each month using a monthly dummy control variable. The daily and monthly models used in this essay is as follows:

$$r_{g,t} = \beta_1 D_{January} + \cdots + \beta_{12} D_{December} + \varepsilon_t \tag{3}$$

$$r_{g,m} = \beta_1 D_{January} + \cdots + \beta_{12} D_{December} + \varepsilon_m \tag{4}$$

Where:

$r_{g,t(m)}$ is gold return at time t or m

D_{month} is monthly dummy variables

β_i is the estimated coefficients for each month

$\varepsilon_{t(m)}$ is the estimated coefficients for each month

As a robustness check, I run a separate model with a constant and 11 months with December as the omitted reference category which yields similar results (see appendix 8). This is set out by the following model:

$$r_{g,m} = \alpha + \beta_1 D_{January} + \cdots + \beta_{12} D_{November} + \varepsilon_m \quad (5)$$

3.3.1 Analysis of Monthly Regression with Dummy Variables

Table 7 is run with monthly dummies and no control variables where $\gamma = 0$ for spot gold, gold futures and spot silver (Equation 5). Results in comparison to table 6 (appendix 8) yield similar results, however, display the statistical significance of the monthly dummy variables.

Additionally, monthly ARCH, Asymmetric ARCH, and GARCH estimates are provided for analysis of variance. This is set out in the models below:

1. ARCH(1) Model (Engle, 1982)

   (1) Mean equation:

$$r_{g,t} = \mu + \varepsilon_t \quad (6)$$

Where:

$r_{g,t}$ is return at time t

μ is the mean return

ε_t is the error term at time t, with $\varepsilon_t \sim N(0, h_t)$

   (2) Variance Equation:

$$h_t = w + \alpha_1 \varepsilon_{t-1}^2 \quad (7)$$

Where:

h_t is the conditional variance at time t

ω is the constant term in the variance equation

α_1 I the effect of the lagged squared shocks (ARCH effect)

2. GJR-GARCH (Glosten *et al*., 1993)

(1) Mean equation:

$$r_t = \mu + \varepsilon_t \tag{8}$$

(2) Variance Equation:

$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \gamma\varepsilon_{t-1}^2 \mathrm{I}_{\{\varepsilon_{t-1}<0\}} + \beta h_{t-1} \tag{9}$$

Where:

r_t is return at time t

ε_t is the return innovation, with $\varepsilon_t \sim N(0, h_t)$

h_t is the conditional variance at time t

ω is the long-run variance (constant)

α is the lagged squared residuals (ARCH effect)

β effect of past variance (GARCH effect)

γ measures the asymmetry or additional effect of negative shocks

$\mathrm{I}_{\{\varepsilon_{t-1}<0\}}$ is the indicator function (1 if negative shock, 0 otherwise)

3. GARCH(1,1) (Bollerslev, 1986)

(1) Mean equation:

$$r_{g,t} = \mu + \varepsilon_t \tag{10}$$

(2) Variance equation:

$$h_t = \omega + \alpha_1\varepsilon_{t-1}^2 + \beta_1 h_{t-1}$$

(11)

Where:

h_t is the conditional variance of returns at time t

ω is the long-run average level of volatility (constant term)

α is the ARCH term (impact of previous shock)

ε_{t-1}^2 is the shock to the return from the previous period

β is the GARCH term

h_{t-1} is the last period's estimated variance

GARCH estimates are run with the optimal lag according to the Akaike Information Criterion (AIC). As specified by Baur (2013), optimal AIC lags at 0 will be run with 1 lag (Appendix 9). This will help control for serial correlation and improve inference. In the ARCH estimations for gold spot, only March is positive and significant indicating volatility clustering in this month. In gold futures, volatility clustering is significant and positive in March whilst being significant and negative in May, September, and November. Finally, for silver spot, volatility clustering is significant and positive in February, March, August, and significant and negative in September and November. In the Asymmetric ARCH estimates, gold spot results show January and October to be highly significant and negative indicating positive shocks increase volatility more than negative shocks. Gold futures were found to be significant and negative in the months of April, May, and September. Finally, silver spot results show May, July, and September to be significant and negative meanwhile March is significant and positive. Lastly, in the GARCH estimates, results in gold spot show the months of May, August, November, and December to be significant. Results also show in gold futures to be significant in July, August, and September. Finally, silver spot is significant in January, February, August, September, November, and December. Lags structures and unit root tests are included in appendices 9, 10, 11, & 12 for gold spot, and for silver spot, appendices 13 & 14. The equation and table are found below:

$$r_{G,t} = \beta_1 D_{Autumn} + \cdots + \beta_{12} D_{Summer} + \gamma X + e_t$$

(12)

Where:

$e_t = z_t\sqrt{h_t}$

$h_t = c + \alpha_1 e_{t-1}^2 + \alpha_2 e_{t-1}^2 I(e_{t-1} < 0) + \gamma h_{t-1}$

yX is placeholder for control variables

Table 7: Regression Monthly Dummy Variable Results (Monthly)

[Can only get a good display when the figures are small. Should I change the layout of the pages this is one to landscape? – old table can be found in the excluded appendices section.]

Gold_Spot												
Month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Coef.	0.0133	-0.0089	0.0291	0.0255	0.0114	-0.0197	0.035	-0.0021	-0.0191	0.019	-0.004	0.0253
t-Stat	1.07	-0.38	1.32	1.83	0.62	-1.24	1.56	-0.22	-1.17	1.54	-0.2	2.08
P >|t|	0.334	0.723	0.256	0.141	0.566	0.284	0.193	0.839	0.306	0.183	0.846	0.092*
ARCH												
Coef.	-0.1437	0.1563	0.3231	0.0979	0.2202	-0.0067	-0.0394	-0.0418	-0.069	-0.0468	0.0403	0.0123
t-Stat	-1.6	1.08	2.34	1.44	1	-0.2	-0.79	-0.34	-0.63	-0.42	0.72	0.37
P >|t|	0.109	0.278	0.019**	0.151	0.319	0.842	0.429	0.731	0.528	0.677	0.472	0.708
Asymmetric ARCH												
Coef.	-0.1559	-0.0345	0.0942	-0.0641	0.345	-0.0328	0.2298	-0.0304	-0.0729	-0.1622	0.0875	-0.0851
t-Stat	-2.16	-0.21	0.77	-0.62	0.83	-0.2	0.09	-0.31	-0.68	-2.68	0.57	-0.59
P >|t|	0.030**	0.833	0.439	0.534	0.405	0.842	0.932	0.759	0.499	0.007***	0.57	0.554
GARCH												
Coef.	0.8231	0.7801	0.1166	0.1825	0.0396	1.1707	0.805	0.9696	0.2882	-0.3897	0.2995	3.2626
t-Stat	1.64	1.62	0.18	0.83	2.23	1.03	2.57	4.34	0.32	-0.13	2.05	19.78
P >|t|	0.101	0.105	0.857	0.406	0.026**	0.302	0.010***	0.000***	0.746	0.894	0.040**	0.000***
Constant												
Coef.	0	8.77E-06	0.0001	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001
t-Stat	0.59	0.2	1.06	14.91	1.3	6.89	3.38	9.53	0.86	0.49	5.62	0.79
P >|t|	0.556	0.841	0.29	0.000***	0.193	0.000***	0.001***	0.000***	0.39	0.622	0.000***	0.432
Gold_Futures												
Coef.	0.0081	0.0108	0.0335	0.0041	0.0192	-0.0196	0.0323	-0.0016	-0.0163	0.0132	0.0067	0.0183
t-Stat	0.69	0.4	1.69	0.36	1.26	-1.13	1.85	-0.11	-0.86	0.84	0.35	2.88
P >|t|	0.523	0.709	0.166	0.737	0.276	0.32	0.138	0.917	0.436	0.437	0.738	0.035**
ARCH												
Coef.	-0.0166	0.2621	0.2566	-0.0599	-0.1719	-0.0412	-0.0601	-0.0522	-0.2019	-0.0682	-0.0995	0.04
t-Stat	-0.63	1.58	1.88	-0.96	-2.99	-0.29	-1.05	-1.43	-4.75	-1.4	-1.88	0.33
P >|t|	0.529	0.115	0.060*	0.336	0.003***	0.773	0.293	0.154	0.000***	0.161	0.060*	0.739
Asymmetric ARCH												
Coef.	-0.0169	0.3361	0.3839	-0.1611	-0.1848	-0.035	-0.153	-0.0578	-0.1934	-0.1391	-0.1256	0.051
t-Stat	-0.13	1.3	1.27	-2.2	-1.67	-0.28	-1.51	-1.02	-2.03	-1.1	-1.27	0.24
P >|t|	0.889	0.193	0.205	0.027**	0.096*	0.781	0.132	0.308	0.042**	0.27	0.203	0.814
GARCH												
Coef.	0.9542	0.0196	0.3976	1.0702	0.5948	0.203	0.228	1.2825	0.7587	0.098	0.1	0.0225
t-Stat	0.79	0.06	0.99	0.84	0.7	0.06	2.73	2.05	2.12	0.66	0.29	0.32
P >|t|	0.428	0.952	0.323	0.399	0.487	0.95	0.006***	0.040**	0.034**	0.51	0.775	0.981
Constant												
Coef.	0.0002	0.0001	0.0002	-5.21E-06	0.0001	0.0001	0.0001	0.0002	0	0	0.0002	0.0001
t-Stat	2.8	2.45	6.08	-0.04	0.64	0.25	0.4	5.42	1.15	-0.41	7.11	0.79

P >|t|	0.005***	0.014**	0.000***	0.972	0.524	0.799	0.692	0.000***	0.25	0.679	0.000***	0.432
Silver_Spot												
Coef.	0.0109	0.0298	-0.0289	-0.0229	0.039	0.0634	0.0128	0.0193	-0.0116	-0.0386	0.0157	0.0203
t-Stat	0.59	1.63	-0.54	-1.03	1.1	1.77	0.22	0.39	-0.43	-1.36	0.69	0.71
P >|t|	0.583	0.179	0.621	0.362	0.333	0.151	0.838	0.717	0.691	0.232	0.518	0.509
ARCH												
Coef.	-0.0522	0.2159	0.4955	-0.113	-0.1167	0.0952	0.1245	0.5504	-0.1467	0.087	-0.0006	-0.0588
t-Stat	-0.53	1.78	3.04	-0.94	-0.61	0.53	4.16	3.04	-4.06	0.72	-1.81	-1.2
P >|t|	0.597	0.075*	0.002***	0.348	0.539	0.593	0.000***	0.002***	0.000***	0.472	0.070*	0.231
Asymmetric ARCH												
Coef.	-0.1263	-0.0242	0.7172	-0.1129	-0.3454	0.0571	-0.0876	0.0159	-0.2387	0.0097	-0.0942	-0.0584
t-Stat	-1.4	-0.1	2	-0.54	-2.45	0.18	-2.46	0.05	-2.77	0.07	-0.48	-0.27
P >|t|	0.162	0.924	0.045**	0.591	0.014**	0.853	0.014**	0.96	0.006***	0.945	0.628	0.789
GARCH												
Coef.	0.672	0.5511	0.1368	0.1881	1.5135	0.2709	0.3929	0.4313	1.1095	1.7606	0.0691	1.3157
t-Stat	2.5	2	0.64	0.18	1.43	0.18	1.32	2.18	6.94	1.34	37.91	3.06
P >|t|	0.012**	0.045**	0.525	0.861	0.152	0.857	0.188	0.030**	0.000***	0.181	0.000***	0.002***
Constant												
Coef.	0.0003	0.0002	0.0001	0.0005	-0.0001	0.0002	0.0006	-0.0001	9.76E-06	-0.0003	0.0034	0.0004
t-Stat	0.25	1.38	1.93	3.1	-0.32	0.44	4.87	-0.7	0.16	-0.67	0	0.69
P >|t|	0.803	0.166	0.053*	0.002***	0.752	0.663	0.000***	0.481	0.871	0.502	0.000***	0.493

Only December in gold spot and futures yield a positive and significant return. No other months in gold spot or futures were found to be significant. In silver spot, no months were found to be significant. In ARCH for gold spot, March is significant and positive. In Asymmetric ARCH, gold spot is significant and negative in January and October.

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Results show average returns in gold spot and futures for the months of Autumn (September, October, November) are statistically insignificant. The only month which is statistically significant for both is December with a positive coefficient. Silver, despite its long-run co-movement with gold returns, showed no months to be significant[21].

Table 7 below shows the variance of gold returns is not constant. Therefore, in the second section, gold's variance is reported and discussed in an asymmetric GARCH model.

3.3.2 Analysis of Monthly Regression with Dummy Variables Conditional on World Market Index Returns

Table 14 displays estimation results of average gold returns conditional on different stock market index returns using monthly dummy variables. See the equation below:

$$r_{g,m} = \beta_1 D_{january} + \cdots + \beta_{12} D_{December} + \delta R_m^{Index} + \varepsilon_m \quad (13)$$

Where:

[21] Average monthly return coefficients are multiplied by 100.

$r_{g,m}$ is gold return at time m

D_{month} is monthly dummy variables

β_i is the estimated coefficients for each month

R_m^{Index} is the return on the representative market index at time m

δ is the conditional effect of the market index on gold

ε_m is the error term

The panels represent monthly gold returns conditional on MSCI Emerging Markets, MSCI World Markets and S&P500 index respectively. These indices capture a large proportion of the world stock market indices for accurate global analysis.

Table 14: Monthly Spot Gold Returns Conditional on Stock Market Index Returns (Monthly)

[Could split this into two tables – seasonal and monthly to be in line with the plots above?]

Month:	MSCI_Emerging_Markets			MSCI_World_Markets			S&P500		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0389	0.42	0.673	0.1508	1.79	0.078*	0.1208	1.37	0.175
Aut	-0.3382	-1.33	0.204	0.0663	0.40	0.694	0.2177	0.97	0.347
Win	-0.0857	-0.40	0.697	-0.3175	-1.10	0.290	0.1104	0.61	0.554
Spr	0.1748	1.90	0.081*	0.1991	1.85	0.087*	0.1328	1.58	0.139
Sum	0.5984	1.84	0.088*	0.7537	2.84	0.014**	0.0392	0.18	0.863
Jan	-0.2798	-1.05	0.353	-0.9277	-2.29	0.084*	0.3527	1.62	0.180
Feb	-0.8882	-2.61	0.080*	-0.9943	-2.64	0.077*	-0.5137	-1.05	0.372
Mar	0.3194	1.86	0.160	0.2557	1.43	0.249	0.0527	0.24	0.829
Apr	0.4075	3.42	0.042**	0.2596	0.74	0.511	0.3674	5.36	0.013**
May	0.3795	1.07	0.361	0.3222	1.48	0.236	0.2108	0.34	0.759
June	0.2889	0.81	0.475	0.3084	0.58	0.602	-0.0957	-1.09	0.356
July	0.7824	1.50	0.231	0.8830	4.06	0.027**	-0.0841	-0.15	0.891
Aug	0.4726	1.42	0.251	0.2410	0.25	0.817	0.4098	1.66	0.195
Sept	0.1695	0.26	0.811	0.3121	0.65	0.561	0.6932	4.57	0.020**
Oct	0.2003	0.96	0.392	0.2713	2.23	0.090*	-0.0278	-0.08	0.939
Nov	-0.8077	-5.18	0.007***	-0.0622	-0.11	0.917	-0.3647	-0.91	0.414
Dec	0.4205	2.56	0.063*	0.8001	2.41	0.073*	0.0482	0.20	0.850

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

Results show only MSCI World Markets to be significant and positive respectively. The S&P500 is positive, opposite to Baur's (2013) paper. Additionally, results showed gold returns are slightly positively correlated with the MSCI Emerging markets and S&P500

indices. When analysing whether the "autumn effect" is still existent, across all 3 stock market measures, Autumn was found to be insignificant. A deeper analysis into the months of autumn uncovered gold conditional on MSCI Emerging Markets to be significant and negative in November, MSCI World Markets to be significant and positive in October, and the S&P 500 to be significant and positive in September. Despite this, all three market indices found significant and positive returns in months outside of the Autumn season too. Given the mixed results, this is further evidence of the disappearing of the 'Autumn effect', and given the mixed results across the indices for months and seasons, there little evidence of a newly emerged seasonal pattern. Results for Silver conditional on MSCI Emerging, World, and S&P500 Market Indices are also available (see appendix 15).

Additionally, in-depth region and country index specific analysis of MSCI Emerging and World Markets Indexes showed most countries which did exhibit significant results in their months and seasons, often positive in at least one month or season during and since the COVID 19 crisis (see Appendices 20 & 21). Recently, the COVID crisis however saw a large amount of stimulus and asset buying programmes by the central banks which propped up the stock market during an uncertain time, especially in western countries[22]. Additionally, stocks have benefited from an AI boom with sectors of technology stocks seeing rapid growth and investment also increasing stock market returns (Floridi, 2024).

Findings show in China, the Autumn effect has disappeared. Results showed India has a significant and negative month in January, and positive in July, October, and December (see appendix 20). MSCI Emerging and World Markets results showed Spring and Summer to be significant and positive, however Autumn to be insignificant. A deeper analysis into the MSCI Emerging Markets Indexes showed the regions of the Americas, EMEA, and Asia Pacific to be insignificant. However, the Americas is significant and negative in January, and positive and significant in August. EMEA and Asia Pacific however were found to be positive and significant in December (Appendix 20). MSCI World Markets Indexes showed the regions of the North America, and Asia Pacific to be insignificant, however Europe was found to be significant and positive. A deeper analysis shows North America to be positive and significant in July, Europe to be positive and

[22] Gold's hedging properties with the stock market do not need to be existent for exhibiting safe haven properties (Baur & Lucey, 2010).

significant in April, July, and September, and finally, Asia Pacific to be positive and significant only in December (Appendix 21).

As an alternative to Table 14 above, Table 15 (Appendix 15) included Silver as a control variable as an alternative specification. Results show a larger number of coefficients for silver estimations are large, representing a long-run co-movement in gold and silver returns. In contrast to Baur's (2013) findings, this paper finds MSCI Emerging Markets, MSCI World Markets to be significant and positive in December, and the S&P 500 to be significant and negative in December. All three market indices conditional on silver were found to be highly significant and positive.

3.3.3 Analysis of Seasonal Regression with Dummy Variables

Finally, in table 22, I analyse the variation in gold returns between the four seasonal dummy variables (Autumn, Winter, Spring, Summer) shown in equation 12 derived from equation 3. Results are compared to findings in literature such as the "Autumn effect" (see Baur, 2013 & Bentes *et al*., 2022) and the "negative January effect" Lucey & Tully (2006). Then equation 3 is re-estimated so the months are included in the four seasonal dummy variables. The error term is also included at the end of the GARCH model explained above.

Table 22: Gold Return Seasonal Dummy Variables (Monthly)

	Coef.	t-Stat	P >|t|
Mean Equation:			
Autumn	-0.0003	-0.04	0.972
Winter	0.0110	1.19	0.252
Spring	0.0220	2.19	0.046**
Summer	0.0044	0.40	0.692
Variance Equation:			
ARCH	0.0875	4.02	0.000***
Asym. ARCH	0.0806	3.50	0.000***
GARCH	0.9543	3.80	0.000***
Const.	0.0001	31.82	0.000***

***,**,* denote statistical significance at the 1%, 5%, and 10% level respectively.

Table 22's results find Spring to be positive and significant at the 5% confidence level. This contrasts to Baur's (2013) findings and aligns with Bentes *et al's* (2022) paper that the "Autumn effect" has vanished and is near zero. This additionally supports evidence towards a possible emergence of a 'Spring effect'. All results yielded positive coefficients apert from Autumn which was slightly negative.

The GARCH coefficient estimates suggest gold has an inverted asymmetric volatility effect. This is a phenomenon where positive shocks to gold's price leads to higher volatility meanwhile negative shocks to gold's price leads to lower volatility (see Figure 10).

Baur's (2013) paper suggested investors traditionally bought gold as a hedge against a stock market crash risk and sell some gold in the Winter season when there is excess positive stock market returns during the "Halloween effect". Later, Bentes *et al* (2022) suggested the Autumn effect disappeared and became slightly negative due to decaying demand in the third quarter of 2020. Findings suggest since 2019, this trend has continued due to the COVID 19 crisis and other global events causing uncertainty and shifts in gold supply and demand. For example, the effect of Basel III NSFR compliance (BIS, 2022). These events have triggered uncertainty outside the Autumn season; hence it is not surprising there has been a 'flight-to-safety' for safe haven assets such as gold. Gold returns increase during these times of turmoil as found in this paper for all seasons. Other previous literature on suggested by Baur (2013) on winter blues, Christmas festive and the Indian gold buying season has not held as a significant factor during and since the COVID 19 crisis.

Findings from Bentes *et al's* (2022) suggest that alternative hedges such as cryptocurrencies, fixed income investments have led a decline of 20% overall gold demand (despite an increase in investment demand) also impacting traditionally positive Autumn season for gold demand (WGC, 2023). Whilst initially this may have been true, accelerated gold demand and returns in 2024 have further shifted this dynamic.

3.4 Analysis of Variance in Returns

This section shows analysis of seasonality in variances in gold returns. Figure 7 shows the asymmetric GARCH specification proposed by Glosten *et al*. (2013) shown in the below model:

Figure 7: Gold Bullion Return and Volatility

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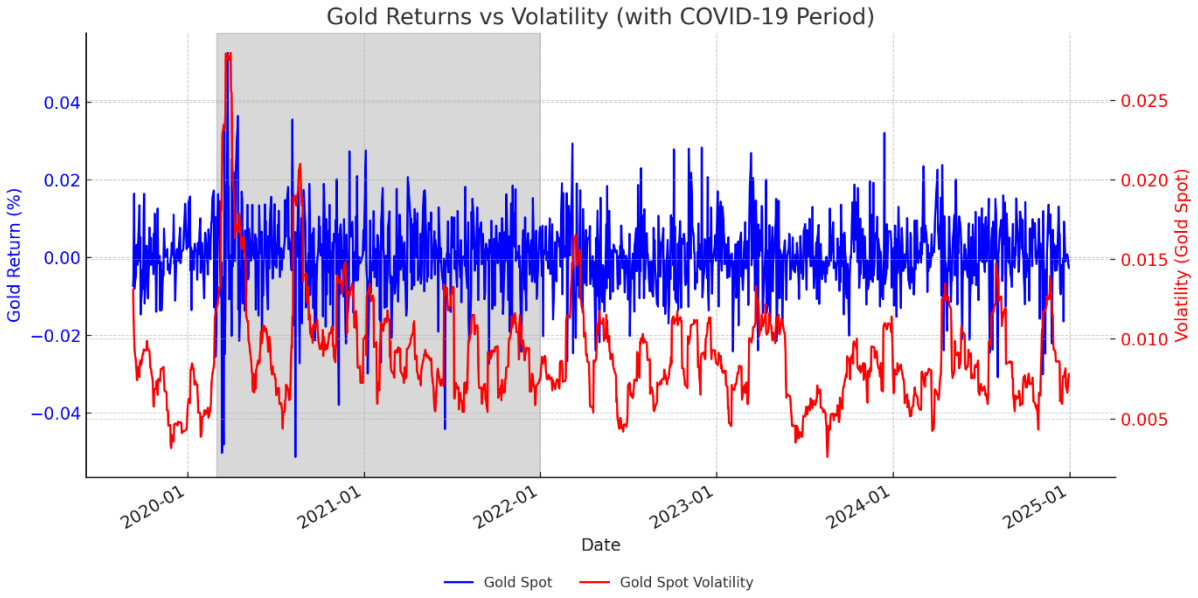

$$h_t = c + \alpha_1 e_{t-1}^2 + \alpha_2 e_{t-1}^2 I(e_{t-1} < 0) + \gamma h_{t-1}$$

(14)

Where:

h_t = the conditional volatility of gold returns

α_2 is the parameter which captures the asymmetric effect. This deciphers whether shock estimates have different effects depending on whether they are positive or negative shocks.

To analyse the seasonality within variances of gold returns, I need to incorporate the variance estimates in figure 7 into seasonal dummy variables. The equation for this is shown below:

$$\widehat{h_t} = \delta_1 D_{autumn} + \delta_2 D_{winter} + \delta_3 D_{spring} + \delta_4 D_{summer} + v$$

(15)

For seasonal volatility in gold returns, I also use a GARCH framework similar to the methodology of Baur (2013). I can then make clear comparison of the volatility of gold returns and whether seasonality has shifted during and since the COVID-19 crisis. The data description in table 2 showed that variance was not constant. Therefore, for this essay, I will specify the error term (e) as volatility for our asymmetric GARCH model.

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Table 24 below shows parameter δ_i estimation results. The results confirm and support the unconditional results the Autumn season is no longer the most volatile, and in fact the least volatile. Since the COVID 19 crisis, the most volatile season has shifted towards the spring season, the only significant season. Seasonal ARCH, Asymmetric ARCH, and GARCH models are also available for more in-depth analysis (Appendix 22).

Table 24: Variance Seasonality of Gold Returns (Regression Estimates)

Asymmetric GARCH (Seasonality)			
	Coef.	t-Stat	P >|t|
Winter	-0.0413	-0.64	0.524
Spring	0.3333	4.32	0.000***
Summer	0.0935	1.60	0.109
Constant	0.5413	6.73	0.000***

Table 23 represents seasonality of variance in gold spot returns for each season. All results apart from Autumn are highly significant at the 1% confidence level. With Autumn as the constant term, the summer, spring, and winter seasons are all positive dummies and has the highest variance with Winter being the highest.

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Findings on seasonality in volatility show Autumn and Spring to be significant and positive. Our results still hold in line with previous literature that positive shocks (good news) create more volatility than negative shocks (bad news) in gold returns (Chkili *et al*., 2014 and Baur, 2011). However, evidence of seasonality in variance is less clear. On one hand, the unconditional reported standard deviation reported in Table 5 (Appendix 7) in the Autumn months do not appear to be significantly larger than any other months and less than spring and summer. However, March and July seem to have the largest standard deviations. This varies from Baur's (2013) findings.

On one hand, this is in line with Baur's (2013) paper which found Autumn to be the most volatile. However, Spring also has a significant and positive asymmetric volatility contrasting Baur's (2013) paper. One possible reason for this could be the implementation of Basel III in winter season (BIS, 2022). Another reason could be the effect of the COVID 19 crisis creating the most volatile time periods outside the autumn season. Additionally, recent global uncertainty has dramatically increased gold demand and returns in most months, thus shifting seasonal volatility. Quantile regression models for the 1, 5, 10, 50, 90, 95, and 99 percent quantiles are provided for additional analysis (Appendix 23). This to assess whether high or low return periods cluster in specific seasons by estimating quantile regressions across various percentiles of the gold return

distribution. This helps determine whether gold market volatility is more pronounced in extreme conditions. Findings contrast Baur's (2013) paper where seasonality effects are not as strong in the upper quantiles (extreme returns), especially in the Autumn period where volatility is low. Spring however is the most consistent season showing mild volatility elevation across the distribution, although with a diminishing significance in the upper tail. Winter and Summer generally display insignificant coefficients.

4.0 Conclusion

Results indicate a possible seasonal pattern has emerged in the season of Spring, particularly in March and April. Although, there is some evidence that the Autumn effect has remained with a lesser significance. Returns in the months of September and November are no longer significant. All monthly unconditional gold returns were insignificant apart from December which was significant and positive. Conditional monthly returns found no significant conditional seasonal returns in the Americas, North America, Asia Pacific, EMEA and Europe indices. However, December had significant and positive returns in Europe, Asia Pacific, and the EMEA. This is not consistent with seasonal volatility where Spring and Autumn exhibited seasonality. The Winter and Summer seasons showed insignificant volatility. Monthly volatility estimates indicated March to be significant in the ARCH model and May, July, August, November, and December to be significant in the GARCH model. These findings show evidence that since the COVID crisis, the "Autumn effect" in returns and disappeared and become less significant in volatility with Spring emerging as a new seasonal effect. Evidence also shows on the conditional gold returns, gold has not acted as a good hedge during uncertain times. This paper attributes this largely due to increased stock returns during the same period.

These results present an anomaly to the efficient markets hypothesis presented by Fama (1970) as results show there is seasons with abnormal returns above and below other seasons of the year. I offer three main explanations for the shift in seasonality from the "Autumn effect". Firstly, Basel III has large implications of central bank holdings of gold derivatives and significantly reduced the number of short positions in the gold market (BIS, 2022). This happened on the 1st of January 2023 and changed the month of CBGA's (previously September). Secondly, the flight-to-safety phenomenon which occurred during the later stages of the COVID crisis. Lastly, the ongoing geopolitical tensions and

worldwide inflationary pressures since COVID all year round causing the autumn effect of returns and volatility to disappear.

This is the one of the limited number of papers to analyse seasonal anomalies in gold return and volatility during and after Baur (2013) and Bentes *et al*. (2022) and the first paper since the COVID 19 crisis. A limitation of this paper is data at the time of writing was only available until early 2025. This the period of analysis may not be sufficient to confirm any new seasonal patterns and decipher from the effects of the COVID 19 crisis. Future research could confirm whether new seasonal patterns such as investigating whether the 'Autumn effect' has remained insignificant. Furthermore, whether the possible emergence of the 'Spring effect' in return and volatility is short lived or an established pattern. Additionally, other types of seasonal patterns could be investigated such as daily patterns like Lucey & Tully's (2006) study on whether a negative Monday effect is still occurring during and since the COVID-19 crisis. These findings have implications for portfolio managers and investors seeking to trade the gold markets.

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6.0 Appendices:

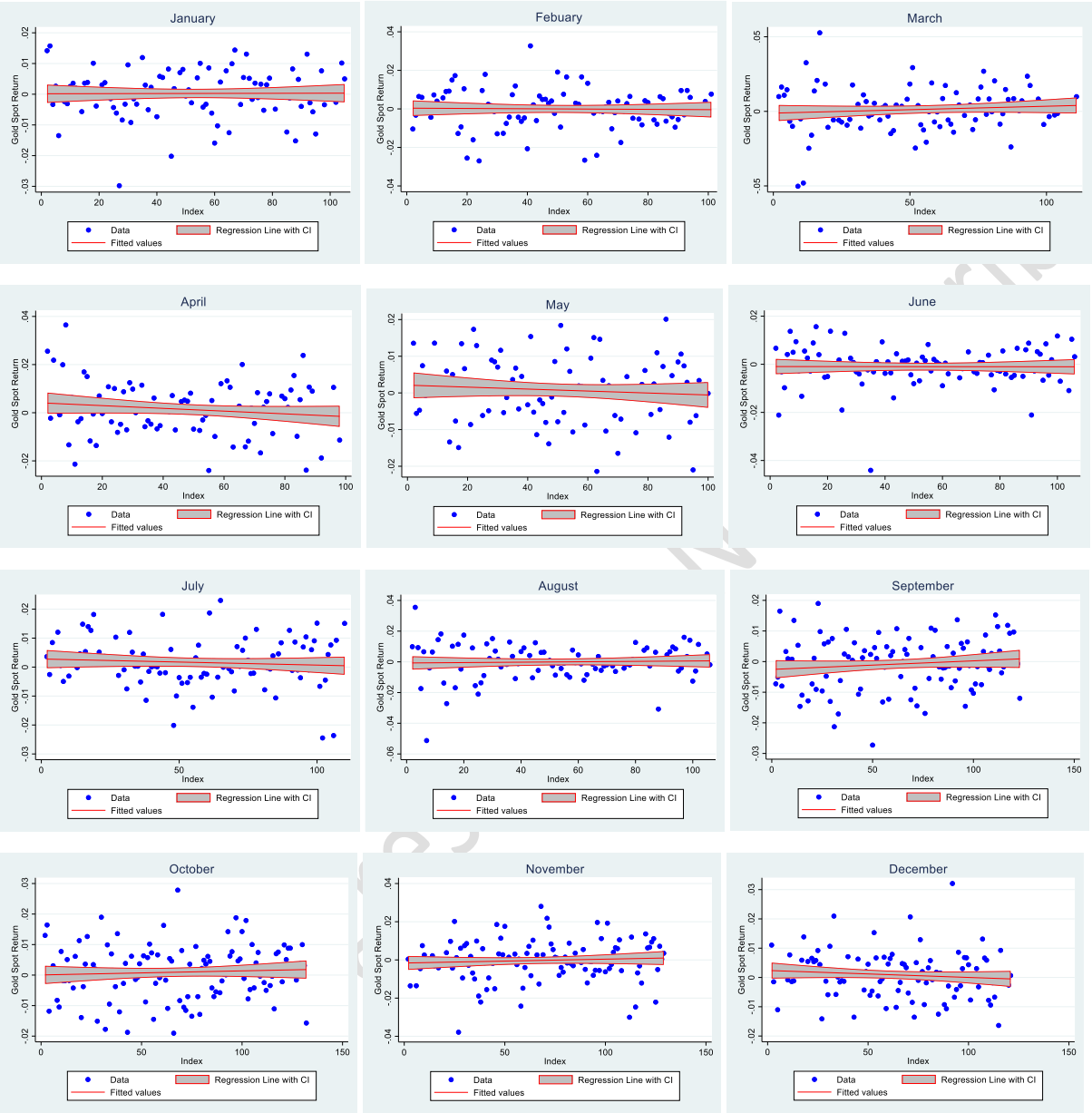
Appendices 1: Table 3: Descriptive Statistics (Daily)

Variable	N	Mean (x100)	Std. Dev.	Min	Max	Skewness	Kurtosis	ADF P-Value
Gold_Spot	1340	0.0464	0.0096	-0.0513	0.0527	-0.3116	6.2189	0.0000
Gold_Futures	1340	0.0471	0.0102	-0.0499	0.0595	-0.1697	6.3573	0.0000
Silver_Spot	1340	0.0567	0.0197	-0.1496	0.0924	-0.2815	8.5415	0.0000
Silver_Futures	1340	0.0571	0.0209	-0.1161	0.0930	-0.2135	6.7682	0.0000
MSCI_Emerging_ Markets	1340	0.0140	0.0109	-0.0671	0.0573	-0.4216	8.1776	0.0000
MSCI_World_Markets	1340	0.0459	0.0112	-0.0991	0.0877	-0.8171	17.7491	0.0000
GSCI_Commodities_Index	1340	0.0348	0.0155	-0.1177	0.0799	-0.9054	11.2734	0.0000
GSCI_Precious_Metals_Index	1340	0.0473	0.0107	-0.0528	0.0588	-0.3022	6.4986	0.0000

Table presents summary statistics (observations, mean, standard deviation, minimum, maximum, skewness, and kurtosis) of daily gold spot, gold futures, silver spot, silver futures, GCSI commodities index and the GCSI commodities precious metals index.

Table 3 below shows a statistical description of all variables specified in the above data specification section for comparison purposes. These statistics show the average daily returns for gold bullion and futures is positive and standard deviations around 0.01 for both. For silver spot, standard deviation is around 0.02 with extreme maximum and minimums of around -0.15 and 0.09 respectively. It is important to note both the MSCI World and Emerging Markets Indexes have increased by 0.01 and 0.05 respectively, which may have implications on results later.

Appendices 2: Figure 3: Unconditional Monthly Gold Spot Returns (January – December) (Daily)



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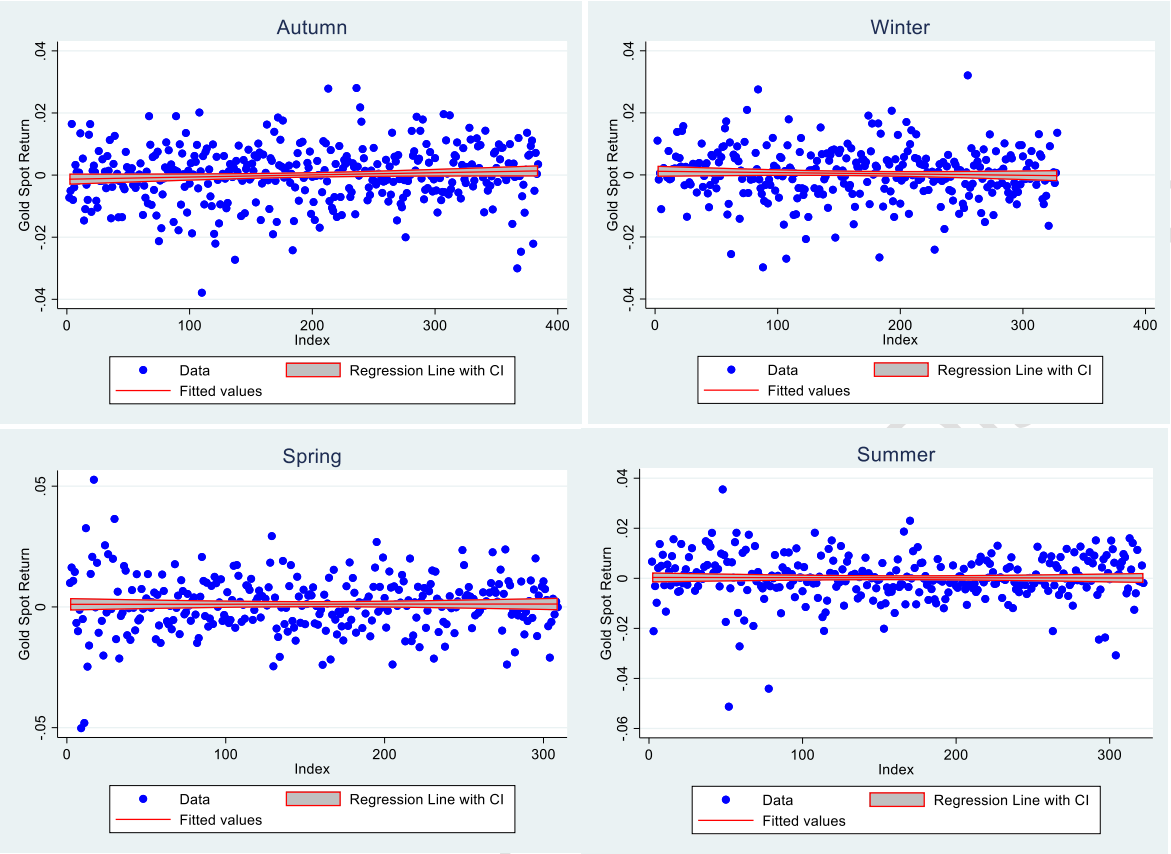
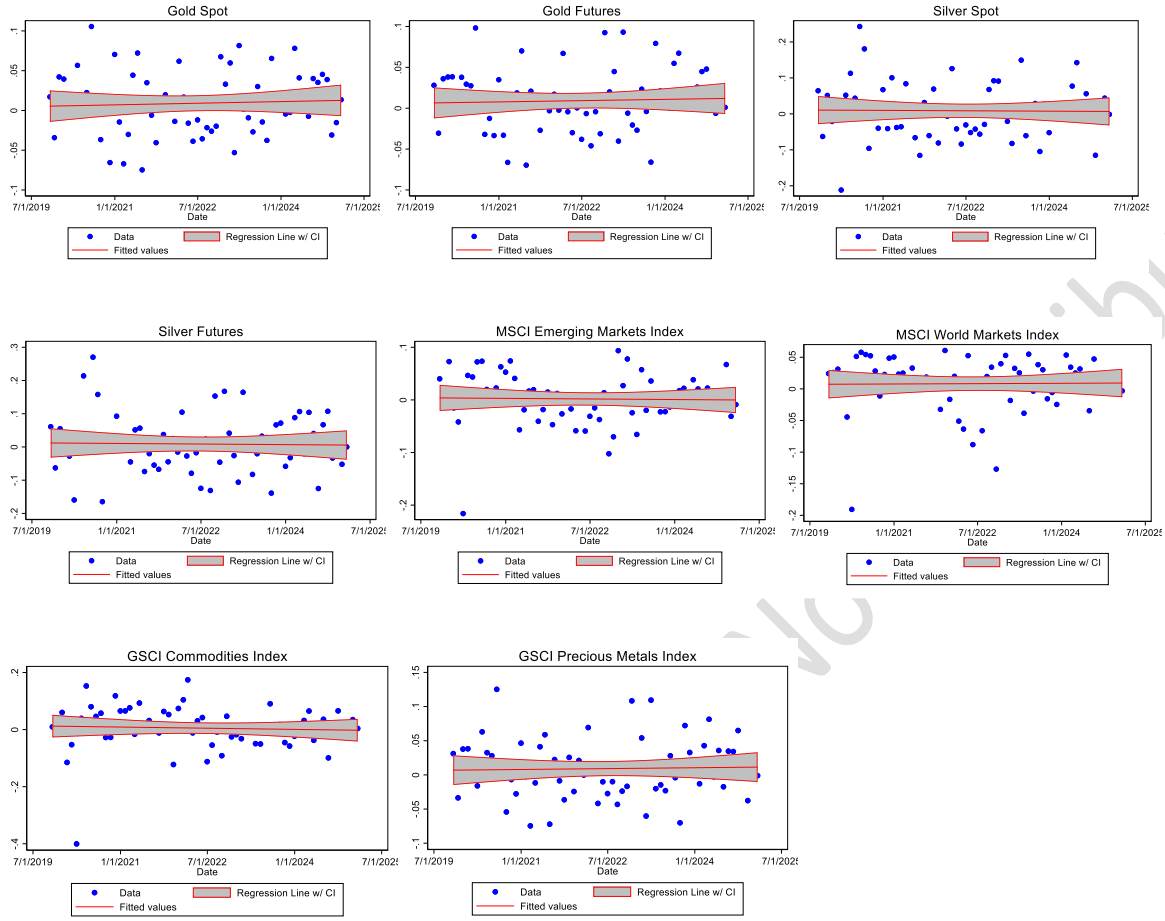
Appendices 3: Figure 4: Unconditional Seasonal Gold Spot Returns (January – December) (Daily)



Appendix 4: Figure 5: Descriptive Statistics Plots (Monthly)



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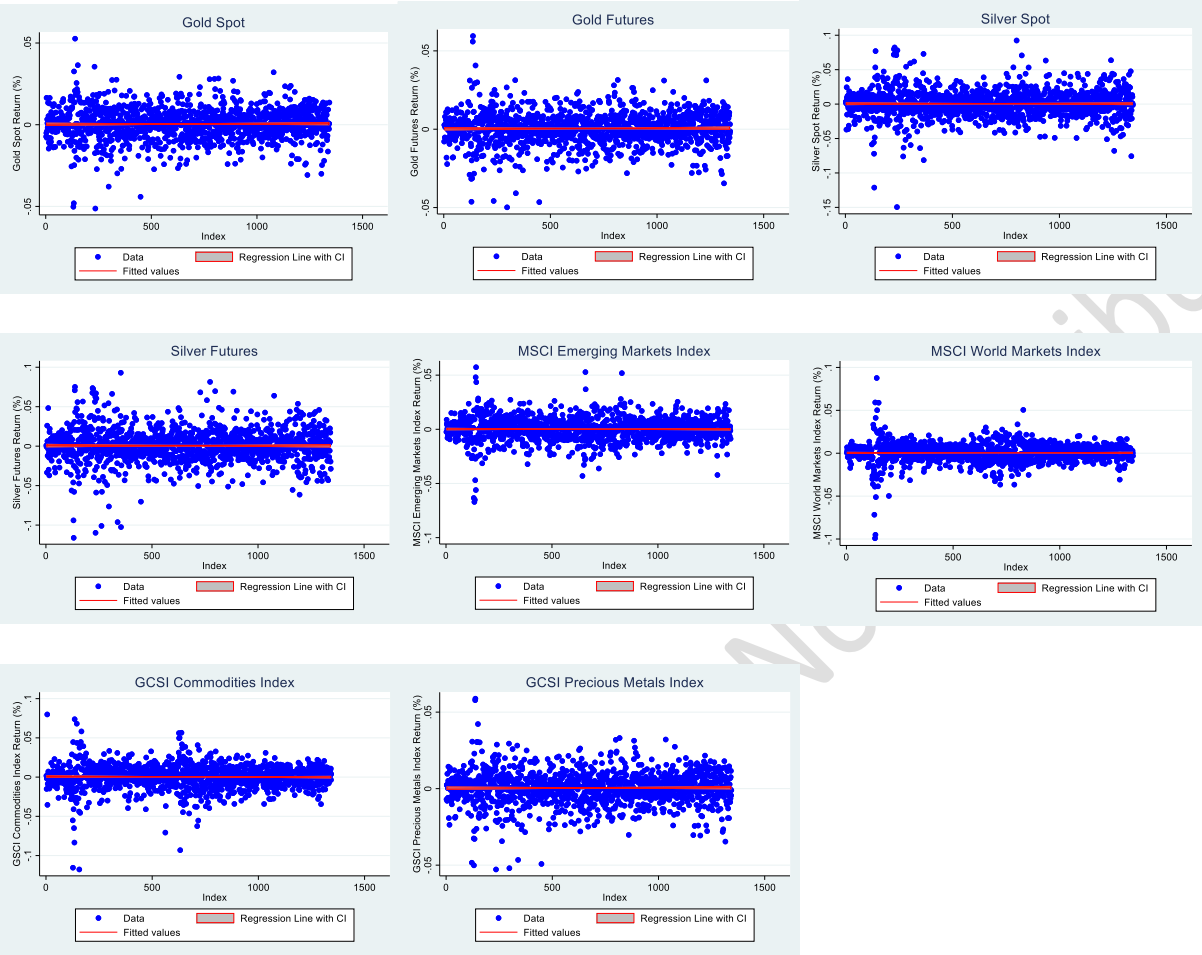
Appendix 5: Figure 6: Descriptive Statistics Plots (Daily)



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Appendix 6: Table 4: Monthly Unconditional Monthly & Seasonal Gold Spot Returns (January – December) (Monthly)

	Months (January – June)					
	January	February	March	April	May	June
Mean (x100)	1.0133	-0.8937	2.9139	2.5476	1.1420	-1.9677
Std. dev.	0.0305	0.0525	0.0492	0.0311	0.0409	0.0356
Minimum	-0.0145	-0.0671	-0.0302	-0.0160	-0.0387	-0.0747
Maximum	0.0597	0.0619	0.0816	0.0567	0.0722	0.0225
Skewness	0.5449	0.1720	0.0578	-0.4144	0.3671	-0.5544
Kurtosis	1.7536	1.6826	1.4076	1.4801	2.2528	2.4040
	Months (July – December)					
	July	August	September	October	November	December
Mean (x100)	3.4998	-0.2140	-1.9110	1.8985	-0.4030	2.5348
Std. dev.	0.0500	0.0221	0.0365	0.0301	0.0482	0.0298
Minimum	-0.0356	-0.0217	-0.0405	-0.0198	-0.0655	-0.0152
Maximum	0.1055	0.0352	0.0453	0.0654	0.0675	0.0704
Skewness	-0.0030	1.1168	1.4196	0.3144	0.2212	0.1907
Kurtosis	2.4750	2.7966	3.1327	2.1171	1.8831	2.1307
	Seasons (Winter – Autumn)					
	Autumn (m9-m11)	Winter (m12-m2)		Spring (m3-m5)		Summer (m6-m8)
Mean (x100)	-0.0343	1.1017		2.2012		0.4394
Std. dev.	0.0400	0.0382		0.0388		0.0421
Minimum	-0.0655	-0.0671		-0.0387		-0.0747
Maximum	0.0675	0.0704		0.0816		0.1055
Skewness	0.2459	-0.3172		0.1275		0.5334
Kurtosis	1.9278	2.5524		1.8532		3.6976

Appendix 7: Table 5: Daily Unconditional Monthly & Seasonal Gold Spot Returns (January – December) (Daily)

	Months (January – June)					
	January	February	March	April	May	June
Mean (x100)	0.0247	-0.0013	0.1427	0.1237	0.0738	-0.0988
Std. dev.	0.0075	0.0100	0.0140	0.0108	0.0087	0.0081
Minimum	-0.0300	-0.0270	-0.0502	-0.0240	-0.0214	-0.0441
Maximum	0.01572	0.0327	0.0527	0.0364	0.0201	0.0156
Skewness	-0.7973	-0.2339	-0.2921	0.2364	-0.1367	-1.6333
Kurtosis	4.9418	4.2747	6.2820	3.6140	2.7948	10.3165
	Months (July – December)					
	July	August	September	October	November	December
Mean (x100)	0.1615	-0.0038	-0.0080	0.0940	-0.0298	0.0927
Std. dev.	0.0082	0.0110	0.0081	0.0085	0.0102	0.0074
Minimum	-0.0245	-0.0513	-0.0273	-0.0190	-0.0379	-0.0164
Maximum	0.0230	0.0355	0.0190	0.0278	0.0280	0.0321
Skewness	-0.3017	-0.9841	-0.3089	-0.0045	-0.4915	0.6301
Kurtosis	4.3107	7.5753	3.3613	3.2893	4.6916	5.2910
	Seasons (Winter – Autumn)					
	Autumn (m9-m11)	Winter (m12-m2)		Spring (m3-m5)		Summer (m6-m8)
Mean (x100)	0.0019	0.0465		0.1138		0.0236
Std. dev.	0.0090	0.0082		0.0116		0.0092
Minimum	-0.0379	-0.0298		-0.0502		-0.0513
Maximum	0.0280	0.0321		0.0527		0.0355
Skewness	-0.3311	-0.2363		-0.1140		-0.9715
Kurtosis	4.2123	4.8514		5.8525		8.0439

Appendix 8: Table 6: Gold Regression with Constant (December Base) (Monthly)

Month:	Gold_Spot		
	Coef.	t-Stat	P >|t|
Jan	-0.0062	-0.26	0.793
Feb	-0.0373	-1.65	0.105
Mar	-0.0263	-1.08	0.287
Apr	-0.0132	-0.54	0.592
May	-0.0168	-0.69	0.495
June	-0.0677	-2.61	0.012**
July	-0.0149	-0.64	0.527
Aug	-0.0516	-2.21	0.032**
Sept	-0.0151	-0.62	0.540
Oct	-0.0423	-1.81	0.076*
Nov	-0.0296	-1.14	0.258
Cons	0.0355	2.06	0.045**

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix 9: Table 8: Optimal GARCH Lag Structure (Daily)

GARCH Optimal Lags			
	Gold Spot	Gold Futures	Silver Spot
Jan	2	0	4
Feb	0	1	3
Mar	0	4	1
Apr	3	0	4
May	0	0	0
June	0	0	0
July	0	4	1
Aug	0	4	3
Sept	0	0	1
Oct	0	3	0
Nov	3	0	1
Dec	0	1	2

Appendix 10: Table 9: GARCH Optimal Lag Structure (Seasonal) for Gold Spot (Daily)

AIC Optimal Lag (Gold_Spot)	
Gold_Spot	0
Winter	0
Spring	0
Summer	0
Autumn	0

Appendix 11: Table 10: MacKinnon (1991) Critical Values

Estimated Cointegrating Regression Residual:

$$z_t = y_t - \beta_0 - \beta_1 x_{1t} - \beta_2 x_{2t} - \beta_3 x_{3t} - \cdots - \beta_N x_{Nt} + \beta_{N+1} T_t$$

Number of Variables N + 1	**Sample Size**	**Critical Values**		
		1%	**5%**	**10%**
2	50	-4.123	-3.461	-3.130
	100	-4.008	-3.398	-3.087
	200	-3.954	-3.368	-3.067
	500	-3.921	-3.350	-3.054
3	50	-4.592	-3.915	-3.578
	100	-4.441	-3.828	-3.514
	200	-4.368	-3.785	-3.483
	500	-4.326	-3.760	-3.464
4	50	-5.017	-4.324	-3.979
	100	-4.827	-4.210	-3.895
	200	-4.737	-4.154	-3.853
	500	-4.684	-4.122	-3.828
5	50	-5.416	-4.700	-4.348
	100	-5.184	-4.557	-4.240
	200	-5.070	-4.487	-4.186
	500	-5.003	-4.446	-4.154

Appendix 12: Table 11: Augmented Dickey Fuller Unit Root Tests (Gold Spot) (Daily)

For optimal lags, refer to appendices 8 & 9 above.

Series (Gold_Spot)	ADF test statistics				
	Level		1st Differences		Con-clusion
	Intercept	Intercept & Trend	Intercept	Intercept & Trend	
Gold_Spot	-34.590(0)***	-34.584(0)***	-48.991(0)***	-48.976(0)***	I(0)
Aut	-18.179(0)***	-18.289(0)***	-27.009(0)***	-26.946(0)***	I(0)
Win	-15.970(0)***	-15.901(0)***	-20.956(0)***	-20.882(0)***	I(0)
Spr	-17.761(0)***	-17.722(0)***	-24.594(0)***	-24.541(0)***	I(0)
Sum	-15.239(0)***	-15.200(0)***	-21.915(0)***	-21.790(0)***	I(0)
Jan	-2.291(2)	-2.063(2)	-5.007(2)***	-4.936(2)***	I(1)
Feb	-9.043(0)***	-8.979(0)***	-11.039(0)***	-10.944(0)***	I(0)
Mar	-10.241(0)***	-10.225(0)***	-16.502(0)***	-16.730(0)***	I(0)
Apr	-0.935(3)	-0.841(3)	-4.174(3)***	-3.725(3)**	I(1)
May	-8.008(0)***	-8.054(0)***	-10.802(0)***	-10.816(0)***	I(0)
June	-9.035(0)***	-9.016(0)***	-13.254(0)***	-13.167(0)***	I(0)
July	-8.294(0)***	-8.268(0)***	-13.049(0)***	-12.949(0)***	I(0)
Aug	-8.563(0)***	-8.563(0)***	-12.186(0)***	-12.029(0)***	I(0)
Sept	-9.200(0)***	-9.341(0)***	-14.331(0)***	-14.333(0)***	I(0)
Oct	-10.227(0)***	-10.234(0)***	-13.344(0)***	-13.243(0)***	I(0)
Nov	-1.843(3)	-1.812(3)	-5.204(3)***	-5.037(3)***	I(1)
Dec	-10.326(0)***	-10.329(0)***	-12.815(0)***	-12.692(0)***	I(0)

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix 13: Table 12: Optimal Lag Structure for Silver Spot (Daily)

AIC Optimal Lag (Silver_Spot)	
Silver_Spot	0
Winter	0
Spring	2
Summer	0
Autumn	2
Jan	4
Feb	3
Mar	1
Apr	4
May	0
June	0
July	1
Aug	3
Sept	1
Oct	0
Nov	1
Dec	2

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Appendix 14: Table 13: Augmented Dickey Fuller Unit Root Tests (Silver Spot)

Series (Silver_Spot)	ADF test statistics				
	Level		1st Differences		Conclusion
	Intercept	Intercept & Trend	Intercept	Intercept & Trend	
Silver_Spot	-31.351(0)***	-31.337(0)***	-50.407(0)***	-50.371(0)***	I(0)
Aut	-18.005(0)***	-17.970(0)***	-25.241(0)***	-25.248(0)***	I(0)
Win	-6.470(2)***	-6.436(2)***	-6.130(2)***	-6.032(2)***	I(0)
Spr	-12.214(0)***	-12.178(0)***	-20.925(0)***	-20.867(0)***	I(0)
Sum	-6.264(2)***	-6.283(2)***	-7.877(2)***	-7.900(2)***	I(0)
Jan	-2.149(4)	-2.228(4)	-5.358(4)***	-5.151(4)***	I(1)
Feb	-2.223(3)	-2.388(3)	-3.887(3)***	-4.380(3)***	I(1)
Mar	-3.269(1)**	-3.289(1)*	-8.368(1)***	-8.241(1)***	I(0)
Apr	-2.536(4)	-2.663(4)	-6.401(4)***	-5.317(4)***	I(1)
May	-7.208(0)***	-7.172(0)***	-9.983(0)***	-9.941(0)***	I(0)
June	-11.742(0)***	-11.751(0)***	-17.774(0)***	-17.524(0)***	I(0)
July	-4.381(1)***	-4.738(1)***	-7.253(1)***	-7.102(1)***	I(0)
Aug	1.201(3)	1.316(3)	-8.347(3)***	-7.904(3)***	I(1)
Sept	-4.835(1)***	-5.077(1)***	-7.264(1)***	-7.086(1)***	I(0)
Oct	-12.172(0)***	-12.747(0)***	-16.592(0)***	-16.469(0)***	I(0)
Nov	-7.501(1)***	-7.519(1)***	-11.043(1)***	-11.221(1)***	I(0)
Dec	-2.416(2)	-2.305(2)	-4.974(2)***	-4.554(2)***	I(0)

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix 15: Table 15: Monthly Spot Silver Returns on Conditional on Stock Market Index Returns (Monthly)

	MSCI_Emerging_Markets			MSCI_World_Markets			S&P500		
Month:	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.7468	4.26	0.000***	0.6406	3.13	0.003***	0.4909	2.70	0.009***
Jan	-0.1647	-0.24	0.824	-0.6655	-0.78	0.477	0.5269	1.23	0.286
Feb	0.2977	0.63	0.572	0.4431	0.91	0.429	0.3603	0.71	0.531
Mar	1.1316	2.07	0.130	0.7648	1.24	0.303	1.0576	2.47	0.090*
Apr	0.9991	3.93	0.029**	0.9334	1.71	0.186	0.4802	1.56	0.217
May	1.2369	1.72	0.185	1.0465	2.17	0.118	1.9535	1.73	0.182
June	-0.1556	-0.14	0.899	-1.1999	-0.95	0.411	1.1073	2.5	0.088*
July	2.2946	2.14	0.122	1.1978	0.86	0.452	0.7897	0.53	0.631
Aug	3.7841	2.30	0.105	13.392	2.18	0.117	1.911	1.43	0.249
Sept	-1.4627	-0.69	0.541	-0.0647	-0.04	0.972	0.3814	0.54	0.625
Oct	0.4383	0.70	0.521	0.0995	0.17	0.873	-0.7772	-0.76	0.491
Nov	-0.4068	-0.82	0.460	0.0937	0.1	0.922	-0.5679	-0.93	0.404
Dec	0.9516	2.16	0.097*	2.2235	4.12	0.015**	-1.1441	-2.14	0.099*

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix 16: Table 16: Variable Descriptions (MSCI Emerging Markets – Country and Regional Specific)

Additionally, individual country and regional data from the MSCI Emerging Markets (EM) index[23] is collected for more in-depth analysis. Data is collected from global indexes in U.S. Dollars and then converted into returns. Some data using U.S. ETF's instead as a proxy from the New York Stock Exchange (NYSE) and the National Association of Security Dealers Automated Quotations (NASDAQ) due to data availability. Finally, some data is converted to U.S. dollars for standardisation using the country own currency to United States Dollar (USD) exchange rate. Data on Americas, Europe, Middle East, and Africa (EMEA), and Asia have been aggregated using authors own calculations. According to Morgan Stanley Capital International (MSCI), countries in the America compromise of 8.7% of the weighting of the EM Index, meanwhile EMEA accounts for 13.2%, and finally, Asia Pacific accounts for 78.1%[24]. Data on Kuwait limited to start on 16th of April 2020 due to data availability. Furthermore, data on Hungary is only available until 27th of July 2023 due to data availability. See table below for MSCI EM regional-specific and country-specific variable descriptions:

Variable:	Description:
MSCI_Americas	Aggregate (authors calculations) equity market returns for countries in Americas. Captures 5 developing countries: Brazil, Mexico, Chile, Peru, and Columbia (component of MSCI EM Index).
MSCI_EMEA	Aggregate (authors calculations) equity market returns for countries in EMEA. Captures 11 developing countries: Saudi Arabia, South Africa, United Arab Emirates (UAE), Qatar, Kuwait, Poland, Turkey, Greece, Hungary, Czech Republic, Egypt (component of MSCI EM Index).
MSCI_Asia_Pacific	Aggregate (authors calculations) equity market returns for countries in EMEA. Captures 8 developing countries: China, Taiwan, India, South Korea, Thailand, Indonesia, Malaysia, and the Philippines (component of MSCI EM Index).
MSCI_Brazil	Equity market return (Global Index) for Brazil (component of MSCI EM Index)[25].
MSCI_Mexico	Equity market return (Global Index) for Mexico (component of MSCI EM Index)[26].

[23] MSCI Emerging Markets (EM) Index. Available at: MSCI Emerging Markets Index
[24] MSCI Emerging Markets (EM) Index accounting for Americas, EMEA, and Asia Pacific countries. Available at: MSCI Emerging Markets Index
[25] MSCI Brazil Data. Available at: MSCI Brazil Historical Data (MIBR00000PUS) - Investing.com

[26] MSCI Mexico Data. Available at: https://www.investing.com/indices/msci-mexico

MSCI_Chile	Equity market return (Global Index) for Chile (component of MSCI EM Index)[27].
MSCI_Peru	Equity market return (Global Index) for Peru (component of MSCI EM Index)[28].
MSCI_Columbia	Equity market return (Global Index) for Columbia (component of MSCI EM Index)[29].
MSCI_Saudi_Arabia	Equity market return (US iShares ETF) for Saudi Arabia (component of MSCI EM Index)[30].
MSCI_South_Africa	Equity market return (US iShares ETF) for South Africa (component of MSCI EM Index)[31].
MSCI_UAE	Equity market return (US iShares ETF) for United Arab Emirates (UAE) (component of MSCI EM Index)[32].
MSCI_Qatar	Equity market return (US iShares ETF) for Qatar (component of MSCI EM Index)[33].
MSCI_Kuwait	Equity market return (US iShares ETF) for Kuwait (component of MSCI EM Index)[34].
MSCI_Poland	Equity market return (US iShares ETF) for Poland (component of MSCI EM Index)[35].
MSCI_Turkey	Equity market return (US iShares ETF) for Turkey (component of MSCI EM Index)[36].
MSCI_Greece	Equity market return (US iShares ETF) for Greece (component of MSCI EM Index)[37].
MSCI_Hungary	Equity market return (Global Index) for Hungary (component of MSCI EM Index)[38].
MSCI_Czech_Republic	Equity market return (Global Index) for Czech Republic (component of MSCI EM Index)[39].
MSCI_Egypt	Equity market return (Global Index) for Egypt (component of MSCI EM Index)[40].

[27] MSCI Chile Data. Available at: MSCI Chile Index Today (MICL00000PUS) - Investing.com

[28] MSCI Peru Data. Available at: MSCI Peru Historical Data (MIPE00000PUS) - Investing.com

[29] MSCI Columbia Data. Available at: MSCI Colombia Historical Data (MICO00000PUS) - Investing.com

[30] MSCI Saudi Arabia Data. Available at: KSA ETF Stock Price History - Investing.com

[31] MSCI South Africa Data. Available at: MSCI South Africa NR USD Index Today (MIZA00000NUS) - Investing.com

[32] MSCI United Arab Emirates (UAE) Data. Available at: UAE ETF Stock Price History - Investing.com

[33] MSCI Qatar Data. Available at: QAT Stock Price | iShares MSCI Qatar Capped ETF - Investing.com

[34] MSCI Kuwait Data (Start 16/04/2020 due to data availability). Available at: MKUW Stock Price | Invesco Markets Plc - Invesco MSCI Kuwait UCITS US ETF - Investing.com

[35] MSCI Poland Data. Available at: EPOL Stock Price | iShares MSCI Poland Capped ETF - Investing.com

[36] MSCI Turkey Data. Available at: https://www.investing.com/etfs/ishares-msci-turkey-historical-data

[37] MSCI Greece Data. Available at: GREK Stock Price | Global X FTSE Greece 20 ETF - Investing.com

[38] MSCI Hungary Data (Converted to USD using the HUF/USD exchange rate) . Available at: MSCI Hungary Historical Data (MIHU00000PHU) - Investing.com

[39] MSCI Czech Republic Data (Converted to USD using CZK/USD rate). Available at: https://www.investing.com/indices/msci-czech-republic-historical-data

[40] MSCI Egypt Data (Converted to USD using the EGP/USD exchange rate). Available at: MSCI Egypt Index Today (MIEG00000PEG) - Investing.com

MSCI_China	Equity market return (Global Index) for China (component of MSCI EM Index)[41].
MSCI_Taiwan	Equity market return (Global Index) for Taiwan (component of MSCI EM Index)[42].
MSCI_India	Equity market return (Global Index) for India (component of MSCI EM Index)[43].
MSCI_South_Korea	Equity market return (US iShares ETF) for South Korea (component of MSCI EM Index)[44].
MSCI_Thailand	Equity market return (Global Index) for Thailand (component of MSCI EM Index)[45].
MSCI_Indonesia	Equity market return (Global Index) for Indonesia (component of MSCI EM Index)[46].
MSCI_Malaysia	Equity market return (Global Index) for Malaysia (component of MSCI EM Index)[47].
MSCI_Philippines	Equity market return (Global Index) for Philippines (component of MSCI EM Index)[48].

[41] MSCI China Data. Available at: MSCI China Net USD Index Today (MICN00000NUS) - Investing.com
[42] MSCI Taiwan Data. Available at: MSCI Taiwan Net USD Index Today (MITW00000NUS) - Investing.com
[43] MSCI India Data. Available at: MSCI India Net USD Index Today (MIIN00000NUS) - Investing.com
[44] MSCI South Korea Data. Available at: EWY Stock Price | iShares MSCI South Korea Capped ETF - Investing.com
[45] MSCI Thailand Data. Available at: MSCI Thailand NR USD Index Today (MITH00000NUS) - Investing.com
[46] MSCI Indonesia Data. Available at: MSCI Indonesia Net USD Historical Data (MIID00000NUS) - Investing.com
[47] MSCI Malaysia Data. Available at: MSCI Malaysia Net USD Index Today (MIMY00000NUS) - Investing.com
[48] MSCI Philippines Data. Available at: MSCI Philippines Invest Net USD Index Today (MIPH000I0NUS) - Investing.com

Appendix 17: Table 17: Variable Descriptions (MSCI World Index – Country and Regional Specific)

Additionally, individual country and regional data from the MSCI World Markets (WM) index is collected for more in-depth analysis. Data is collected from global indexes in U.S. Dollars and then converted into returns. Some data using U.S. ETF's instead as a proxy from the New York Stock Exchange (NYSE) and the National Association of Security Dealers Automated Quotations (NASDAQ) due to data availability. Finally, some data is converted to U.S. dollars for standardisation using the country own currency to United States Dollar (USD) exchange rate. Data on North America, Europe, and Asia Pacific have been aggregated using authors own calculations. According to Morgan Stanley Capital International (MSCI), countries in the North America compromise of 75.93% of the weighting of the WM Index, meanwhile Europe accounts for 11.55%, and finally, Asia Pacific accounts for 6.05%[49]. Israel is the only country represented in the Middle East in the data set and account for <0.5% of the index. Due to data availability, data from Luxembourg was unavailable. See table below for MSCI EM regional-specific and country-specific variable descriptions:

Variable:	Description:
MSCI_North_America	Aggregate (authors calculations) equity market returns for countries in North America. Captures 2 developed countries: United States and Canada (component of MSCI WM Index).
MSCI_Europe	Aggregate (authors calculations) equity market returns for countries in North America. Captures 15 developed countries: United Kingdom, Germany, France, Switzerland, Netherlands, Sweden, Italy, Spain, Denmark, Belgium, Finland, Ireland, Norway, Austria, and Portugal (component of MSCI WM Index).
MSCI_Asia_Pacific	Aggregate (authors calculations) equity market returns for countries in Asia Pacific. Captures 4 developed countries: Japan, Australia, New Zealand, and South Korea (component of MSCI WM Index).
MSCI_United_States	Equity market return (Global Index) for the United States (component of MSCI WM Index)[50].
MSCI_Canada	Equity market return (Global Index) for Canada (component of MSCI WM Index)[51].
MSCI_United_Kingdom	Equity market return (US iShares ETF) for the United Kingdom (component of MSCI WM Index)[52].

[49] MSCI World Markets (WM) Index: Available at: MSCI World Index
[50] MSCI United States Data. Available at: MSCI USA Index Today (MIUS00000PUS) - Investing.com
[51] MSCI Canada Data. Available at: MSCI Canada Net USD Historical Data (MICA00000NUS) - Investing.com
[52] MSCI United Kingdom Data. Available at: EWU Stock Price | iShares MSCI United Kingdom ETF - Investing.com

MSCI_Germany	Equity market return (US iShares ETF) for Germany (component of MSCI WM Index)[53].
MSCI_France	Equity market return (US iShares ETF) for France (component of MSCI WM Index)[54].
MSCI_Switzerland	Equity market return (US iShares ETF) for Switzerland (component of MSCI WM Index)[55].
MSCI_Netherlands	Equity market return (US iShares ETF) for the Netherlands (component of MSCI WM Index)[56].
MSCI_Sweden	Equity market return (US iShares ETF) for Sweden (component of MSCI WM Index)[57].
MSCI_Italy	Equity market return (US iShares ETF) for Italy (component of MSCI WM Index)[58].
MSCI_Spain	Equity market return (US iShares ETF) for Spain (component of MSCI WM Index)[59].
MSCI_Denmark	Equity market return (US iShares ETF) for Denmark (component of MSCI WM Index)[60].
MSCI_Belgium	Equity market return (US iShares ETF) for Belgium (component of MSCI WM Index)[61].
MSCI_Finland	Equity market return (US iShares ETF) for Finland (component of MSCI WM Index)[62].
MSCI_Ireland	Equity market return (US iShares ETF) for Ireland (component of MSCI WM Index)[63].
MSCI_Norway	Equity market return (US iShares ETF) for Norway (component of MSCI WM Index)[64].
MSCI_Austria	Equity market return (US iShares ETF) for Austria (component of MSCI WM Index)[65].
MSCI_Portugal	Equity market return (Global Index) for Sweden (component of MSCI WM Index)[66].
MSCI_Japan	Equity market return (US iShares ETF) for Japan (component of MSCI WM Index)[67].
MSCI_Australia	Equity market return (Global Index) for Australia (component of MSCI WM Index)[68].

[53] MSCI Germany Data. Available at: EWG Stock Price | iShares MSCI Germany ETF - Investing.com
[54] MSCI France Data. Available at: EWQ Stock Price | iShares MSCI France ETF - Investing.com
[55] MSCI Switzerland Data. Available at: EWL Stock Price | iShares MSCI Switzerland Capped ETF - Investing.com
[56] MSCI Netherlands Data. Available at: EWN Stock Price | iShares MSCI Netherlands ETF - Investing.com
[57] MSCI Sweden Data. Available at: EWD ETF Stock Price History - Investing.com
[58] MSCI Italy Data. Available at: EWI Stock Price | iShares MSCI Italy Capped ETF - Investing.com
[59] MSCI Spain Data. Available at: EWP ETF Stock Price History - Investing.com
[60] MSCI Denmark Data. Available at: EDEN Stock Price | iShares MSCI Denmark Capped ETF - Investing.com
[61] MSCI Belgium Data. Available at: EWK Stock Price | iShares MSCI Belgium Capped ETF - Investing.com
[62] MSCI Finland Data. Available at: EFNL Stock Price | iShares MSCI Finland Capped ETF - Investing.com
[63] MSCI Ireland Data. Available at: EIRL Stock Price | iShares MSCI Ireland ETF - Investing.com
[64] MSCI Norway Data. Available at: ENOR ETF Stock Price History - Investing.com
[65] MSCI Austria Data. Available at: EWO Stock Price | iShares MSCI Austria Capped ETF - Investing.com
[66] MSCI Portugal Data (Converted to USD using EUR/USD exchange). Available at: MSCI Portugal Historical Data (MIPT00000PEU) - Investing.com
[67] MSCI Japan Data. Available at: EWJ Stock Price | iShares MSCI Japan ETF - Investing.com
[68] MSCI Australia Data. Available at: MSCI Australia USD Index Today (MIAU00000NUS) - Investing.com

MSCI_New_Zealand	Equity market return (US iShares ETF) for New Zealand (component of MSCI WM Index)[69].
MSCI_South_Korea	Equity market return (US iShares ETF) for South Korea (component of MSCI WM Index)[70].
MSCI_Hong_Kong	Equity market return (US iShares ETF) for Hong Kong (component of MSCI WM Index)[71]
MSCI_Israel	Equity market return (Global Index) for Israel (component of MSCI WM Index)[72]

Appendix 18: Table 18: MSCI Emerging Markets (EM) Descriptive Statistics (Monthly)

Variable	N	Mean (x100)	Std. Dev.	Min	Max	Skewness	Kurtosis	ADF P-Value
MSCI_Americas	64	-0.0003	0.0766	-0.4217	0.1317	-2.5461	15.6438	0.0000
MSCI_EMEA	55	0.0015	0.0566	-0.2541	0.0881	-1.6056	8.6942	0.0000
MSCI_Asia_Pacific	64	0.2	0.0544	-0.2948	0.1203	-2.3611	13.3842	0.0000
MSCI_Brazil	64	-0.5982	0.1048	-0.5052	0.1986	-1.6078	7.1387	0.0000
MSCI_Mexico	64	0.2775	0.0858	-0.428	0.1471	-1.9661	9.0918	0.0000
MSCI_Chile	64	-0.528	0.0871	-0.3207	0.192	-0.7241	1.5101	0.0000
MSCI_Peru	64	0.2139	0.0894	-0.3214	0.198	-0.6652	1.8784	0.0000
MSCI_Columbia	64	-0.6028	0.1157	-0.5609	0.2349	-1.7105	7.4336	0.0000
MSCI_Saudi_Arabia	64	0.4602	0.0558	-0.1836	0.0939	-0.8224	0.7772	0.0000
MSCI_South_Africa	64	0.4364	0.0747	-0.3192	0.1533	-1.3404	4.6666	0.0000
MSCI_UAE	64	0.3317	0.0555	-0.1882	0.1183	-0.6591	1.1473	0.0000
MSCI_Qatar	64	-0.058	0.0451	-0.1226	0.0801	-0.4969	-0.0167	0.0000
MSCI_Kuwait	57	0.8492	0.0375	-0.0811	0.0813	-0.1917	-0.2509	0.0000
MSCI_Poland	64	0.0631	0.0903	-0.2594	0.289	0.1864	1.0472	0.0000
MSCI_Turkey	64	0.4779	0.0996	-0.2879	0.2399	-0.1193	0.1509	0.0000
MSCI_Greece	64	0.5022	0.2408	-1.3885	1.183	-1.2638	26.4762	0.0000
MSCI_Hungary	55	0.3842	0.0881	-0.3191	0.1929	-1.3043	3.807	0.0000
MSCI_Czech_Republic	64	0.7398	0.0788	-0.3579	0.1731	-1.5081	6.5323	0.0000
MSCI_Egypt	64	-0.733	0.1144	-0.4138	0.3104	-0.331	2.7584	0.0000
MSCI_China	64	-0.0135	0.0756	-0.1599	0.2819	0.7451	2.048	0.0000
MSCI_Taiwan	64	1.4573	0.0657	-0.1574	0.2119	-0.127	1.149	0.0000
MSCI_India	64	1.0763	0.064	-0.3495	0.1033	-2.8865	15.066	0.0000
MSCI_South_Korea	64	0.0456	0.0715	-0.2156	0.1695	0.0447	0.6453	0.0000
MSCI_Thailand	64	-0.2345	0.0621	-0.2149	0.1761	-0.1921	2.1426	0.0000
MSCI_Indonesia	64	0.103	0.0822	-0.4991	0.1693	-3.402	21.5582	0.0000
MSCI_Malaysia	64	0.1165	0.044	-0.1417	0.0815	-0.4448	0.6792	0.0000
MSCI_Philippines	64	-0.108	0.0667	-0.2945	0.1521	-1.0649	5.1865	0.0000

Table presents summary statistics (observations, mean, standard deviation, minimum, maximum, skewness, and kurtosis) of daily countries and regions in the MSCI Emerging Markets (EM) Index.

[69] MSCI New Zealand Data. Available at: https://www.investing.com/etfs/ishares-msci-n.z.-investable-mar.-historical-data

[70] MSCI South Korea Data. Available at: EWY ETF Stock Price History - Investing.com

[71] MSCI Hong Kong Data. Available at: EWH ETF Stock Price History - Investing.com

[72] MSCI Israel Data. Available at: MSCI Israel Index Today (MIIL00000PUS) - Investing.com

Appendix 19: Table 19: MSCI World Markets (WM) Descriptive Statistics (Monthly)

Variable	N	Mean (x100)	Std. Dev.	Min	Max	Skewness	Kurtosis	ADF P-Value
MSCI_North_America	64	0.8678	0.0498	-0.2849	0.1229	-3.132	20.3066	0.0000
MSCI_Europe	64	0.3604	0.0528	-0.2053	0.1252	-0.7655	5.9603	0.0000
MSCI_Asia_Pacific	64	0.2	0.0544	-0.2948	0.1203	-2.3054	15.2689	0.0000
MSCI_United_States	64	1.0873	0.0525	-0.1779	0.1177	-0.8513	4.486	0.0000
MSCI_Canada	64	0.7431	0.0633	-0.3435	0.126	-2.7875	16.0585	0.0000
MSCI_United_Kingdom	64	0.1659	0.0566	-0.2348	0.1395	-0.8601	6.638	0.0000
MSCI_Germany	64	0.2346	0.0629	-0.2318	0.1733	-0.3679	5.1586	0.0000
MSCI_France	64	0.2715	0.0625	-0.2255	0.1489	-0.4065	4.9167	0.0000
MSCI_Switzerland	64	0.3508	0.0472	-0.1165	0.1065	-0.3634	2.9572	0.0000
MSCI_Netherlands	64	0.551	0.0656	-0.1969	0.1893	-0.1672	3.8721	0.0000
MSCI_Sweden	64	0.39	0.0685	-0.2291	0.1488	-0.5198	3.9882	0.0000
MSCI_Italy	64	0.4151	0.0718	-0.2734	0.1928	-0.4641	5.708	0.0000
MSCI_Spain	64	0.2452	0.0682	-0.2842	0.1919	-0.623	6.885	0.0000
MSCI_Denmark	64	0.9802	0.0584	-0.1788	0.1083	-0.6745	3.7928	0.0000
MSCI_Belgium	64	-0.0083	0.0604	-0.2069	0.1434	-0.2705	4.3505	0.0000
MSCI_Finland	64	-0.1335	0.0608	-0.2108	0.1454	-0.5389	4.3152	0.0000
MSCI_Ireland	64	0.5808	0.0692	-0.2862	0.1392	-1.0517	6.404	0.0000
MSCI_Norway	64	0.0554	0.0743	-0.2824	0.2224	-0.9051	6.6028	0.0000
MSCI_Austria	64	0.1269	0.0756	-0.3258	0.1944	-0.8214	7.6307	0.0000
MSCI_Portugal	64	-0.0558	0.0597	-0.1919	0.1221	-0.5058	3.8531	0.0000
MSCI_Japan	64	0.2706	0.0462	-0.0888	0.1145	0.0362	2.7255	0.0000
MSCI_Australia	64	0.5784	0.0705	-0.3768	0.1042	-2.512	14.7174	0.0000
MSCI_New_Zealand	64	-0.221	0.057	-0.1649	0.1298	-0.1271	3.4359	0.0000
MSCI_South_Korea	64	0.0456	0.0715	-0.2156	0.1695	0.0436	3.5037	0.0000
MSCI_Hong_Kong	64	-0.4299	0.0641	-0.1597	0.2059	0.3181	4.1836	0.0000
MSCI_Israel	64	0.8678	0.0498	-0.2849	0.1229	-3.132	20.3066	0.0000

Table presents summary statistics (observations, mean, standard deviation, minimum, maximum, skewness, and kurtosis) of daily data in the MSCI World Markets (WM) Index (excluding Luxembourg).

Appendix 20: Table 20: Monthly Spot Gold Returns Conditional on MSCI Emerging Markets (EM) Index Returns (Monthly)

Appendix 20 represents the regression estimation results for gold returns conditional on developing country sectors and individual country returns in the MSCI Emerging Markets Index returns. The country sectors include the Americas, Europe, the Middle East, and Africa (EMEA), and Asia Pacific. The Americas include 5 countries: Brazil, Mexico, Chile, Peru, and Columbia. EMEA includes 11 countries: Saudi Arabia, South Africa, United Arab Emirates (UAE), Qatar, Kuwait, Poland, Turkey, Greece, Hungary, Czech Republic, and Egypt. Finally, Asia Pacific includes 8 countries: China, Taiwan, India, South Korea, Thailand, Indonesia, Malaysia, and the Philippines.

Month:	MSCI_Americas			MSCI_EMEA			MSCI_Asia_Pacific		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0451	0.69	0.494	0.1388	1.40	0.166	0.0124	0.13	0.894
Aut	-0.0565	-0.31	0.763	-0.1228	-0.36	0.722	-0.2319	-1.08	0.299
Win	0.0564	0.32	0.751	0.1814	0.86	0.404	0.0868	0.32	0.751
Spr	0.0640	0.75	0.468	0.112	0.85	0.414	0.1121	0.90	0.386
Sum	0.1270	0.61	0.55	0.3439	1.15	0.277	0.1344	0.47	0.645
Jan	-0.8510	-2.79	0.049**	0.170	0.39	0.723	-0.5327	-0.84	0.447
Feb	-0.1336	-0.31	0.777	0.0183	0.04	0.970	-0.4638	-0.76	0.504
Mar	0.0855	0.61	0.587	0.0819	0.37	0.736	0.1502	0.72	0.526
Apr	-0.3811	-1.24	0.302	0.2848	1.05	0.373	0.2609	0.68	0.543
May	0.2877	1.29	0.288	0.4932	0.96	0.440	0.6801	0.94	0.416
June	0.4016	1.09	0.355	0.1919	0.37	0.750	0.1781	0.46	0.674
July	0.3413	1.13	0.339	0.5628	0.77	0.521	1.0238	2.21	0.114
Aug	1.7387	4.65	0.019**	-0.0260	-0.20	0.861	0.5494	1.13	0.339
Sept	-0.2094	-0.29	0.793	0.0298	0.13	0.907	-0.1358	-0.25	0.821
Oct	-0.1172	-0.32	0.768	0.1387	0.32	0.768	0.2825	0.95	0.398
Nov	-0.0856	-0.29	0.786	-0.2216	-0.21	0.844	-0.5763	-1.98	0.119
Dec	0.2406	1.34	0.253	0.6198	3.23	0.048**	0.5706	3.54	0.024**
	MSCI_Brazil			MSCI_Mexico			MSCI_Chile		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0732	1.55	0.126	-0.0131	-0.22	0.824	0.0441	0.77	0.446
Aut	0.0566	0.35	0.734	-0.0875	-0.59	0.563	-0.0171	-0.13	0.897
Win	0.2153	1.99	0.066*	-0.054	-0.38	0.712	0.0071	0.05	0.959
Spr	0.0537	0.83	0.424	0.0361	0.45	0.661	0.0262	0.28	0.783
Sum	0.0788	0.67	0.515	-0.0522	-0.28	0.783	0.1514	1.13	0.279
Jan	0.2584	0.83	0.453	-0.5956	-3.52	0.024**	-0.2241	-1.19	0.299
Feb	0.2047	0.80	0.480	-0.2915	-0.91	0.432	-0.0688	-0.21	0.846
Mar	0.0818	0.68	0.546	0.0739	0.54	0.629	0.0139	0.08	0.944
Apr	-0.1631	-1.00	0.391	-0.2706	-1.7	0.188	0.1343	0.46	0.677
May	0.1934	1.53	0.224	0.2459	1.13	0.339	0.0510	0.23	0.833

June	0.1688	0.70	0.535	0.2595	0.63	0.574	0.1650	0.97	0.403
July	0.2946	1.85	0.161	0.1584	0.47	0.669	0.4931	4.13	0.026**
Aug	0.1077	0.46	0.678	0.7509	2.22	0.113	-0.2813	-1.60	0.209
Sept	0.0600	0.18	0.869	-0.6132	-1.39	0.260	-0.1301	-0.43	0.699
Oct	0.2758	1.46	0.218	-0.1694	-0.73	0.504	0.1547	0.72	0.514
Nov	-0.1645	-0.51	0.636	-0.0573	-0.22	0.834	-0.0127	-0.05	0.961
Dec	0.1877	1.23	0.285	0.1794	1.06	0.350	0.3161	2.27	0.086*
	MSCI_Peru			MSCI_Columbia			MSCI_Saudi_Arabia		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0937	1.70	0.095*	0.0444	1.03	0.308	0.0678	0.75	0.453
Aut	0.0186	0.16	0.878	0.0204	0.18	0.862	0.1141	0.54	0.597
Win	0.0425	0.33	0.750	0.2402	2.33	0.034**	0.0170	0.10	0.921
Spr	0.1772	2.21	0.045**	-0.0148	-0.24	0.812	0.0015	0.01	0.992
Sum	0.1949	1.35	0.200	0.1634	1.40	0.185	0.1541	0.60	0.556
Jan	0.0086	0.03	0.977	-0.0555	-0.13	0.903	-0.7195	-3.33	0.029**
Feb	0.1158	0.35	0.750	0.2405	0.94	0.416	0.1599	0.33	0.762
Mar	0.1686	1.22	0.310	0.0166	0.15	0.893	0.0052	0.02	0.987
Apr	0.1907	1.53	0.224	-0.1185	-0.60	0.590	0.2538	0.59	0.598
May	0.5613	2.37	0.099*	0.0079	0.04	0.969	0.0682	0.14	0.900
June	0.1409	0.73	0.521	0.0744	0.40	0.719	0.0186	0.04	0.967
July	0.0584	0.16	0.885	0.2608	1.30	0.284	0.7937	2.21	0.114
Aug	0.1799	0.74	0.511	-0.0118	-0.06	0.954	-0.1086	-0.19	0.862
Sept	0.4663	3.09	0.054*	-0.2126	-0.91	0.431	0.0713	0.16	0.886
Oct	-0.3163	-2.37	0.077*	0.1524	1.48	0.213	0.1279	0.39	0.716
Nov	-0.0664	-0.30	0.779	-0.0856	-0.29	0.788	0.6172	1.63	0.179
Dec	0.0010	0.01	0.995	0.2973	4.24	0.013**	0.1756	1.03	0.363
	MSCI_South_Africa			MSCI_UAE			MSCI_Qatar		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0574	0.85	0.396	0.123	1.37	0.174	0.0994	0.89	0.375
Aut	-0.0304	-0.18	0.861	-0.0599	-0.33	0.747	-0.1984	-0.78	0.449
Win	-0.0013	-0.01	0.994	0.2365	1.13	0.278	0.1967	0.87	0.396
Spr	0.0411	0.41	0.691	0.2796	2.16	0.050**	0.2193	1.15	0.27
Sum	0.2898	1.89	0.082*	0.122	0.51	0.616	0.2467	0.94	0.363
Jan	-0.3917	-0.99	0.379	-0.7918	-1.64	0.176	-0.6623	-1.78	0.150
Feb	-0.3550	-0.74	0.514	0.2648	0.62	0.577	0.243	0.49	0.655
Mar	0.0606	0.31	0.780	0.1684	0.65	0.564	-0.2205	-0.35	0.748
Apr	-0.1754	-0.49	0.657	0.4950	2.18	0.118	0.1747	0.51	0.643
May	0.1960	0.91	0.431	0.4288	1.89	0.155	0.496	1.61	0.206
June	0.1929	0.53	0.633	0.0844	0.23	0.834	0.4692	0.82	0.472
July	0.3394	1.26	0.295	-0.9349	-2.01	0.138	-0.4448	-0.58	0.603
Aug	0.2523	2.63	0.078*	0.3061	1.52	0.225	0.3165	2.08	0.129
Sept	-0.1583	-0.35	0.748	0.8018	1.00	0.390	-0.2561	-0.60	0.591
Oct	0.2045	1.37	0.243	-0.2632	-0.54	0.619	0.7294	4.16	0.014**
Nov	-0.7741	-1.67	0.170	-0.4586	-1.88	0.133	-0.882	-2.34	0.080*
Dec	0.2576	1.68	0.169	0.1955	0.49	0.648	0.3504	1.02	0.363
	MSCI_Kuwait			MSCI_Poland			MSCI_Turkey		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|

	0.0358	0.25	0.807	0.0659	1.19	0.237	-0.0369	-0.73	0.467
Aut	0.0736	0.16	0.878	0.0840	0.53	0.605	-0.1206	-1.46	0.165
Win	0.2185	0.70	0.496	0.0777	0.88	0.394	-0.0371	-0.33	0.742
Spr	-0.0239	-0.10	0.922	0.1178	1.10	0.292	0.0975	1.01	0.333
Sum	-0.1360	-0.44	0.670	-0.0288	-0.21	0.839	-0.0228	-0.18	0.863
Jan	-0.6020	-0.86	0.454	-0.1476	-0.58	0.592	-0.2268	-2.15	0.098*
Feb	1.7358	2.81	0.107	-0.0341	-0.11	0.916	-0.4844	-1.38	0.262
Mar	-0.7904	-1.79	0.215	0.1716	0.89	0.441	0.1377	0.88	0.444
Apr	-0.0609	-0.16	0.889	0.4700	3.39	0.043**	0.1406	0.62	0.578
May	0.4314	1.28	0.290	0.1171	0.33	0.761	0.0921	0.22	0.843
June	0.1536	0.21	0.845	-0.0259	-0.14	0.894	0.3099	1.52	0.226
July	-1.1024	-2.51	0.087*	0.2748	0.87	0.449	-0.1653	-0.64	0.566
Aug	0.2291	1.08	0.358	-0.0010	0.00	0.997	-0.1434	-1.26	0.296
Sept	0.3818	0.41	0.707	0.5146	1.13	0.342	-0.1503	-0.62	0.580
Oct	-0.6222	-1.18	0.322	0.0780	0.34	0.752	-0.2067	-1.75	0.154
Nov	-0.1100	-0.06	0.954	0.0805	0.29	0.787	-0.0935	-0.55	0.610
Dec	-0.0223	-0.06	0.956	0.1044	1.24	0.284	0.1990	1.85	0.1370
	MSCI_Greece			MSCI_Hungary			MSCI_Czech_Republic		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0296	1.43	0.156	0.0137	0.21	0.833	0.0738	1.17	0.248
Aut	0.0554	0.28	0.783	0.0766	0.54	0.599	-0.1148	-0.67	0.516
Win	0.1188	1.16	0.263	-0.0675	-0.57	0.580	0.0608	0.49	0.629
Spr	0.0238	1.14	0.275	0.1192	1.14	0.278	0.0862	0.89	0.390
Sum	0.0674	0.43	0.672	0.0298	0.14	0.891	0.2337	1.36	0.196
Jan	-0.0881	-0.43	0.692	-0.2399	-0.54	0.627	0.2189	1.32	0.258
Feb	0.0209	0.08	0.939	-0.2884	-1.91	0.152	-0.5035	-2.88	0.064*
Mar	0.0273	0.67	0.553	0.0836	0.4	0.715	0.0853	0.56	0.613
Apr	0.0373	1.50	0.230	0.317	1.55	0.219	0.1028	0.15	0.890
May	-0.2078	-0.52	0.641	0.4569	1.98	0.187	0.5790	1.94	0.148
June	0.1434	0.73	0.517	-0.1994	-0.21	0.854	0.1724	0.66	0.554
July	-0.0283	-0.08	0.943	-0.6679	-1.42	0.291	-0.0522	-0.04	0.970
Aug	0.1062	0.52	0.639	0.0397	0.63	0.590	0.0415	0.25	0.818
Sept	-0.0528	-0.12	0.914	-0.0968	-1.95	0.190	-0.0076	-0.02	0.984
Oct	-0.0486	-0.21	0.844	-0.1189	-0.46	0.678	0.2907	1.51	0.205
Nov	0.7224	1.84	0.140	-0.2106	-0.47	0.671	-0.5638	-2.33	0.080*
Dec	0.2889	2.62	0.059*	0.4318	1.18	0.323	0.3612	3.00	0.040**
	MSCI_Egypt			MSCI_China			MSCI_Taiwan		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0589	1.36	0.179	-0.0434	-0.65	0.516	0.0392	0.51	0.611
Aut	0.1696	0.83	0.419	-0.1513	-1.45	0.168	-0.2183	-1.47	0.162
Win	0.1061	1.68	0.114	-0.0132	-0.1	0.923	-0.1184	-0.89	0.389
Spr	0.0313	0.48	0.638	0.0661	0.4	0.696	0.3339	2.22	0.044**
Sum	-0.0736	-0.47	0.649	0.12	0.67	0.517	0.49	2.77	0.016**
Jan	0.1628	2.59	0.06*	0.2218	1.21	0.291	-0.4337	-3.09	0.036**
Feb	0.1237	0.93	0.422	-0.5351	-1.98	0.142	-0.5341	-2.02	0.136
Mar	0.0435	0.21	0.847	0.7576	1.84	0.163	0.2557	0.73	0.516
Apr	0.3501	8.02	0.004***	0.2677	0.7	0.535	0.6826	2.07	0.13
May	-0.0346	-0.33	0.761	-0.082	-0.19	0.863	0.5655	2.63	0.079*

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June	0.102	0.32	0.768	0.128	0.42	0.705	0.5377	1.54	0.221
July	-0.7564	-2.25	0.110	-0.036	-0.09	0.937	0.5937	5.39	0.012**
Aug	-0.0289	-0.25	0.822	0.219	0.76	0.504	0.6427	2.43	0.094*
Sept	-0.11	-0.23	0.830	-1.2314	-2.13	0.123	-0.467	-1.30	0.284
Oct	-0.2963	-0.82	0.459	0.1259	0.62	0.572	0.1397	0.80	0.468
Nov	0.4276	1.54	0.200	-0.2066	-1.58	0.188	-0.6307	-3.49	0.025**
Dec	-0.0434	-0.31	0.770	0.2165	1.58	0.188	0.1297	0.73	0.505
	MSCI_India			MSCI_South_Korea			MSCI_Thailand		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0103	0.13	0.897	0.1018	1.47	0.147	-0.0486	-0.6	0.551
Aut	-0.2275	-0.77	0.456	0.0257	0.13	0.902	-0.1793	-1.24	0.233
Win	-0.0994	-0.44	0.667	-0.0784	-0.68	0.504	0.0601	0.35	0.732
Spr	0.0495	0.48	0.638	0.23	2.03	0.063*	0.0469	0.34	0.74
Sum	0.3163	1.44	0.172	0.3403	1.91	0.078*	-0.1187	-0.43	0.677
Jan	-0.6214	-3.73	0.02**	-0.6423	-3.31	0.03**	-0.0609	-0.18	0.868
Feb	-1.1538	-1.52	0.225	-0.3739	-2.27	0.108	-0.2979	-0.8	0.483
Mar	0.0997	0.53	0.636	0.3017	1.65	0.197	-0.0127	-0.04	0.968
Apr	0.0001	0.00	1.00	0.4203	2.5	0.088*	0.1272	0.44	0.688
May	0.9732	1.79	0.172	0.1331	0.36	0.741	0.6085	1.46	0.239
June	0.0066	0.02	0.984	0.363	1.49	0.232	0.4981	0.67	0.55
July	0.7528	2.99	0.058*	0.4357	1.54	0.221	0.9126	1.12	0.343
Aug	1.7554	1.41	0.254	0.0949	0.32	0.772	0.2098	0.78	0.491
Sept	-0.2984	-0.79	0.486	0.3274	0.99	0.396	-0.0245	-0.05	0.964
Oct	0.8753	2.48	0.068*	0.3407	1.41	0.232	0.1308	0.67	0.542
Nov	-1.0979	-1.5	0.2070	-0.6679	-2.1	0.103	-0.3548	-1.55	0.195
Dec	0.5081	3.71	0.021**	0.2475	2.43	0.072*	0.4041	2.1	0.104
	MSCI_Indonesia			MSCI_Malaysia			MSCI_Philippines		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.029	0.47	0.638	0.1125	0.99	0.326	0.0138	0.18	0.855
Aut	-0.119	-0.67	0.513	0.106	0.43	0.676	-0.066	-0.43	0.671
Win	0.2558	1.08	0.296	0.1178	0.49	0.629	0.1836	0.94	0.362
Spr	0.0463	0.62	0.547	0.0456	0.22	0.831	0.1912	1.58	0.137
Sum	0.0948	0.51	0.616	0.2677	1.1	0.29	-0.1347	-0.71	0.488
Jan	-0.715	-1.02	0.367	-0.165	-0.26	0.809	0.1383	0.33	0.757
Feb	-0.0037	-0.01	0.995	-0.4923	-0.85	0.458	0.0855	0.16	0.881
Mar	0.0851	0.75	0.51	-0.0072	-0.02	0.985	0.1793	0.94	0.414
Apr	0.096	0.36	0.74	0.567	0.94	0.416	0.8044	2.12	0.125
May	-0.1864	-0.4	0.719	0.3776	0.46	0.675	0.7438	1.5	0.231
June	0.1135	0.58	0.601	0.3095	0.92	0.425	0.0036	0.01	0.991
July	0.5469	0.98	0.399	0.8465	2.75	0.071*	1.0255	2.56	0.083*
Aug	0.8096	2.31	0.104	-0.009	-0.02	0.982	-0.035	-0.08	0.942
Sept	0.1079	0.27	0.806	0.1677	0.41	0.711	-0.0281	-0.07	0.949
Oct	-0.0392	-0.11	0.919	0.3539	1.5	0.209	0.1789	1.08	0.341
Nov	-0.3485	-1.35	0.247	-0.5821	-0.73	0.506	-0.3997	-1.46	0.218
Dec	0.5067	2.74	0.052*	0.4183	1.94	0.124	0.364	2.14	0.099*

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

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At first glance, in the Americas countries, Brazil, Peru, and Columbia had significant and positive seasons. Results showed in the MSCI Peru index, Spring was significant and positive. Columbia and Brazil found Winter to be significant and positive. The MSCI Americas Aggregated Markets Index is not statistically significant lacking evidence of a positive relationship with gold. Next, in the MSCI EMEA Index countries, no countries were found to be significant. In terms of seasons, South Africa was found to be significant and positive in the Summer, and the UAE to be significant and positive in the Spring. Finally, results show in the MSCI Asia Pacific countries, Taiwan and South Korea are significant and positive in the Summer and Spring.

A deeper look finds the MSCI Americas is only significant and positive in August, and significant and negative in January. Subsequently, MSCI EMEA and Asia Pacific Aggregated Markets Indexes is found to be significant and positive in December. In the MSCI Americas Index country returns, Peru was the only country found to be significant and positive. Finally, in the MSCI Asia Pacific and EMEA Index countries returns, no country is found to be significant. Most of the countries observed which have been significant have been positively correlated with gold returns, not supporting gold's role as a hedge against uncertainty. There are no statistically significant seasons in the MSCI Americas, EMEA, or Asia Pacific Indexes. The statistically significant months in the MSCI Americas Index is January (negative) and August (positive). In the MSCI EMEA and Asia Pacific Indexes, it is only December which is significant and positive.

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Appendix 21: Table 21: Monthly Spot Gold Returns Conditional on MSCI World Markets (WM) Index Returns (Monthly)

Appendices 21 represents the regression estimation results for gold returns conditional on developing country sectors and individual country returns in the MSCI World Markets Index returns. The country sectors include North America, Europe, and Asia Pacific. North America includes 2 developed countries: the United States and Canada. Europe includes 15 developed countries: United Kingdom, Germany, France, Switzerland, Netherlands, Sweden, Italy, Spain, Denmark, Belgium, Finland, Ireland, Norway, Austria, and Portugal. Finally, Asia Pacific includes 4 developed countries: Japan, Australia, New Zealand, and South Korea.

Month:	MSCI_North_America			MSCI_Europe			MSCI_Asia_Pacific		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.1186	1.18	0.241	0.1792	1.93	0.058*	0.0124	0.13	0.894
Aut	0.2689	0.98	0.345	0.1434	0.53	0.601	-0.2319	-1.08	0.299
Win	-0.1556	-0.41	0.686	0.1479	0.87	0.399	0.0868	0.32	0.751
Spr	0.1091	0.93	0.368	0.2112	1.43	0.178	0.1121	0.9	0.386
Sum	0.4589	1.08	0.301	0.1797	0.73	0.481	0.1344	0.47	0.645
Jan	-0.3672	-0.61	0.575	-0.1259	-0.3	0.781	-0.5327	-0.84	0.447
Feb	-0.882	-1.21	0.312	-0.6226	-1.13	0.34	-0.4638	-0.76	0.504
Mar	0.0696	0.34	0.759	0.2252	0.82	0.474	0.1502	0.72	0.526
Apr	0.4003	1.88	0.156	0.6957	5.27	0.013**	0.2609	0.68	0.543
May	0.4084	0.97	0.403	0.3134	0.7	0.533	0.6801	0.94	0.416
June	0.2729	0.31	0.778	0.2391	0.66	0.557	0.1781	0.46	0.674
July	1.3385	3.72	0.034**	0.9003	5.69	0.011**	1.0238	2.21	0.114
Aug	0.5142	0.87	0.448	-0.2948	-0.25	0.821	0.5494	1.13	0.339
Sept	1.1771	1.6	0.208	0.4351	0.75	0.506	-0.1358	-0.25	0.821
Oct	0.7248	1.8	0.147	0.3015	1.18	0.305	0.2825	0.95	0.398
Nov	-0.6136	-0.72	0.51	0.058	0.07	0.949	-0.5763	-1.98	0.119
Dec	0.9453	1.89	0.132	0.3202	2.73	0.052*	0.5706	3.54	0.024**
	MSCI_United_States			MSCI_Canada			MSCI_United_Kingdom		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.1032	1.08	0.282	0.0751	0.95	0.346	0.1303	1.49	0.142
Aut	0.0201	0.11	0.917	0.2264	1.1	0.288	0.1497	0.61	0.549
Win	0.0849	0.37	0.72	-0.1919	-0.7	0.492	0.1443	0.94	0.36
Spr	0.1781	1.25	0.232	0.0714	0.73	0.476	0.1342	0.97	0.35
Sum	0.1841	0.64	0.534	0.1869	0.67	0.516	0.0394	0.15	0.887
Jan	0.4698	1.48	0.212	-0.5809	-1.82	0.143	-0.093	-0.25	0.818
Feb	-0.4292	-0.77	0.499	-0.7944	-1.12	0.345	-0.1107	-0.28	0.8
Mar	0.1381	0.49	0.658	0.0501	0.28	0.799	0.1899	0.8	0.484
Apr	0.2838	1.95	0.147	0.2424	1.02	0.381	0.4879	3.11	0.053*
May	0.2382	0.38	0.728	0.3114	0.99	0.396	-0.21	-0.35	0.747

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June	-0.1027	-0.24	0.825	0.3244	0.55	0.622	0.0349	0.09	0.936
July	-0.2952	-0.34	0.756	0.9137	5.33	0.013**	1.079	3.49	0.04**
Aug	0.3157	1.22	0.311	0.0418	0.05	0.962	0.3916	0.56	0.617
Sept	0.6762	1.62	0.203	0.4211	0.54	0.629	0.4769	1.03	0.377
Oct	-0.4517	-1.44	0.222	0.3840	2.1	0.103	0.5549	3	0.04**
Nov	-0.3988	-0.79	0.474	-0.1000	-0.2	0.851	-0.2913	-0.57	0.601
Dec	0.0937	0.27	0.800	0.4253	1.25	0.279	0.3736	3.97	0.017**
	MSCI_Germany			MSCI_France			MSCI_Switzerland		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.1323	1.69	0.097*	0.1257	1.59	0.117	0.0821	0.77	0.443
Aut	0.1038	0.4	0.698	0.0193	0.08	0.939	-0.0548	-0.21	0.84
Win	0.0227	0.15	0.882	0.1393	1.02	0.326	-0.0752	-0.34	0.736
Spr	0.1985	1.67	0.119	0.1716	1.3	0.215	0.2185	1.14	0.277
Sum	0.1871	0.97	0.35	0.0879	0.44	0.666	0.1391	0.61	0.551
Jan	-0.1409	-0.45	0.676	-0.0345	-0.11	0.919	-0.5396	-1.16	0.31
Feb	-0.3292	-0.85	0.46	-0.1725	-0.39	0.726	-0.79	-1.95	0.147
Mar	0.2043	0.82	0.47	0.1752	0.73	0.516	0.899	2.17	0.118
Apr	0.4398	10.11	0.002***	0.5278	3.3	0.046**	0.5329	1.66	0.195
May	0.2416	0.72	0.521	0.1655	0.45	0.682	0.0746	0.18	0.867
June	0.2982	1.06	0.368	0.2342	0.71	0.531	0.0215	0.06	0.953
July	0.6776	3.49	0.04**	0.5968	2.5	0.088*	0.7746	4.01	0.028**
Aug	0.6746	2.55	0.084*	-0.1103	-0.19	0.859	-0.3245	-0.59	0.595
Sept	0.3135	0.55	0.623	0.2806	0.58	0.603	0.497	1.06	0.368
Oct	0.2882	1.04	0.358	0.4652	1.66	0.172	0.4915	1.53	0.202
Nov	-0.2692	-0.37	0.73	-0.304	-0.57	0.598	-0.6307	-1.09	0.338
Dec	0.208	1.19	0.299	0.3036	2.69	0.055*	0.325	1.59	0.188
	MSCI_Netherlands			MSCI_Sweden			MSCI_Italy		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0899	1.18	0.242	0.1427	2	0.05**	0.1059	1.54	0.13
Aut	-0.223	-0.98	0.34	0.2395	1.19	0.252	-0.0483	-0.21	0.833
Win	0.0161	0.12	0.904	0.0241	0.18	0.857	0.1379	1.09	0.292
Spr	0.255	2.03	0.063*	0.1633	1.42	0.178	0.1101	0.99	0.34
Sum	0.1567	0.82	0.429	0.2282	1.27	0.228	0.1523	0.94	0.367
Jan	-0.0328	-0.14	0.895	-0.0398	-0.2	0.85	-0.1983	-0.56	0.608
Feb	-0.5682	-1.59	0.21	-0.5036	-1.52	0.226	-0.1016	-0.22	0.841
Mar	0.2419	0.96	0.408	0.2226	1.02	0.382	0.1379	0.7	0.535
Apr	0.5047	8.67	0.003***	0.3515	1.95	0.146	0.311	2.55	0.084*
May	0.36	1.03	0.377	0.1295	0.39	0.72	-0.1561	-0.38	0.731
June	0.248	0.98	0.4	0.1676	0.65	0.565	0.2024	0.8	0.484
July	0.6964	4.56	0.02**	0.6337	9.2	0.003***	0.5593	2.67	0.076*
Aug	-0.5772	-1.89	0.154	-0.6633	-1.08	0.361	0.2545	1.29	0.287
Sept	0.0994	0.2	0.851	0.3253	0.9	0.436	-0.017	-0.04	0.969
Oct	0.1563	0.51	0.635	0.2803	1.49	0.21	0.4891	1.79	0.148
Nov	-0.7713	-1.73	0.159	-0.0783	-0.12	0.91	-0.3169	-0.67	0.538
Dec	0.1823	1.26	0.275	0.2745	2.04	0.111	0.2344	2.28	0.085*

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	MSCI_Spain			MSCI_Denmark			MSCI_Belgium		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0879	1.2	0.234	0.1999	2.42	0.018**	0.1316	1.61	0.113
Aut	-0.0402	-0.18	0.858	0.141	0.86	0.403	0.0126	0.05	0.963
Win	0.1772	1.46	0.165	0.1191	0.75	0.466	0.1667	1.21	0.246
Spr	0.0818	0.66	0.52	0.2732	1.76	0.101	0.1747	1.17	0.262
Sum	0.0362	0.19	0.853	0.2446	1.05	0.311	0.0767	0.41	0.686
Jan	0.1161	0.37	0.728	-0.1257	-0.24	0.82	0.0986	0.27	0.799
Feb	0.0154	0.04	0.974	-0.489	-1.12	0.344	-0.1982	-0.45	0.68
Mar	0.1449	0.71	0.527	0.418	1.44	0.247	0.2661	0.93	0.42
Apr	0.4355	1.4	0.257	0.6138	2.93	0.061*	0.4919	2.05	0.132
May	-0.1404	-0.28	0.798	0.2195	0.54	0.63	0.2349	0.46	0.678
June	0.0265	0.09	0.935	0.1836	0.59	0.596	0.1284	0.52	0.642
July	0.6966	1.76	0.177	0.8549	7.27	0.005***	0.7325	2.69	0.074*
Aug	0.242	1.17	0.326	-1.1126	-3.06	0.055*	0.3178	0.87	0.448
Sept	0.1219	0.24	0.823	0.8059	1.21	0.314	0.6126	1.39	0.258
Oct	0.4445	2.02	0.114	0.086	0.48	0.657	0.6601	2.31	0.082*
Nov	-0.4486	-1.13	0.321	0.4425	1.36	0.246	-0.5654	-1.37	0.243
Dec	0.2521	2.63	0.058*	0.2826	2.16	0.097*	0.2752	2.39	0.075*
	MSCI_Finland			MSCI_Ireland			MSCI_Norway		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.1701	2.12	0.038**	0.0876	1.22	0.229	0.1432	2.19	0.032**
Aut	0.3863	2.16	0.048**	-0.1969	-0.96	0.352	0.213	1.56	0.139
Win	0.0851	0.54	0.597	0.0908	0.69	0.502	0.1429	1.12	0.282
Spr	0.1887	1.37	0.194	0.1768	1.72	0.11	0.072	0.61	0.553
Sum	0.0674	0.34	0.741	0.0845	0.41	0.687	0.1628	0.96	0.357
Jan	-1.1631	-1.43	0.225	-0.2235	-0.91	0.413	-0.3202	-1.19	0.3
Feb	-0.9305	-3.57	0.037**	-0.1479	-0.33	0.761	-1.2173	-1.84	0.164
Mar	0.2325	0.71	0.529	0.1521	0.83	0.467	0.0249	0.12	0.911
Apr	0.4469	3.66	0.035**	0.404	5.56	0.011**	0.124	0.36	0.741
May	0.8831	2.2	0.115	0.2312	0.56	0.613	0.619	2.36	0.1*
June	0.2719	0.67	0.551	0.227	0.66	0.556	0.2914	0.8	0.484
July	0.7028	4.98	0.016**	0.7045	2.63	0.078*	0.5712	12.93	0.001***
Aug	-0.1946	-0.38	0.732	0.3054	0.91	0.431	-0.26	-1.14	0.335
Sept	0.474	1.37	0.264	-0.0343	-0.09	0.934	0.2373	0.72	0.526
Oct	0.2416	1.03	0.359	0.3553	1.14	0.319	0.2182	1.86	0.136
Nov	0.7487	2.67	0.056*	-0.6338	-1.68	0.168	0.5166	1.53	0.2
Dec	0.2631	2.77	0.05**	0.2383	2.77	0.051*	0.2615	3.6	0.023**
	MSCI_Austria			MSCI_Portugal			MSCI_Japan		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0413	0.62	0.536	0.1104	1.33	0.19	0.1283	1.19	0.239
Aut	-0.1512	-0.67	0.513	0.0583	0.48	0.641	0.0711	0.35	0.728
Win	0.0299	0.25	0.805	0.4384	2.76	0.015**	0.0025	0.01	0.99
Spr	0.1426	1.45	0.17	-0.0276	-0.17	0.868	0.3525	1.49	0.159
Sum	-0.0448	-0.22	0.829	0.0859	0.19	0.849	0.2978	0.98	0.345

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Jan	-0.38	-1.59	0.186	0.906	5.82	0.004***	0.0205	0.03	0.977
Feb	-0.2517	-0.74	0.512	-0.9225	-0.77	0.498	-0.5627	-1.42	0.25
Mar	0.13	0.73	0.519	-0.2191	-0.57	0.61	0.9238	1.26	0.296
Apr	0.3606	9.62	0.002***	-0.7398	-4.7	0.018**	0.9223	3.39	0.043**
May	0.3593	0.79	0.487	0.3009	1.41	0.252	0.1171	0.29	0.792
June	-0.0297	-0.1	0.93	0.5766	1.51	0.229	0.6461	1.52	0.226
July	0.7094	1.53	0.223	3.6864	0.8	0.48	0.6902	1.22	0.308
Aug	0.3672	1.43	0.247	-0.7037	-2.2	0.115	0.4826	1.78	0.173
Sept	0.4111	0.63	0.575	0.9381	1.23	0.306	0.1143	0.22	0.837
Oct	0.2454	0.78	0.48	0.0625	0.43	0.691	0.2946	1.41	0.231
Nov	-0.4009	-1.09	0.338	0.1178	0.48	0.658	-0.9348	-1.73	0.158
Dec	0.2189	2.16	0.097*	0.5003	6.12	0.004***	0.3382	1.5	0.207
	MSCI_Australia			MSCI_New_Zealand			MSCI_South_Korea		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0573	0.81	0.424	0.1986	2.34	0.022**	0.1018	1.47	0.147
Aut	0.0095	0.05	0.96	0.0443	0.27	0.791	0.0257	0.13	0.902
Win	-0.1486	-0.82	0.425	0.5313	3.25	0.005***	-0.0784	-0.68	0.504
Spr	0.0611	0.67	0.517	0.2288	1.44	0.172	0.23	2.03	0.063*
Sum	0.4519	2.07	0.059*	0.2513	1.3	0.215	0.3403	1.91	0.078*
Jan	-0.5731	-1.6	0.184	0.3386	2.04	0.11	-0.6423	-3.31	0.03**
Feb	-0.6124	-2.45	0.092*	1.2523	2.97	0.059*	-0.3739	-2.27	0.108
Mar	0.0627	0.4	0.716	0.2945	0.87	0.449	0.3017	1.65	0.197
Apr	0.0876	0.28	0.797	0.3917	3.88	0.03**	0.4203	2.5	0.088*
May	0.3827	1.26	0.297	-0.0899	-0.18	0.87	0.1331	0.36	0.741
June	0.381	1.24	0.304	0.2023	0.82	0.474	0.363	1.49	0.232
July	0.6667	2.96	0.06*	-0.3606	-0.5	0.649	0.4357	1.54	0.221
Aug	0.2288	0.22	0.838	0.3297	3.49	0.04**	0.0949	0.32	0.772
Sept	-0.2157	-0.45	0.684	0.245	0.42	0.705	0.3274	0.99	0.396
Oct	0.3053	1.93	0.125	-0.9119	-2.11	0.103	0.3407	1.41	0.232
Nov	-0.5882	-1.37	0.242	-0.0089	-0.03	0.977	-0.6679	-2.1	0.103
Dec	0.3621	2.27	0.086*	0.2446	0.5	0.641	0.2475	2.43	0.072*
	MSCI_Hong_Kong			MSCI_Israel					
	0.0669	0.85	0.396	0.0529	0.63	0.531			
Aut	-0.0089	-0.05	0.958	0.0726	0.51	0.619			
Win	0.1118	0.72	0.484	-0.4884	-2.31	0.046			
Spr	0.2404	1.55	0.146	0.1310	1.09	0.294			
Sum	-0.0417	-0.26	0.800	0.5956	1.98	0.070*			
Jan	0.4052	1.56	0.195	-0.4854	-2.32	0.081			
Feb	-0.2470	-0.74	0.513	-0.588	-1.58	0.213			
Mar	0.1743	0.54	0.628	0.1655	0.68	0.543			
Apr	0.4498	2.83	0.066*	0.2299	0.75	0.508			
May	0.2058	0.51	0.644	0.2998	0.91	0.431			
June	0.0588	0.30	0.786	0.0167	0.03	0.975			
July	0.1801	0.43	0.695	0.9676	2.08	0.128			
Aug	-0.0894	-0.18	0.869	0.3323	0.26	0.813			

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Sept	0.1566	0.44	0.692	0.0141	0.04	0.967	
Oct	0.1577	0.91	0.416	0.1544	0.86	0.438	
Nov	-0.5108	-1.56	0.194	0.0038	0.01	0.993	
Dec	0.4523	3.14	0.035**	0.0852	0.26	0.808	

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

At first glance, the MSCI Europe Aggregated Markets Index is significant and positive. Meanwhile, the MSCI North America and Asia Pacific Aggregated Indexes are insignificant. Furthermore, in the MSCI North America Index, both the U.S. and Canada were found to be insignificant in all seasons. Next, results from the MSCI Europe Index show the Netherlands to be significant and positive in the Spring. Meanwhile, Portugal is found to be positive and significant in the Winter and Finland to be significant and positive in Autumn. Lastly, the results from the MSCI Asia Pacific Index shows Australia and South Korea to be significant and positive in the summer whilst New Zealand is significant and positive in the Winter season. Finally, Israel is also significant and positive in the Summer.

A deeper look into the results of MSCI North America countries show the Canada is significant and positive in July. Next, results in MSCI Europe countries show the United Kingdom, Germany, France, Netherlands, Italy, Denmark, Finland, Ireland, Austria, and to be significant and positive and Portugal to be significant and negative. Other common months included December for the United Kingdom, France, Italy, Spain, Denmark, Belgium, Finland, Ireland, Norway, Austria, and Portugal which were all significant and positive. Finally, in the MSCI Asia Pacific countries, results show only New Zealand to be significant and is positive. Specifically, New Zealand was significant and positive the Winter whilst South Korea is significant and positive in the Spring. A deeper dive into the months uncover December as the most common month which is significant and positive in Australia, South Korea, and Hong Kong. Finally, Israel is only positive and significant in the Summer. Most results which were significant exhibited a positive coefficient. The positive correlation additionally supports the findings in the MSCI Emerging Markets Index whereby during the period, there is little evidence to support gold's property of being a hedge against uncertainty. Looking at the individual months, MSCI North America is found to be significant and positive in July. Meanwhile, MSCI Europe is found to be significant and positive in April, July, and December. Finally, MSCI Asia Pacific is found to be significant and positive December only.

Work in Progress – Do Not Distribute

Appendix 22: Table 24: Seasonal ARCH, Asymmetric ARCH, and GARCH Models (Daily)

For GARCH estimates, the Akaike Information Criterion (AIC) sets the optimal number of lags. Any optimal lags of 0 will be set at 1 as default to run the GARCH model.

ARCH (Seasonality)			
	Coef.	t-Stat	P >|t|
Winter	-0.0165	-0.36	0.719
Spring	0.2472	3.82	0.000***
Summer	-0.0277	-0.84	0.402
Constant	-0.0170	-0.36	0.718
Asymmetric ARCH (Seasonality)			
	Coef.	t-Stat	P >|t|
Winter	-0.0396	-0.58	0.561
Spring	0.0832	1.15	0.249
Summer	-0.0275	-0.92	0.356
Constant	-0.0050	-0.09	0.931
GARCH (Seasonality)			
	Coef.	t-Stat	P >|t|
Winter	0.9481	3.77	0.000***
Spring	0.1876	0.46	0.646
Summer	0.6846	3.32	0.001***
Constant	0.9905	0.88	0.377

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix 23: Table 25: Gold Spot Quantile Regression Results (Daily)

1% Quantile			
	Coef.	t-Stat	P >|t|
Winter	0.0075	1.47	0.142
Spring	0.0158	3.06	0.002***
Summer	0.0014	0.28	0.779
Constant	0.0029	0.85	0.398
5% Quantile			
	Coef.	t-Stat	P >|t|
Winter	0.0200	1.41	0.159
Spring	0.0183	1.27	0.204
Summer	-0.0119	-0.84	0.402
Constant	0.0376	3.93	0.000***
10% Quantile			
	Coef.	t-Stat	P >|t|
Winter	0.0167	0.75	0.451
Spring	0.0437	1.94	0.052*
Summer	-0.0060	-0.27	0.788
Constant	0.0728	4.87	0.000***
50% Quantile			
	Coef.	t-Stat	P >|t|
Winter	-0.0485	-0.82	0.410
Spring	0.1408	2.36	0.018**
Summer	-0.0975	-1.66	0.097*
Constant	0.5312	13.39	0.000***
90% Quantile			
	Coef.	t-Stat	P >|t|
Winter	-0.1690	-1.09	0.274
Spring	0.2440	1.56	0.119
Summer	-0.0715	-0.46	0.643
Constant	1.4728	14.14	0.000***
95% Quantile			
	Coef.	t-Stat	P >|t|
Winter	-0.0329	-0.14	0.888
Spring	0.2564	1.09	0.277
Summer	0.0586	0.25	0.801
Constant	1.7921	11.42	0.000***
99% Quantile			
	Coef.	t-Stat	P >|t|
Winter	0.0461	0.05	0.964
Spring	0.4620	0.45	0.651
Summer	0.7441	0.74	0.460
Constant	2.7461	4.04	0.000***

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

OLD DATA – NOT NEEDED

Appendices …: Table …: Regression Monthly Dummy Variable Results (Daily)

	Gold_Spot			Gold_Futures			Silver_Spot		
Month:	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
Jan	0.0002	0.33	0.743	0.0011	0.01	0.990	0.0540	0.31	0.756
Feb	0.0000	-0.01	0.990	0.1002	1.07	0.289	0.1900	0.62	0.536
Mar	0.0015	1.05	0.297	0.0016	1.07	0.288	-0.0012	-0.51	0.609
Apr	0.0012	1.10	0.274	0.0001	0.12	0.902	-0.0013	-0.83	0.407
May	0.0007	0.84	0.403	0.0029	1.45	0.152	0.0019	1.11	0.271
June	-0.0010	-1.23	0.221	-0.0010	-1.04	0.300	0.0032	1.95	0.054*
July	0.0016	2.03	0.045**	0.0018	1.97	0.052*	0.0010	0.52	0.603
Aug	0.0000	-0.03	0.973	-0.0001	-0.10	0.922	0.0016	0.54	0.591
Sept	-0.0008	-1.07	0.287	-0.0008	-0.96	0.341	0.0006	-0.37	0.715
Oct	0.0009	1.24	0.216	0.0005	0.74	0.461	-0.0016	-0.88	0.382
Nov	-0.0003	-0.32	0.747	0.0003	0.32	0.747	0.0008	0.46	0.648
Dec	0.0009	1.34	0.184	0.0009	1.15	0.254	0.0011	0.60	0.551
ARCH									
Jan	-0.1437	-1.60	0.109	-0.0166	-0.63	0.529	-0.0522	-0.53	0.597
Feb	0.1563	1.08	0.278	0.2621	1.58	0.115	0.2159	1.78	0.075*
Mar	0.3231	2.34	0.019**	0.2566	1.88	0.060*	0.4955	3.04	0.002***
Apr	0.0979	1.44	0.151	-0.0599	-0.96	0.336	-0.1130	-0.94	0.348
May	0.2202	1.00	0.319	-0.1719	-2.99	0.003***	-0.1167	-0.61	0.539
June	-0.0067	-0.20	0.842	-0.0412	-0.29	0.773	0.0952	0.53	0.593
July	-0.0394	-0.79	0.429	-0.0601	-1.05	0.293	0.1245	4.16	0.000***
Aug	-0.0418	-0.34	0.731	-0.0522	-1.43	0.154	0.5504	3.04	0.002***
Sept	-0.0690	-0.63	0.528	-0.2019	-4.75	0.000***	-0.1467	-4.06	0.000***
Oct	-0.0468	-0.42	0.677	-0.0682	-1.40	0.161	0.0870	0.72	0.472
Nov	0.0403	0.72	0.472	-0.0995	-1.88	0.060*	-0.0006	-1.81	0.070*
Dec	0.0123	0.37	0.708	0.0400	0.33	0.739	-0.0588	-1.20	0.231
Asymmetric ARCH									
Jan	-0.1559	-2.16	0.030**	-0.0169	-0.13	0.889	-0.1263	-1.40	0.162
Feb	-0.0345	-0.21	0.833	0.3361	1.30	0.193	-0.0242	-0.10	0.924
Mar	0.0942	0.77	0.439	0.3839	1.27	0.205	0.7172	2.00	0.045**
Apr	-0.0641	-0.62	0.534	-0.1611	-2.20	0.027**	-0.1129	-0.54	0.591
May	0.3450	0.83	0.405	-0.1848	-1.67	0.096*	-0.3454	-2.45	0.014**
June	-0.0328	-0.20	0.842	-0.0350	-0.28	0.781	0.0571	0.18	0.853
July	0.2298	0.09	0.932	-0.1530	-1.51	0.132	-0.0876	-2.46	0.014**
Aug	-0.0304	-0.31	0.759	-0.0578	-1.02	0.308	0.0159	0.05	0.960
Sept	-0.0729	-0.68	0.499	-0.1934	-2.03	0.042**	-0.2387	-2.77	0.006***
Oct	-0.1622	-2.68	0.007***	-0.1391	-1.10	0.270	0.0097	0.07	0.945
Nov	0.0875	0.57	0.570	-0.1256	-1.27	0.203	-0.0942	-0.48	0.628

Dec	-0.0851	-0.59	0.554	0.0510	0.24	0.814	-0.0584	-0.27	0.789
GARCH									
Jan	0.8231	1.64	0.101	0.9542	0.79	0.428	0.6720	2.50	0.012**
Feb	0.7801	1.62	0.105	0.0196	0.06	0.952	0.5511	2.00	0.045**
Mar	0.1166	0.18	0.857	0.3976	0.99	0.323	0.1368	0.64	0.525
Apr	0.1825	0.83	0.406	1.0702	0.84	0.399	0.1881	0.18	0.861
May	0.0396	2.23	0.026**	0.5948	0.70	0.487	1.5135	1.43	0.152
June	1.1707	1.03	0.302	0.2030	0.06	0.950	0.2709	0.18	0.857
July	0.8050	2.57	0.010***	0.2280	2.73	0.006***	0.3929	1.32	0.188
Aug	0.9696	4.34	0.000***	1.2825	2.05	0.040**	0.4313	2.18	0.030**
Sept	0.2882	0.32	0.746	0.7587	2.12	0.034**	1.1095	6.94	0.000***
Oct	-0.3897	-0.13	0.894	0.0980	0.66	0.510	1.7606	1.34	0.181
Nov	0.2995	2.05	0.040**	0.1000	0.29	0.775	0.0691	37.91	0.000***
Dec	3.2626	19.78	0.000***	0.0225	0.32	0.981	1.3157	3.06	0.002***
Constant									
Jan	0.0000	0.59	0.556	0.0002	2.80	0.005***	0.0003	0.25	0.803
Feb	8.77E-06	0.20	0.841	0.0001	2.45	0.014**	0.0002	1.38	0.166
Mar	0.0001	1.06	0.290	0.0002	6.08	0.000***	0.0001	1.93	0.053*
Apr	0.0003	14.91	0.000***	-5.21E-06	-0.04	0.972	0.0005	3.10	0.002***
May	0.0001	1.30	0.193	0.0001	0.64	0.524	-0.0001	-0.32	0.752
June	0.0001	6.89	0.000***	0.0001	0.25	0.799	0.0002	0.44	0.663
July	0.0001	3.38	0.001***	0.0001	0.40	0.692	0.0006	4.87	0.000***
Aug	0.0001	9.53	0.000***	0.0002	5.42	0.000***	-0.0001	-0.70	0.481
Sept	0.0001	0.86	0.390	0.0000	1.15	0.250	9.76E-06	0.16	0.871
Oct	0.0001	0.49	0.622	0.0000	-0.41	0.679	-0.0003	-0.67	0.502
Nov	0.0002	5.62	0.000***	0.0002	7.11	0.000***	0.0034	0.00	0.000***
Dec	0.0001	0.79	0.432	0.0001	0.79	0.432	0.0004	0.69	0.493

Only July in gold spot and futures yield a positive and significant return. In silver spot, only June yields a significant and positive return. In ARCH for gold spot, March is significant and positive. In Asymmetric ARCH, gold spot is significant and negative in January and October. Finally, in gold spot, April, June, July, November, and December are significant and negative and August is significant and positive.

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendices…: Table …: Monthly Spot Gold Returns Conditional on Stock Market Index Returns (Daily)

Month:	MSCI_Emerging_Markets			MSCI_World_Markets			S&P500		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	-0.0088	-0.37	0.713	0.0134	0.57	0.567	0.0633	3.19	0.001***
Aut	-0.0128	-0.25	0.806	0.0098	0.19	0.850	0.0214	0.49	0.627
Win	0.0020	0.04	0.966	-0.0294	-0.54	0.592	-0.0250	-0.57	0.572
Spr	-0.0017	-0.04	0.970	0.0240	0.60	0.547	0.1521	4.60	0.000***
Sum	-0.0151	-0.29	0.774	0.0308	0.56	0.578	-0.0714	-1.42	0.157
Jan	0.0807	0.95	0.345	-0.1595	-1.53	0.129	-0.0964	-1.24	0.217
Feb	-0.0981	-1.01	0.317	-0.0640	-0.59	0.558	-0.0199	-0.26	0.796
Mar	-0.0930	-1.32	0.188	0.0178	0.30	0.762	0.1874	4.06	0.000***
Apr	0.1356	1.55	0.125	0.0426	0.49	0.622	0.1793	2.42	0.018**
May	0.0842	0.84	0.401	-0.0297	-0.32	0.751	-0.0692	-0.92	0.358
June	0.0162	0.21	0.830	-0.0552	-0.77	0.444	-0.0156	-0.24	0.809
July	-0.0157	-0.20	0.846	0.1432	1.75	0.083*	-0.1813	-2.23	0.028**
Aug	-0.0094	-0.08	0.939	0.0895	0.56	0.576	-0.0779	-0.60	0.548
Sept	0.1234	-1.37	0.172	-0.0711	0.71	0.482	-0.0197	-0.29	0.774
Oct	-0.0742	-0.89	0.377	-0.0239	-0.30	0.768	-0.0315	-0.44	0.662
Nov	0.1374	1.38	0.171	0.1409	1.44	0.152	0.1532	1.56	0.122
Dec	0.0404	0.61	0.543	0.0779	0.98	0.330	-0.0044	-0.05	0.957

The table shows the only month which is significant and negative for MSCI Emerging Markets is July. Furthermore, the S&P500 is found to be significant and positive. The months of March and April are significant and positive, and July is significant and negative.

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix …: Table …: Gold Return Seasonal Dummy Variables (Daily)

	Coef.	t-Stat	P >|t|
Mean Equation:			
Autumn	0.0019	0.04	0.968
Winter	0.0465	1.01	0.313
Spring	0.1138	1.71	0.089*
Summer	0.0236	0.46	0.649
Variance Equation:			
ARCH	0.0875	4.02	0.000***
Asym. ARCH	0.0806	3.50	0.000***
GARCH	0.9543	3.80	0.000***
Const.	0.0001	31.82	0.000***

***,**,* denote statistical significance at the 1%, 5%, and 10% level respectively.

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Appendix …: Table…: Regression Monthly Dummy Variable Results (Monthly)

	Gold_Spot			Gold_Futures			Silver_Spot		
Month:	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
Jan	0.0133	1.07	0.334	0.0081	0.69	0.523	0.0109	0.59	0.583
Feb	-0.0089	-0.38	0.723	0.0108	0.40	0.709	0.0298	1.63	0.179
Mar	0.0291	1.32	0.256	0.0335	1.69	0.166	-0.0289	-0.54	0.621
Apr	0.0255	1.83	0.141	0.0041	0.36	0.737	-0.0229	-1.03	0.362
May	0.0114	0.62	0.566	0.0192	1.26	0.276	0.0390	1.10	0.333
June	-0.0197	-1.24	0.284	-0.0196	-1.13	0.320	0.0634	1.77	0.151
July	0.0350	1.56	0.193	0.0323	1.85	0.138	0.0128	0.22	0.838
Aug	-0.0021	-0.22	0.839	-0.0016	-0.11	0.917	0.0193	0.39	0.717
Sept	-0.0191	-1.17	0.306	-0.0163	-0.86	0.436	-0.0116	-0.43	0.691
Oct	0.0190	1.54	0.183	0.0132	0.84	0.437	-0.0386	-1.36	0.232
Nov	-0.0040	-0.20	0.846	0.0067	0.35	0.738	0.0157	0.69	0.518
Dec	0.0253	2.08	0.092*	0.0183	2.88	0.035**	0.0203	0.71	0.509
ARCH									
Jan	-0.1437	-1.60	0.109	-0.0166	-0.63	0.529	-0.0522	-0.53	0.597
Feb	0.1563	1.08	0.278	0.2621	1.58	0.115	0.2159	1.78	0.075*
Mar	0.3231	2.34	0.019**	0.2566	1.88	0.060*	0.4955	3.04	0.002***
Apr	0.0979	1.44	0.151	-0.0599	-0.96	0.336	-0.1130	-0.94	0.348
May	0.2202	1.00	0.319	-0.1719	-2.99	0.003***	-0.1167	-0.61	0.539
June	-0.0067	-0.20	0.842	-0.0412	-0.29	0.773	0.0952	0.53	0.593
July	-0.0394	-0.79	0.429	-0.0601	-1.05	0.293	0.1245	4.16	0.000***
Aug	-0.0418	-0.34	0.731	-0.0522	-1.43	0.154	0.5504	3.04	0.002***
Sept	-0.0690	-0.63	0.528	-0.2019	-4.75	0.000***	-0.1467	-4.06	0.000***
Oct	-0.0468	-0.42	0.677	-0.0682	-1.40	0.161	0.0870	0.72	0.472
Nov	0.0403	0.72	0.472	-0.0995	-1.88	0.060*	-0.0006	-1.81	0.070*
Dec	0.0123	0.37	0.708	0.0400	0.33	0.739	-0.0588	-1.20	0.231
Asymmetric ARCH									
Jan	-0.1559	-2.16	0.030**	-0.0169	-0.13	0.889	-0.1263	-1.40	0.162
Feb	-0.0345	-0.21	0.833	0.3361	1.30	0.193	-0.0242	-0.10	0.924
Mar	0.0942	0.77	0.439	0.3839	1.27	0.205	0.7172	2.00	0.045**
Apr	-0.0641	-0.62	0.534	-0.1611	-2.20	0.027**	-0.1129	-0.54	0.591
May	0.3450	0.83	0.405	-0.1848	-1.67	0.096*	-0.3454	-2.45	0.014**
June	-0.0328	-0.20	0.842	-0.0350	-0.28	0.781	0.0571	0.18	0.853
July	0.2298	0.09	0.932	-0.1530	-1.51	0.132	-0.0876	-2.46	0.014**
Aug	-0.0304	-0.31	0.759	-0.0578	-1.02	0.308	0.0159	0.05	0.960
Sept	-0.0729	-0.68	0.499	-0.1934	-2.03	0.042**	-0.2387	-2.77	0.006***
Oct	-0.1622	-2.68	0.007***	-0.1391	-1.10	0.270	0.0097	0.07	0.945
Nov	0.0875	0.57	0.570	-0.1256	-1.27	0.203	-0.0942	-0.48	0.628
Dec	-0.0851	-0.59	0.554	0.0510	0.24	0.814	-0.0584	-0.27	0.789
GARCH									
Jan	0.8231	1.64	0.101	0.9542	0.79	0.428	0.6720	2.50	0.012**
Feb	0.7801	1.62	0.105	0.0196	0.06	0.952	0.5511	2.00	0.045**
Mar	0.1166	0.18	0.857	0.3976	0.99	0.323	0.1368	0.64	0.525

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Apr	0.1825	0.83	0.406	1.0702	0.84	0.399	0.1881	0.18	0.861
May	0.0396	2.23	0.026**	0.5948	0.70	0.487	1.5135	1.43	0.152
June	1.1707	1.03	0.302	0.2030	0.06	0.950	0.2709	0.18	0.857
July	0.8050	2.57	0.010***	0.2280	2.73	0.006***	0.3929	1.32	0.188
Aug	0.9696	4.34	0.000***	1.2825	2.05	0.040**	0.4313	2.18	0.030**
Sept	0.2882	0.32	0.746	0.7587	2.12	0.034**	1.1095	6.94	0.000***
Oct	-0.3897	-0.13	0.894	0.0980	0.66	0.510	1.7606	1.34	0.181
Nov	0.2995	2.05	0.040**	0.1000	0.29	0.775	0.0691	37.91	0.000***
Dec	3.2626	19.78	0.000***	0.0225	0.32	0.981	1.3157	3.06	0.002***
Constant									
Jan	0.0000	0.59	0.556	0.0002	2.80	0.005***	0.0003	0.25	0.803
Feb	8.77E-06	0.20	0.841	0.0001	2.45	0.014**	0.0002	1.38	0.166
Mar	0.0001	1.06	0.290	0.0002	6.08	0.000***	0.0001	1.93	0.053*
Apr	0.0003	14.91	0.000***	-5.21E-06	-0.04	0.972	0.0005	3.10	0.002***
May	0.0001	1.30	0.193	0.0001	0.64	0.524	-0.0001	-0.32	0.752
June	0.0001	6.89	0.000***	0.0001	0.25	0.799	0.0002	0.44	0.663
July	0.0001	3.38	0.001***	0.0001	0.40	0.692	0.0006	4.87	0.000***
Aug	0.0001	9.53	0.000***	0.0002	5.42	0.000***	-0.0001	-0.70	0.481
Sept	0.0001	0.86	0.390	0.0000	1.15	0.250	9.76E-06	0.16	0.871
Oct	0.0001	0.49	0.622	0.0000	-0.41	0.679	-0.0003	-0.67	0.502
Nov	0.0002	5.62	0.000***	0.0002	7.11	0.000***	0.0034	0.00	0.000***
Dec	0.0001	0.79	0.432	0.0001	0.79	0.432	0.0004	0.69	0.493

Appendix …: Table …: Optimal Lag Structure (Monthly)

Seasonal Optimal Lags			
	Gold Spot	Gold Futures	Silver Spot
Aut	11	10	11
Wint	12	12	12
Spr	10	12	12
Sum	12	12	12
Jan	12	6	12
Feb	6	12	6
Mar	7	12	7
Apr	12	12	12
May	12	5	4
June	12	12	9
July	12	7	11
Aug	12	3	11
Sept	10	9	12
Oct	7	12	12
Nov	5	7	12
Dec	8	9	12

Appendix …: Table …: Monthly Gold Futures Returns on Conditional on Stock Market Index Returns (Daily)

	MSCI_Emerging_Markets			MSCI_World_Markets			S&P500		
Month:	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	-0.0066	-0.26	0.797	0.0510	2.05	0.040**	0.0858	4.07	0.000***
Aut	0.0632	1.13	0.261	0.0252	0.45	0.650	0.1307	2.79	0.006***
Win	-0.0431	-0.83	0.408	0.0707	1.17	0.243	-0.0396	-0.81	0.416
Spr	-0.0270	-0.57	0.572	0.0611	1.47	0.144	0.0965	2.72	0.007***
Sum	0.0115	0.21	0.836	0.0383	0.65	0.514	0.1188	2.24	0.026**
Jan	-0.1856	-1.90	0.060*	0.0839	0.69	0.494	0.0314	0.35	0.730
Feb	0.0816	0.81	0.422	-0.0308	-0.27	0.785	-0.2167	-2.85	0.005***
Mar	-0.0486	-0.62	0.537	0.0350	0.54	0.591	0.0965	1.77	0.079*
Apr	-0.0837	-0.95	0.345	0.1286	1.51	0.136	0.1557	2.08	0.040**
May	0.1649	1.57	0.120	0.1430	1.45	0.150	0.0171	0.21	0.832
June	0.0675	0.74	0.459	0.0334	0.38	0.702	-0.0651	-0.84	0.404
July	-0.1125	-1.26	0.212	-0.0205	-0.22	0.826	0.2028	2.23	0.028**
Aug	0.1350	1.20	0.233	0.1851	1.27	0.207	0.4101	3.67	0.000***
Sept	0.0332	0.33	0.740	0.0839	0.75	0.453	0.1850	2.51	0.014**
Oct	0.1334	1.65	0.102	0.0393	0.50	0.618	0.0308	0.44	0.661
Nov	0.0161	0.14	0.889	0.0404	0.36	0.719	0.1572	1.40	0.164
Dec	-0.0284	-0.39	0.696	0.1149	1.35	0.178	0.1817	2.05	0.042**

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix …: Table …: Optimal Lag Structure for Gold Futures (Daily)

AIC Optimal Lag (Gold_Futures)	
Gold_Futures	4
Winter	1
Spring	4
Summer	1
Autumn	0
Jan	0
Feb	1
Mar	4
Apr	0
May	0
June	0
July	4
Aug	4
Sept	0
Oct	3
Nov	0
Dec	1

Appendix …: Table …: Augmented Dickey Fuller Unit Root Tests (Silver Spot) (Daily)

Series (Silver_Spot)	ADF test statistics				
	Level		1st Differences		Conclusion
	Intercept	Intercept & Trend	Intercept	Intercept & Trend	
Silver_Spot	-10.232(4)***	-10.230(4)***	-15.529(4)***	-15.377(4)***	I(0)
Aut	-10.374(1)***	-10.389(1)***	-13.830(1)***	-13.702(1)***	I(0)
Win	-6.343(4)***	-6.289(4)***	-9.981(4)***	-9.851(4)***	I(0)
Spr	-7.981(1)***	-7.937(1)***	-10.385(1)***	-10.537(1)***	I(0)
Sum	-17.763(0)***	-17.753(0)***	-24.862(0)***	-24.743(0)***	I(0)
Jan	-9.962(0)***	-9.890(0)***	-12.785(0)***	-12.659(0)***	I(0)
Feb	-6.049(1)***	-5.989(1)***	-7.686(1)***	-7.567(1)***	I(0)
Mar	-3.406(4)**	-2.880(4)	-4.257(4)***	-4.495(4)***	I(0)
Apr	-10.491(0)***	-10.610(0)***	-14.356(0)***	-14.210(0)***	I(0)
May	-9.783(0)***	-10.173(0)***	-13.426(0)***	-13.346(0)***	I(0)
June	-10.933(0)***	-10.933(0)***	-15.509(0)***	-15.278(0)***	I(0)
July	-1.976(4)	-2.900(4)	-13.293(4)***	-11.594(4)***	I(1)
Aug	-2.789(4)*	-2.675(4)	-10.112(4)***	-11.042(4)***	I(1)
Sept	-9.571(0)***	-9.612(0)***	-15.735(0)***	-15.620(0)***	I(0)
Oct	-4.191(3)***	-3.674(3)**	-6.189(3)***	-6.281(3)***	I(0)
Nov	-9.085(0)***	-9.062(0)***	-16.114(0)***	-16.160(0)***	I(0)
Dec	-6.989(1)***	-7.100(1)***	-6.242(1)***	-6.140(1)***	I(0)

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix …: Table …: Monthly Spot Silver Returns on Conditional on Stock Market Index Returns (Daily)

	MSCI_Emerging_Markets			MSCI_World_Markets			S&P500		
Month:	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0571	1.15	0.249	0.0185	0.38	0.701	0.0498	1.21	0.226
Jan	0.1285	0.66	0.513	0.0278	0.11	0.909	0.1735	0.97	0.335
Feb	-0.3170	-1.67	0.098*	-0.0179	-0.08	0.933	-0.2794	-1.89	0.061*
Mar	0.1266	1.07	0.287	0.0662	0.67	0.502	0.0792	0.95	0.344
Apr	0.0213	0.17	0.865	-0.1234	-1.02	0.312	-0.0270	-0.25	0.803
May	-0.1415	-0.72	0.471	-0.1257	-0.69	0.493	0.0534	0.36	0.717
June	0.0722	0.47	0.636	0.1956	1.36	0.178	0.1912	1.88	0.141
July	0.1160	0.62	0.537	0.0463	0.24	0.811	0.2867	1.49	0.138
Aug	0.2207	0.65	0.519	0.5841	1.33	0.187	0.0590	0.16	0.870
Sept	-0.0180	-0.09	0.931	-0.2641	-1.15	0.251	-0.1121	-0.72	0.474
Oct	0.2899	1.49	0.139	-0.1479	-0.78	0.435	0.0949	0.56	0.573
Nov	0.0021	0.01	0.991	-0.1588	-0.88	0.383	-0.2912	-1.60	0.111
Dec	-0.0318	-0.18	0.856	0.1260	0.61	0.541	0.3850	1.80	0.074*

***, **, * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix …: Table …: MSCI Emerging Markets (EM) Descriptive Statistics (Daily)

Variable	N	Mean (x100)	Std. Dev.	Min	Max	Skewness	Kurtosis	ADF P-Value
MSCI_Americas	1340	0.0070	0.0127	-0.1160	0.0767	-1.0069	14.2905	0.0000
MSCI_EMEA	1340	0.0124	0.0120	-0.0776	0.0464	-0.5230	6.5055	0.0000
MSCI_Asia_Pacific	1340	0.0113	0.0077	-0.0541	0.0588	-0.6274	13.5854	0.0000
MSCI_Brazil	1340	0.0060	0.0213	-0.1766	0.1637	-0.7000	15.4060	0.0000
MSCI_Mexico	1340	0.0026	0.0158	-0.1058	0.0710	-0.6524	8.2217	0.0000
MSCI_Chile	1340	-0.0029	0.0201	-0.1541	0.1182	-0.4642	10.0076	0.0000
MSCI_Peru	1340	0.0029	0.0195	-0.1268	0.1071	-0.3840	8.3674	0.0000
MSCI_Columbia	1340	-0.0062	0.0222	-0.1967	0.1728	-0.6918	19.1146	0.0000
MSCI_Saudi_Arabia	1340	0.0019	0.0139	-0.1708	0.1602	-0.1740	40.2793	0.0000
MSCI_South_Africa	1340	0.0034	0.0187	-0.1158	0.0871	-0.3577	7.1003	0.0000
MSCI_UAE	1340	0.0221	0.0132	-0.1353	0.0885	-0.5786	17.9679	0.0000
MSCI_Qatar	1340	0.0038	0.0113	-0.1283	0.0769	-1.0263	20.7255	0.0000
MSCI_Kuwait	1190	0.0474	0.0086	-0.0591	0.0500	-0.0846	8.3783	0.0000
MSCI_Poland	1340	0.0194	0.0194	-0.1374	0.0925	-0.2054	6.9682	0.0000
MSCI_Turkey	1340	0.0532	0.0228	-0.1894	0.2122	-0.0095	15.0263	0.0000
MSCI_Greece	1340	0.4179	0.1113	-0.6667	2.1004	14.2568	265.2484	0.0000
MSCI_Hungary	975	0.0011	0.0195	-0.1440	0.0888	-1.0912	11.0528	0.0000
MSCI_Czech_Republic	1340	0.0445	0.0144	-0.0886	0.0642	-0.8434	8.5043	0.0000
MSCI_Egypt	1340	-0.0111	0.0215	-0.3757	0.1279	-4.3688	79.7838	0.0000
MSCI_China	1340	0.0108	0.0168	-0.0818	0.1454	0.5400	9.2235	0.0000
MSCI_Taiwan	1340	0.0804	0.0139	-0.0813	0.0773	-0.1292	6.5277	0.0000
MSCI_India	1340	0.0626	0.0128	-0.1435	0.0960	-1.4791	22.5861	0.0000
MSCI_South_Korea	1340	0.0178	0.0172	-0.1581	0.1245	-0.4996	12.3397	0.0000
MSCI_Thailand	1340	-0.0424	0.0129	-0.1120	0.0861	-0.8074	17.9874	0.0000
MSCI_Indonesia	1340	0.0135	0.0149	-0.1089	0.1692	0.3666	23.2684	0.0000
MSCI_Malaysia	1340	0.0092	0.0089	-0.0571	0.0747	0.1567	11.5664	0.0000
MSCI_Philippines	1340	0.0028	0.0136	-0.1383	0.0792	-1.1751	16.1272	0.0000

Table presents summary statistics (observations, mean, standard deviation, minimum, maximum, skewness, and kurtosis) of daily countries and regions in the MSCI Emerging Markets (EM) Index.

Appendix …: Table …: MSCI World Markets (WM) Descriptive Statistics (Daily)

Variable	N	Mean (x100)	Std. Dev.	Min	Max	Skewness	Kurtosis	ADF P-Value
MSCI_North_America	1340	0.0463	0.0095	-0.1052	0.0899	-1.0115	27.0395	0.0000
MSCI_Europe	1340	0.0220	0.0097	-0.0951	0.0454	-1.2582	14.9340	0.0000
MSCI_Asia_Pacific	1340	0.0113	0.0077	-0.0541	0.0588	-0.6274	13.5854	0.0000
MSCI_United_States	1340	0.0606	0.0132	-0.1212	0.0940	-0.5633	16.2852	0.0000
MSCI_Canada	1340	0.0449	0.0133	-0.1325	0.1300	-0.9906	27.7854	0.0000
MSCI_United_Kingdom	1340	0.0185	0.0134	-0.1199	0.1155	-0.8598	17.3450	0.0000
MSCI_Germany	1340	0.0226	0.0150	-0.1269	0.1076	-0.6556	14.2479	0.0000
MSCI_France	1340	0.0244	0.0150	-0.1268	0.0910	-0.8496	14.6356	0.0000
MSCI_Switzerland	1340	0.0231	0.0117	-0.1052	0.0777	-0.6680	15.7430	0.0000
MSCI_Netherlands	1340	0.0382	0.0153	-0.1038	0.0822	-0.3230	8.4255	0.0000
MSCI_Sweden	1340	0.0335	0.0170	-0.1208	0.0907	-0.4464	8.9079	0.0000
MSCI_Italy	1340	0.0322	0.0159	-0.1564	0.1122	-1.3631	18.8046	0.0000
MSCI_Spain	1340	0.0247	0.0153	-0.1459	0.0891	-1.0897	17.3282	0.0000
MSCI_Denmark	1340	0.0544	0.0132	-0.0863	0.0493	-0.5052	6.9482	0.0000
MSCI_Belgium	1340	0.0097	0.0138	-0.1325	0.0775	-1.0820	16.7970	0.0000
MSCI_Finland	1340	0.0030	0.0142	-0.1142	0.0710	-0.7782	10.2869	0.0000
MSCI_Ireland	1340	0.0404	0.0156	-0.1343	0.0722	-0.7601	12.5180	0.0000
MSCI_Norway	1340	0.0180	0.0174	-0.1461	0.1261	-0.9716	14.9071	0.0000
MSCI_Austria	1340	0.0199	0.0164	-0.1533	0.0703	-1.4971	17.4307	0.0000
MSCI_Portugal	1340	0.0082	0.0139	-0.1011	0.0859	-0.4065	8.6895	0.0000
MSCI_Japan	1340	0.0217	0.0116	-0.0980	0.0694	-0.4932	9.9185	0.0000
MSCI_Australia	1340	0.0371	0.0140	-0.1067	0.0790	-0.8878	11.5313	0.0000
MSCI_New_Zealand	1340	-0.0030	0.0152	-0.1513	0.1573	-0.1643	22.6536	0.0000
MSCI_South_Korea	1340	0.0178	0.0172	-0.1581	0.1245	-0.4996	12.3397	0.0000
MSCI_Hong_Kong	1340	-0.0145	0.0138	-0.0936	0.0663	-0.2516	7.9515	0.0000
MSCI_Israel	1340	0.0306	0.0136	-0.1103	0.1033	-0.5417	12.5800	0.0000

Table presents summary statistics (observations, mean, standard deviation, minimum, maximum, skewness, and kurtosis) of daily data in the MSCI World Markets (WM) Index (excluding Luxembourg).

Appendix …: Table …: Monthly Spot Gold Returns Conditional on MSCI Emerging Markets (EM) Index Returns (Daily)

Appendix 8 represents the regression estimation results for gold returns conditional on developing country sectors and individual country returns in the MSCI Emerging Markets Index returns. The country sectors include the Americas, Europe, the Middle East, and Africa (EMEA), and Asia Pacific. The Americas include 5 countries: Brazil, Mexico, Chile, Peru, and Columbia. EMEA includes 11 countries: Saudi Arabia, South Africa, United Arab Emirates (UAE), Qatar, Kuwait, Poland, Turkey, Greece, Hungary, Czech Republic, and Egypt. Finally, Asia Pacific includes 8 countries: China, Taiwan, India, South Korea, Thailand, Indonesia, Malaysia, and the Philippines. At first glance, in the Americas countries, all countries which had significant seasons were all positive. Results showed in all 5 MSCI country indexes (Brazil, Mexico, Chile, Peru, and Columbia) had the season of Spring to be significant. Brazil also found the summer to be significant meanwhile Peru also found autumn and winter to be significant. The MSCI Americas Aggregated Markets Index is statistically significant and positive evidencing a positive relationship with gold. Next, in the MSCI EMEA Index countries, only Turkey and the Czech Republic had significant and positive seasons of spring and autumn respectively. Finally, results show in the MSCI Asia Pacific countries, Taiwan and India are significant in the summer, whilst Thailand and Indonesia are significant and positive in spring, and the Philippines in significant and negative in Autumn.

A deeper look finds the MSCI Americas is only significantly positive in March and April, and significantly negative in October. Subsequently, MSCI EMEA Aggregated Markets Index is found to be significant and positive in November. Meanwhile MSCI Asia Pacific Aggregated Markets Index in significant in July and October, of which it is positive in July, and negative in October. In the MSCI Americas Index country returns, Brazil, Peru, and Columbia were found to be significant and positive. Within the EMEA, no country returns were found to be significant overall. Finally, in the MSCI Asia Pacific Index country returns, China is found to be significant and positive, meanwhile Indonesia is found to be significant and negative. Most of the countries observed which have been significant have been positively correlated with gold returns, not supporting gold's role as a hedge against uncertainty. The statistically significant season in the MSCI Americas Index is Spring which is highly significant and positive. Next, the MSCI EMEA Index has no significant

seasons, and finally the MSCI Asia Pacific Index had Autumn as the only significant and negative season. The statistically significant months in the MSCI Americas Index is March, April, and October. In the MSCI EMEA Index, it is only November, and finally in the MSCI Asia Pacific Index, it is found to be the months of July and October.

Month:	MSCI_Americas			MSCI_EMEA			MSCI_Asia_Pacific		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0727	3.55	0.000***	0.0047	0.18	0.858	-0.0190	-0.56	0.577
Aut	-0.0117	-0.27	0.789	0.0343	0.60	0.552	-0.1562	-2.07	0.039**
Win	0.0453	0.96	0.339	0.0092	0.18	0.885	-0.0026	-0.03	0.973
Spr	0.1400	3.93	0.000***	0.0067	0.14	0.891	-0.0030	-0.05	0.960
Sum	0.0031	0.06	0.949	-0.0361	-0.60	0.547	0.0731	0.98	0.328
Jan	0.1194	1.46	0.148	0.0146	0.16	0.871	-0.0173	-0.12	0.906
Feb	0.0418	0.44	0.664	-0.1448	-1.43	0.156	-0.0838	-0.58	0.564
Mar	0.1605	3.13	0.002***	-0.0487	-0.59	0.560	-0.0504	-0.55	0.584
Apr	0.2031	2.37	0.020**	0.0620	0.70	0.487	0.0535	0.42	0.678
May	0.0023	0.03	0.974	0.0250	0.28	0.781	0.0978	0.74	0.463
June	-0.1050	-1.57	0.119	-0.0314	-0.40	0.687	-0.0096	-0.10	0.919
July	0.0449	0.67	0.503	-0.0007	-0.01	0.994	0.2865	2.18	0.032**
Aug	0.1922	1.54	0.126	-0.0331	-0.22	0.824	0.1943	1.03	0.304
Sept	-0.0091	-0.12	0.903	-0.0230	-0.25	0.801	-0.1546	-1.13	0.262
Oct	-0.1283	-1.73	0.086*	-0.0981	-0.94	0.348	-0.2361	-1.78	0.077*
Nov	0.0526	0.67	0.507	0.2808	2.46	0.016**	0.1441	-1.07	0.288
Dec	0.0499	0.70	0.487	0.1076	1.58	0.118	0.1825	1.58	0.117
	MSCI_Brazil			MSCI_Mexico			MSCI_Chile		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0483	3.96	0.000***	0.0260	1.57	0.116	0.0134	1.03	0.305
Aut	0.0184	0.72	0.474	-0.0456	-1.37	0.173	-0.0024	-0.10	0.923
Win	0.0280	1.03	0.304	0.0067	0.19	0.851	0.0005	-0.02	0.985
Spr	0.0656	3.09	0.002***	0.0860	2.71	0.007***	0.0620	2.25	0.025**
Sum	0.0543	1.84	0.067*	-0.0053	-0.15	0.878	-0.0235	-0.88	0.382
Jan	0.0414	0.84	0.401	0.0606	0.98	0.331	0.0461	1.15	0.253
Feb	0.0638	1.15	0.253	-0.0019	-0.03	0.978	-0.0599	-0.97	0.335
Mar	0.0813	2.68	0.008***	0.1035	2.08	0.040**	0.0806	1.88	0.062*
Apr	0.0865	1.63	0.107	0.1290	2.01	0.048**	0.1155	1.93	0.057*
May	0.0030	0.07	0.942	-0.0175	-0.31	0.760	-0.0320	-0.67	0.504
June	0.0018	0.04	0.966	-0.0700	-1.34	0.182	-0.0421	-1.26	0.211
July	0.0900	1.99	0.049**	0.0178	0.37	0.709	0.0212	0.45	0.652
Aug	0.1505	2.23	0.028**	0.0778	0.87	0.387	-0.0216	-0.33	0.745
Sept	0.0242	0.54	0.592	-0.0379	-0.70	0.486	-0.0063	-0.13	0.894
Oct	-0.0064	-0.14	0.885	-0.1060	-1.89	0.061*	-0.0396	-0.95	0.343
Nov	0.0166	0.37	0.712	-0.0170	-0.27	0.787	0.0286	0.66	0.509
Dec	0.0109	0.28	0.783	0.0020	0.04	0.971	0.0030	0.09	0.927
	MSCI_Peru			MSCI_Columbia			MSCI_Saudi_Arabia		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|

	0.0643	4.85	0.000***	0.0237	2.02	0.044**	0.0093	0.50	0.619
Aut	0.0501	1.94	0.053*	0.0031	0.12	0.908	0.0378	0.76	0.446
Win	0.0532	1.88	0.061*	0.0113	0.41	0.682	-0.0102	-0.24	0.813
Spr	0.1151	4.48	0.000***	0.0392	1.83	0.068*	0.0118	0.40	0.689
Sum	0.0007	0.02	0.980	0.0125	0.54	0.591	-0.0122	-0.23	0.815
Jan	0.0330	0.65	0.519	0.1374	2.67	0.009***	-0.0490	-0.71	0.481
Feb	0.0485	0.92	0.362	0.0044	0.08	0.936	-0.0474	-0.48	0.634
Mar	0.1605	3.96	0.000***	0.0448	1.41	0.161	-0.0123	-0.31	0.761
Apr	0.0464	0.76	0.450	0.0479	1.02	0.312	0.1977	2.52	0.013**
May	0.0567	1.48	0.142	-0.0007	-0.02	0.988	0.0322	0.45	0.654
June	-0.0178	-0.44	0.662	-0.0101	-0.32	0.748	-0.0781	-1.03	0.306
July	-0.0266	-0.61	0.542	0.0464	1.23	0.223	-0.0603	-0.79	0.430
Aug	0.0506	0.70	0.488	0.0573	0.92	0.358	0.1468	1.11	0.269
Sept	0.0154	0.31	0.756	0.0706	1.48	0.142	-0.0461	-0.48	0.630
Oct	-0.0411	-0.81	0.421	-0.0034	-0.08	0.933	-0.0358	0.41	0.684
Nov	0.0986	2.47	0.015**	-0.0443	-0.90	0.372	0.0987	1.20	0.233
Dec	0.9578	2.18	0.031**	-0.0111	-0.27	0.785	0.0421	0.68	0.500
	MSCI_South_Africa			MSCI_UAE			MSCI_Qatar		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0102	0.73	0.466	-0.0005	-0.03	0.980	0.0191	0.83	0.406
Aut	0.0351	1.23	0.218	-0.0079	-0.20	0.842	-0.0178	-0.37	0.710
Win	-0.0064	-0.24	0.812	-0.0277	-0.66	0.511	0.0292	0.65	0.518
Spr	-0.0028	-0.10	0.922	0.0244	0.62	0.534	0.0643	1.55	0.122
Sum	0.0247	0.84	0.400	-0.0677	-1.30	0.193	-0.0847	-1.41	0.159
Jan	-0.0367	-0.74	0.462	-0.0898	-1.43	0.156	-0.0227	-0.30	0.766
Feb	-0.0395	-0.81	0.418	-0.0065	-0.07	0.943	-0.0179	-0.19	0.847
Mar	-0.0399	-0.89	0.375	-0.0600	-0.97	0.334	0.0764	1.24	0.218
Apr	0.0715	1.21	0.230	0.2321	3.17	0.002***	0.0896	0.93	0.355
May	0.0096	-0.17	0.864	0.0355	0.52	0.608	-0.0009	-0.01	0.991
June	0.0234	0.51	0.613	-0.0262	-0.34	0.737	-0.1181	-1.39	0.169
July	0.0450	0.91	0.364	-0.1235	-1.60	0.112	-0.1305	-1.28	0.202
Aug	0.0334	0.59	0.556	-0.0845	-0.71	0.477	-0.0317	-0.24	0.807
Sept	-0.0181	-0.41	0.684	-0.0493	-0.74	0.461	0.1042	1.31	0.191
Oct	-0.0117	-0.23	0.820	-0.0673	-0.92	0.361	-0.0455	-0.63	0.533
Nov	0.1452	2.65	0.009***	0.0210	0.30	0.762	-0.0100	-1.00	0.320
Dec	0.0383	0.94	0.350	-0.0119	-0.18	0.860	0.0857	1.28	0.203
	MSCI_Kuwait			MSCI_Poland			MSCI_Turkey		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	-0.0115	-0.37	0.711	-0.0079	-0.58	0.560	0.0056	0.49	0.624
Aut	-0.0009	-0.02	0.987	0.0350	-1.25	0.211	0.0050	0.23	0.820
Win	0.0034	0.04	0.968	-0.0311	-1.19	0.234	-0.0273	-1.64	0.102
Spr	-0.0055	-0.09	0.929	-0.0089	-0.33	0.741	0.0530	1.94	0.053*
Sum	-0.0531	-0.81	0.418	0.0390	1.39	0.164	0.0055	0.18	0.855
Jan	-0.3115	-2.43	0.017**	-0.0319	-0.64	0.521	-0.0618	-1.97	0.052
Feb	-0.0149	-0.07	0.946	-0.1281	-2.29	0.024**	-0.0082	-0.21	0.835
Mar	0.0226	0.13	0.897	-0.0097	-0.21	0.835	0.1186	2.83	0.006***
Apr	-0.1080	-0.94	0.350	-0.0463	-1.08	0.281	-0.0429	-0.64	0.521
May	-0.0096	-0.17	0.864	0.0534	1.01	0.315	-0.0413	-1.43	0.156

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June	0.0470	0.47	0.643	0.0268	0.68	0.497	0.0298	0.69	0.492
July	0.0260	0.26	0.793	0.0015	0.03	0.973	-0.0207	-0.41	0.681
Aug	-0.2391	-1.66	0.100	0.0828	1.27	0.209	-0.0333	-0.52	0.605
Sept	0.0347	0.33	0.746	-0.0374	-0.68	0.497	0.0154	0.45	0.652
Oct	-0.0608	-0.77	0.441	-0.0835	-1.88	0.062*	-0.0378	-0.95	0.345
Nov	0.0134	0.14	0.890	0.0101	0.21	0.836	0.0210	0.53	0.600
Dec	0.1871	1.60	0.113	0.0147	0.41	0.682	-0.0236	-1.11	0.269
	MSCI_Greece			MSCI_Hungary			MSCI_Czech_Republic		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	-0.0017	-0.71	0.476	-0.0069	-0.42	0.671	0.0070	0.39	0.699
Aut	-0.0011	-0.03	0.973	-0.0132	-0.36	0.721	0.0901	2.40	0.017**
Win	-0.0003	-0.07	0.942	-0.0250	-1.00	0.319	0.0219	0.63	0.531
Spr	-0.0021	-0.63	0.531	-0.0031	-0.09	0.925	-0.0303	-0.78	0.435
Sum	-0.0410	-1.33	0.184	0.0234	0.52	0.603	-0.0302	-0.86	0.391
Jan	-0.0081	-0.15	0.880	-0.0969	-1.49	0.140	-0.0494	-0.65	0.519
Feb	-0.0006	-0.12	0.905	-0.0328	-0.90	0.369	-0.0046	-0.08	0.934
Mar	0.0020	0.39	0.697	0.0329	0.59	0.554	-0.0843	-1.27	0.206
Apr	0.0389	0.94	0.351	-0.0922	-1.39	0.168	0.1439	1.75	0.083*
May	0.0326	0.60	0.552	0.0102	0.20	0.839	-0.0260	-0.45	0.654
June	-0.0560	-1.27	0.207	0.0013	0.02	0.983	-0.0315	-0.74	0.460
July	-0.0608	-1.30	0.197	-0.0235	-0.34	0.738	0.0014	0.02	0.981
Aug	0.0055	0.08	0.939	0.1093	0.87	0.387	-0.0995	-1.01	0.314
Sept	0.0872	1.41	0.161	0.0539	0.86	0.391	0.1493	2.57	0.011**
Oct	-0.0585	-1.12	0.265	-0.0098	-0.16	0.871	-0.0065	-0.11	0.915
Nov	-0.0041	-0.07	0.946	-0.1081	-1.47	0.145	0.1541	1.95	0.054*
Dec	0.0362	0.83	0.408	0.0306	0.59	0.555	0.0704	1.11	0.271
	MSCI_Egypt			MSCI_China			MSCI_Taiwan		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0058	0.48	0.634	0.0360	2.23	0.020**	0.0036	0.19	0.848
Aut	0.0267	0.76	0.447	0.0266	0.85	0.397	-0.0141	-0.42	0.672
Win	0.0166	0.82	0.411	0.0404	1.48	0.140	-0.0200	-0.55	0.584
Spr	0.0152	0.72	0.472	0.0527	1.61	0.108	-0.0456	-1.04	0.300
Sum	-0.0650	-2.00	0.046	0.0098	0.29	0.770	0.1125	2.93	0.004***
Jan	0.0499	1.18	0.239	0.0644	1.38	0.170	0.0103	0.13	0.895
Feb	-0.1269	-0.37	0.712	-0.0204	-0.30	0.768	0.0046	0.07	0.943
Mar	0.0073	0.11	0.909	0.1427	2.28	0.025**	-0.0941	-1.31	0.193
Apr	0.0139	0.28	0.782	0.0148	0.32	0.750	-0.0599	-0.65	0.520
May	0.0249	0.67	0.502	-0.0131	-0.21	0.838	0.0301	0.41	0.684
June	-0.0573	1.14	0.256	0.0296	0.53	0.595	0.0695	1.21	0.228
July	-0.0557	-1.20	0.232	0.0767	1.55	0.125	0.0357	0.52	0.602
Aug	-0.0810	-1.09	0.277	-0.0586	-0.81	0.419	0.2364	3.12	0.002***
Sept	0.0657	1.53	0.130	-0.0017	-0.03	0.974	0.0082	0.18	0.859
Oct	-0.1093	-1.35	0.178	0.0903	1.40	0.163	-0.0475	-0.77	0.442
Nov	0.0168	0.22	0.823	0.0042	0.08	0.934	-0.0050	-0.07	0.945
Dec	0.0453	1.22	0.224	0.0494	1.40	0.163	-0.0418	-0.75	0.453
	MSCI_India			MSCI_South_Korea			MSCI_Thailand		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|

Work in Progress – Do Not Distribute

	-0.0257	-1.26	0.207	0.0151	0.99	0.321	0.0464	2.30	0.021**
Aut	-0.0462	-0.94	0.349	-0.0407	-1.20	0.233	-0.0670	-1.59	0.113
Win	-0.0641	-1.36	0.176	-0.0316	-1.14	0.257	-0.0332	-0.87	0.385
Spr	-0.0355	-1.07	0.286	0.0455	1.63	0.105	0.1578	4.33	0.000***
Sum	0.1024	1.99	0.048**	0.0557	1.53	0.126	0.0054	0.11	0.916
Jan	-0.0991	-1.19	0.239	0.0046	0.10	0.924	-0.1017	-1.57	0.119
Feb	-0.1564	-1.85	0.067*	-0.1558	-2.92	0.004***	0.1101	1.27	0.206
Mar	-0.1174	-2.32	0.022**	0.0532	1.27	0.208	0.1918	3.75	0.000***
Apr	0.0788	1.23	0.223	0.0213	0.40	0.693	0.1017	1.31	0.194
May	0.1338	1.95	0.054*	0.0408	0.61	0.540	-0.0080	-0.08	0.935
June	0.0146	0.19	0.851	0.0396	0.84	0.401	-0.0697	-1.00	0.321
July	0.1610	2.56	0.012**	-0.0079	-0.12	0.903	-0.0169	-0.19	0.851
Aug	0.1882	1.08	0.282	0.0987	1.15	0.252	0.2143	1.83	0.071*
Sept	-0.0201	-0.27	0.789	0.0195	-0.35	0.728	-0.0318	-0.40	0.689
Oct	-0.1857	-2.27	0.025**	-0.0265	-0.45	0.627	-0.0230	-0.38	0.703
Nov	0.1042	0.99	0.325	-0.0660	-1.03	0.304	-0.1038	-1.44	0.153
Dec	0.0678	0.87	0.386	0.0657	1.56	0.121	0.0089	0.15	0.880
	MSCI_Indonesia			MSCI_Malaysia			MSCI_Philippines		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	-0.0342	-1.95	0.051*	-0.0441	-1.51	0.131	-0.0265	-1.38	0.168
Aut	-0.0368	-0.93	0.351	-0.1050	-1.78	0.076*	-0.0945	-2.26	0.025**
Win	-0.0001	-0.00	0.998	-0.0656	-1.24	0.216	0.0400	0.94	0.346
Spr	-0.0604	-2.00	0.046**	0.0159	0.27	0.785	-0.0298	-0.83	0.406
Sum	0.0200	0.51	0.613	-0.0344	-0.51	0.611	-0.0130	-0.33	0.742
Jan	-0.0218	-0.29	0.773	-0.0615	-0.65	0.517	0.0946	1.27	0.206
Feb	-0.0154	-0.17	0.866	-0.1228	-0.92	0.358	-0.0742	-0.93	0.355
Mar	-0.0692	-1.51	0.133	-0.0111	-0.13	0.899	-0.0911	-1.65	0.102
Apr	-0.0470	-0.69	0.491	0.1181	0.99	0.326	-0.0004	-0.01	0.996
May	-0.0164	-0.25	0.804	0.0191	0.14	0.886	0.1163	1.40	0.165
June	0.0078	0.16	0.870	-0.0829	-0.84	0.400	-0.0153	-0.29	0.772
July	0.0479	0.65	0.518	0.0343	0.33	0.739	0.1033	1.44	0.153
Aug	0.0615	0.60	0.549	0.0239	0.15	0.881	-0.0346	-0.39	0.694
Sept	-0.0692	-1.14	0.258	-0.0706	-0.80	0.424	-0.0443	-0.64	0.523
Oct	-0.1325	-1.97	0.051*	-0.0544	-0.53	0.598	-0.0823	-1.01	0.314
Nov	0.0319	0.41	0.680	-0.1837	-1.54	0.127	-0.1657	-2.13	0.035**
Dec	0.0609	1.05	0.295	-0.0191	-0.28	0.779	0.0994	1.50	0.135

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

Work in Progress – Do Not Distribute

Appendix …: Table …: Monthly Spot Gold Returns Conditional on MSCI World Markets (WM) Index Returns (Daily)

Appendices 8 represents the regression estimation results for gold returns conditional on developing country sectors and individual country returns in the MSCI World Markets Index returns. The country sectors include North America, Europe, and Asia Pacific. North America includes 2 developed countries: the United States and Canada. Europe includes 15 developed countries: United Kingdom, Germany, France, Switzerland, Netherlands, Sweden, Italy, Spain, Denmark, Belgium, Finland, Ireland, Norway, Austria, and Portugal. Finally, Asia Pacific includes 4 developed countries: Japan, Australia, New Zealand, and South Korea. At first glance, the MSCI North America and Europe Aggregated Markets Index's is significant and positive. Meanwhile, the MSCI Asia Pacific Aggregated Index is insignificant.

Furthermore, in the MSCI North America Index, both the U.S. and Canada were found to be highly significant and positive in spring. Next, results from the MSCI Europe Index show many countries (Germany, France, Switzerland, Netherlands, Sweden, Italy, Belgium) to be significant and positive in the summer. Next, Denmark is also significant and positive in spring, however significant and negative in the Autumn season. Results from Finland show additionally to be significant and positive in summer and spring. Norway is also significant and positive in the spring season. Finally, Austria is significant and negative in Autumn. Lastly, the results from the MSCI Asia Pacific Index shows Japan to be significant and negative in the winter whilst New Zealand, Hong Kong, and Israel is significant and positive in the spring season.

A deeper look into the results of MSCI North America countries show the United Stated and Canada are highly significant and positive. Next, results in MSCI Europe countries show Finland, Norway, and Portugal to be highly significant and positive. Finally, in the MSCI Asia Pacific countries, results show only New Zealand to be significant and is positive. All MSCI World country results were found significant were positive. The positive correlation additionally supports the findings in the MSCI Emerging Markets Index whereby during the period, there is little evidence to support gold's property of being a hedge against uncertainty. Looking at the individual months, MSCI North America is found to be highly significant and positive in March, April, and December. Meanwhile, MSCI Europe is found to be significant and positive in March and August, and negative in

February. Finally, MSCI Asia Pacific is found to be significant and positive in July and significant and negative in October.

Month:	MSCI_North_America			MSCI_Europe			MSCI_Asia_Pacific		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.1718	6.34	0.000***	0.0558	2.07	0.038**	-0.0190	-0.56	0.577
Aut	0.0580	0.86	0.392	-0.0942	-1.58	0.116	-0.1562	-2.07	0.039**
Win	0.1509	2.28	0.024**	-0.0277	-0.49	0.625	-0.0026	-0.03	0.973
Spr	0.2687	6.37	0.000***	0.1217	2.51	0.013**	-0.0030	-0.05	0.960
Sum	-0.0371	-0.57	0.572	0.1303	2.22	0.027**	0.0731	0.98	0.328
Jan	-0.0196	-0.15	0.878	-0.0141	-0.12	0.902	-0.0173	-0.12	0.906
Feb	0.1331	1.03	0.305	-0.2455	-2.04	0.044**	-0.0838	-0.58	0.564
Mar	0.3170	5.69	0.000***	0.1843	2.55	0.012**	-0.0504	-0.55	0.584
Apr	0.2765	2.74	0.007***	-0.0757	-0.80	0.427	0.0535	0.42	0.678
May	-0.0079	-0.07	0.942	0.1182	1.08	0.283	0.0978	0.74	0.463
June	-0.0131	-0.14	0.888	0.0125	0.15	0.878	-0.0096	-0.10	0.919
July	0.0071	0.07	0.944	0.1279	1.42	0.159	0.2865	2.18	0.032**
Aug	-0.0819	-0.51	0.610	0.3495	2.39	0.019**	0.1943	1.03	0.304
Sept	0.0220	0.20	0.845	-0.1083	-0.88	0.382	-0.1546	-1.13	0.262
Oct	-0.0102	-0.09	0.927	-0.0868	-0.92	0.361	-0.2361	-1.78	0.077*
Nov	0.1119	0.77	0.444	-0.0929	-0.86	0.389	-0.1441	-1.07	0.288
Dec	0.3187	3.43	0.001***	0.0644	0.85	0.397	0.1825	1.58	0.117
	MSCI_United_States			MSCI_Canada			MSCI_United_Kingdom		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0953	4.88	0.000***	0.0844	4.32	0.000***	0.0141	0.74	0.461
Aut	0.0351	0.81	0.417	0.0186	0.40	0.689	-0.0346	-0.76	0.448
Win	0.0446	1.03	0.306	0.0983	2.02	0.044**	-0.0324	-0.80	0.425
Spr	0.1783	5.52	0.000***	0.1250	3.99	0.000***	0.0283	0.84	0.403
Sum	-0.0540	-1.08	0.279	-0.0024	-0.05	0.960	0.0636	1.51	0.133
Jan	-0.1095	-1.45	0.149	0.0744	0.82	0.415	-0.0348	-0.49	0.623
Feb	0.1066	1.44	0.154	0.0229	0.22	0.825	-0.1519	-1.64	0.105
Mar	0.2104	4.69	0.000***	0.1456	3.44	0.001***	0.0377	0.76	0.450
Apr	0.1305	1.76	0.082*	0.1833	2.28	0.025**	-0.0276	-0.41	0.681
May	0.0822	1.16	0.248	-0.0673	-0.83	0.408	0.1393	1.61	0.111
June	-0.0208	-0.33	0.745	0.0027	0.04	0.969	-0.0117	-0.20	0.843
July	-0.1535	-1.75	0.084*	0.0653	0.88	0.382	0.0247	0.38	0.705
Aug	-0.0441	-0.37	0.712	-0.0370	-0.34	0.736	0.2431	2.35	0.021**
Sept	0.0370	0.53	0.597	-0.0141	-0.17	0.868	-0.0859	-0.95	0.343
Oct	-0.0214	-0.31	0.759	0.0084	0.11	0.913	-0.0032	-0.05	0.964
Nov	0.0934	1.03	0.306	0.0108	0.12	0.902	-0.0516	-0.64	0.524
Dec	0.0740	0.92	0.359	0.2162	3.34	0.001***	0.0293	0.53	0.600
	MSCI_Germany			MSCI_France			MSCI_Switzerland		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0140	0.81	0.419	0.0123	0.70	0.482	-0.0005	-0.02	0.983
Aut	-0.0462	-1.18	0.239	-0.0403	-0.98	0.326	-0.0213	-0.41	0.683
Win	-0.0319	-0.84	0.404	-0.0468	-1.24	0.215	-0.0727	-1.57	0.117

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Spr	0.0333	1.06	0.289	0.0259	0.84	0.402	-0.0094	-0.24	0.813
Sum	0.0648	1.78	0.076*	0.0794	2.12	0.034**	0.1257	2.57	0.011**
Jan	0.0076	0.10	0.921	-0.0089	-0.12	0.903	0.0503	0.53	0.601
Feb	-0.1976	-2.32	0.022**	-0.2497	-2.96	0.004***	-0.2874	-3.12	0.002***
Mar	0.0617	1.22	0.226	0.0365	0.76	0.452	-0.0124	-0.22	0.829
Apr	-0.0566	-1.08	0.284	-0.0408	-0.75	0.458	-0.0326	-0.39	0.698
May	0.1069	1.58	0.118	0.0863	1.24	0.217	0.0942	0.89	0.376
June	-0.0097	-0.18	0.858	-0.0005	-0.01	0.992	0.0682	0.91	0.364
July	0.0407	0.73	0.465	0.0870	1.58	0.116	0.0855	1.23	0.223
Aug	0.1783	2.15	0.034**	0.1791	2.02	0.046**	0.2488	2.11	0.037**
Sept	-0.0454	-0.57	0.570	-0.0313	-0.39	0.696	-0.0266	-0.24	0.809
Oct	-0.0628	-1.03	0.307	-0.0244	-0.37	0.715	-0.0502	-0.60	0.548
Nov	-0.0431	-0.62	0.539	-0.0663	-0.90	0.368	-0.0020	-0.02	0.982
Dec	0.0220	0.45	0.655	0.0240	0.49	0.623	0.0086	0.14	0.888
	MSCI_Netherlands			MSCI_Sweden			MSCI_Italy		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0148	0.86	0.388	0.0027	0.18	0.859	0.0041	0.25	0.803
Aut	-0.0451	-1.25	0.213	-0.0400	-1.17	0.243	-0.0402	-1.03	0.303
Win	-0.0236	-0.67	0.504	0.0008	0.03	0.979	-0.008	-0.22	0.826
Spr	0.0297	0.93	0.355	0.0019	0.07	0.948	0.0009	0.03	0.975
Sum	0.0780	2.18	0.030**	0.0568	1.76	0.079*	0.0581	1.74	0.083*
Jan	0.0291	0.43	0.671	0.0324	0.58	0.566	0.0208	0.30	0.762
Feb	-0.1796	-2.48	0.015**	-0.1160	-1.67	0.099*	-0.1654	-2.00	0.048**
Mar	0.0469	0.88	0.379	0.0043	0.09	0.927	0.0029	0.06	0.949
Apr	-0.0263	-0.49	0.623	-0.0350	-0.68	0.496	-0.0535	-0.97	0.333
May	0.0899	1.34	0.183	0.0553	0.95	0.345	0.0865	1.21	0.228
June	0.0402	0.77	0.441	0.0019	0.04	0.967	-0.0150	-0.29	0.771
July	0.0512	0.91	0.363	0.0634	1.27	0.206	0.0590	1.22	0.225
Aug	0.1492	1.79	0.076*	0.1201	1.50	0.136	0.1476	1.92	-0.058*
Sept	-0.0203	-0.30	0.761	-0.0263	-0.42	0.677	-0.0158	-0.21	0.832
Oct	-0.0384	-0.64	0.522	-0.0298	-0.55	0.583	0.0089	0.14	0.892
Nov	-0.0686	-1.06	0.293	-0.0723	-1.15	0.253	-0.0950	-1.38	0.170
Dec	0.0387	0.80	0.426	0.0423	1.01	0.317	0.0523	1.05	0.298
	MSCI_Spain			MSCI_Denmark			MSCI_Belgium		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0018	0.11	0.916	0.0005	1.51	0.130	0.0001	0.26	0.797
Aut	-0.0483	-1.19	0.235	-0.0637	-1.67	0.097*	-0.0542	-1.24	0.215
Win	-0.0323	-0.91	0.365	-0.0024	-0.06	0.953	-0.0461	-1.19	0.233
Spr	0.0221	0.72	0.473	0.1255	3.17	0.002***	0.0355	1.02	0.310
Sum	0.0343	0.93	0.354	0.0588	1.37	0.173	0.0894	2.24	0.026**
Jan	-0.0375	-0.52	0.602	-0.1091	-1.47	0.146	-0.0162	-0.20	0.841
Feb	-0.2279	-2.83	0.006***	0.0073	0.09	0.926	-0.2325	-2.84	0.006***
Mar	0.0343	0.76	0.451	0.2218	3.88	0.000***	0.0143	0.26	0.794
Apr	-0.0483	-0.76	0.447	-0.0752	-0.94	0.351	0.0039	0.06	0.953
May	0.0496	0.70	0.488	-0.0051	-0.06	0.951	0.1302	1.56	0.122
June	-0.0467	-0.92	0.360	0.0468	0.79	0.429	-0.0131	-0.24	0.809
July	0.0347	0.60	0.553	0.0579	0.86	0.389	0.0587	0.95	0.347
Aug	0.1680	1.90	0.060*	0.0989	0.88	0.382	0.3304	3.20	0.002***

Work in Progress – Do Not Distribute

Sept	-0.0653	-0.83	0.407	-0.1054	-1.60	0.112	-0.0647	-0.79	0.433
Oct	0.0142	0.21	0.833	-0.0502	-0.78	0.437	-0.0453	-0.63	0.528
Nov	-0.0952	-1.36	0.178	-0.0227	-0.31	0.756	-0.0761	-0.97	0.332
Dec	0.0575	1.26	0.212	0.0378	0.63	0.532	0.0334	0.63	0.527
	MSCI_Finland			MSCI_Ireland			MSCI_Norway		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0524	2.87	0.004***	0.0148	0.89	0.376	0.0606	4.05	0.000***
Aut	-0.0595	-1.50	0.134	-0.5272	-1.46	0.146	0.0348	-1.05	0.296
Win	0.0435	1.12	0.263	-0.0138	-0.39	0.698	0.0382	1.20	0.230
Spr	0.1140	3.33	0.001***	0.0379	1.26	0.207	0.1182	4.46	0.000***
Sum	0.0894	2.24	0.026**	0.0602	1.56	0.120	0.0271	0.85	0.399
Jan	0.0398	0.56	0.576	0.0260	0.36	0.718	0.0230	0.42	0.673
Feb	0.0222	0.28	0.779	-0.1251	-1.77	0.081*	-0.0021	-0.03	0.976
Mar	0.1659	3.08	0.003***	0.0546	1.12	0.265	0.1506	4.19	0.000***
Apr	0.0034	0.06	0.956	-0.0353	-0.68	0.501	-0.0012	-0.03	0.974
May	0.0837	1.08	0.283	0.0819	1.38	0.172	0.0428	0.68	0.499
June	-0.0127	-0.22	0.824	-0.0223	-0.41	0.682	0.0165	0.37	0.710
July	0.0607	1.14	0.258	0.0855	1.38	0.170	0.0545	1.16	0.247
Aug	0.1449	1.45	0.149	0.1418	1.59	0.114	0.0212	0.25	0.805
Sept	-0.0593	-0.81	0.421	-0.0360	-0.49	0.625	-0.0959	-1.51	0.133
Oct	-0.1043	-1.65	0.102	-0.0479	-0.80	0.427	-0.0378	-0.67	0.505
Nov	-0.0050	-0.07	0.945	-0.0633	-1.03	0.306	0.1607	0.25	0.805
Dec	0.0381	0.66	0.508	0.0379	0.80	0.426	0.0508	1.06	0.291
	MSCI_Austria			MSCI_Portugal			MSCI_Japan		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0073	0.46	0.646	0.0584	3.12	0.002***	0.0008	0.04	0.970
Aut	-0.0944	-2.36	0.019**	0.0455	1.21	0.228	-0.0018	-0.04	0.968
Win	-0.0109	-0.31	0.754	-0.0132	-0.35	0.728	-0.0769	-1.74	0.084*
Spr	0.0298	1.08	0.279	0.1275	3.63	0.000***	-0.0011	-0.03	0.980
Sum	0.0501	1.45	0.148	-0.0019	-0.05	0.964	0.0777	1.62	0.106
Jan	-0.0214	-0.30	0.761	0.0021	0.03	0.978	-0.0035	-0.04	0.965
Feb	-0.1507	-1.87	0.064*	0.0166	0.22	0.823	-0.2189	-2.36	0.020**
Mar	0.0632	1.43	0.156	0.2089	4.09	0.000***	0.0318	0.43	0.665
Apr	-0.0470	-1.03	0.308	0.0723	0.77	0.442	-0.0942	-1.22	0.227
May	0.0469	0.77	0.446	-0.0927	-1.70	0.093*	0.0679	0.77	0.443
June	0.0198	0.41	0.680	-0.0049	-0.07	0.943	0.1165	1.80	0.074*
July	0.0636	1.20	0.235	-0.0069	-0.11	0.914	-0.0471	-0.62	0.539
Aug	0.0803	0.95	0.344	0.0224	0.24	0.808	0.1635	1.43	0.157
Sept	-0.0850	-1.12	0.263	0.1439	2.20	0.030**	0.0415	0.61	0.544
Oct	-0.0836	-1.31	0.193	-0.0173	-0.29	0.769	0.0665	0.90	0.372
Nov	-0.1101	-1.50	0.136	0.0522	0.69	0.494	-0.1612	-1.69	0.094*
Dec	0.0467	1.03	0.307	-0.0744	-1.39	0.168	-0.0242	-0.38	0.705
	MSCI_Australia			MSCI_New_Zealand			MSCI_South_Korea		
	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|	Coef.	t-Stat	P >|t|
	0.0147	0.79	0.428	0.0643	3.76	0.000***	0.0151	0.99	0.321
Aut	0.0370	0.91	0.365	-0.0185	-0.49	0.624	0.0407	-1.20	0.233
Win	0.0091	0.23	0.819	0.0249	0.65	0.518	0.0316	-1.14	0.257

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Spr	0.0199	0.59	0.557	0.1458	5.00	0.000***	0.0455	1.63	0.105
Sum	-0.0209	-0.52	0.604	-0.0059	-0.15	0.883	0.0557	1.53	0.126
Jan	-0.0361	-0.47	0.636	0.0235	0.35	0.725	0.0046	0.10	0.924
Feb	-0.0328	-0.42	0.673	-0.0240	-0.31	0.757	-0.1558	-2.92	0.004***
Mar	-0.0628	-1.19	0.236	0.1826	4.83	0.000***	-0.0399	-0.89	0.375
Apr	0.1761	2.68	0.009***	0.0404	0.47	0.641	0.0213	0.40	0.693
May	0.0563	0.84	0.402	-0.0112	-0.16	0.873	0.0408	0.61	0.540
June	-0.0582	-1.09	0.280	-0.0045	-0.09	0.932	0.0396	0.84	0.401
July	-0.0386	-0.60	0.550	-0.0770	-1.17	0.244	-0.0079	-0.12	0.903
Aug	0.0888	0.91	0.366	0.0175	0.18	0.859	0.0987	1.15	0.252
Sept	0.0648	0.93	0.355	-0.0295	-0.50	0.619	-0.0195	-0.35	0.728
Oct	-0.0575	-0.88	0.379	-0.0673	-0.95	0.344	-0.0265	-0.45	0.657
Nov	0.1030	1.29	0.201	0.0280	0.40	0.689	-0.0660	-1.03	0.304
Dec	0.0912	1.52	0.132	0.0094	0.16	0.876	0.0657	1.56	0.121
	MSCI_Hong_Kong			MSCI_Israel					
	0.0308	1.63	0.103	0.0257	1.34	0.179			
Aut	-0.0046	-0.12	0.903	-0.0223	-0.57	0.572			
Win	-0.0100	-0.30	0.766	-0.0200	-0.49	0.622			
Spr	0.0699	1.77	0.078*	0.0844	2.41	0.016**			
Sum	0.0486	1.18	0.238	-0.0100	-0.23	0.821			
Jan	-0.0258	-0.42	0.666	-0.0670	-0.99	0.326			
Feb	-0.2213	-2.96	0.004***	-0.0620	-0.72	0.472			
Mar	0.0485	0.77	0.442	0.0878	1.66	0.099*			
Apr	0.0535	0.74	0.463	0.0385	0.52	0.605			
May	0.1336	1.63	0.108	0.1183	1.69	0.094*			
June	0.0534	1.05	0.297	-0.0400	-0.61	0.544			
July	-0.0562	-0.80	0.425	0.0264	0.41	0.675			
Aug	0.1674	1.53	0.129	-0.0348	-0.33	0.741			
Sept	-0.0950	-1.19	0.238	-0.0204	-0.33	0.741			
Oct	-0.0143	-0.21	0.831	-0.0077	-0.11	0.910			
Nov	0.0057	0.09	0.925	-0.0388	-0.52	0.606			
Dec	0.1052	2.30	0.023**	0.0380	0.64	0.525			

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

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Appendix 22: Table 23: Seasonal ARCH, Asymmetric ARCH, and GARCH Models (Daily)

For GARCH estimates, the Akaike Information Criterion (AIC) sets the optimal number of lags. Any optimal lags of 0 will be set at 1 as default to run the GARCH model.

ARCH (Seasonality)			
	Coef.	t-Stat	P >|t|
Winter	-0.0548	-0.59	0.554
Spring	0.4345	4.87	0.000***
Summer	0.1259	1.53	0.127
Constant	-0.2238	-3.13	0.002***
Asymmetric ARCH (Seasonality)			
	Coef.	t-Stat	P >|t|
Winter	-0.0671	-0.71	0.478
Spring	0.4142	4.56	0.000***
Summer	0.1291	1.53	0.127
Constant	-0.2435	-3.35	0.001***
GARCH (Seasonality)			
	Coef.	t-Stat	P >|t|
Winter	-0.0347	-0.52	0.604
Spring	0.3575	4.47	0.000***
Summer	0.0989	1.65	0.099*
Constant	0.4980	5.46	0.000***

*, **, *** denote statistical significance at the 1%, 5%, and 10% level respectively.

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