WORLD GOLD COUNCIL

Gold Investor

Risk management and capital preservation

In this edition:

- Investment commentary: Q4 and full year 2012
- Gold and currencies: hedging foreign-exchange risk
- Tail-risk hedging: an international perspective
- Foreign-reserve diversification for emerging-market central banks

Volume 1, January 2013

About the World Gold Council

The World Gold Council is the market development organisation for the gold industry. Working within the investment, jewellery and technology sectors, as well as engaging with governments and central banks, our purpose is to provide industry leadership, whilst stimulating and sustaining demand for gold.

We develop gold-backed solutions, services and markets based on true market insight. As a result we create structural shifts in demand for gold across key market sectors.

We provide insights into international gold markets, helping people to better understand the wealth preservation qualities of gold and its role in meeting the social and environmental needs of society.

Based in the UK, with operations in India, the Far East, Europe and the US, the World Gold Council is an association whose members comprise the world's leading gold mining companies.

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Foreword

Welcome to this first edition of *Gold Investor*, which provides a selection from the World Gold Council's latest body of research on the increasing relevance of gold as an investment asset. Whether acting as a portfolio diversifier or as a risk management tool, gold's distinctive qualities within a portfolio context are coming to the fore in these times of economic uncertainty.

As we look forward into 2013, while hoping for stronger global economic growth, a few themes remain prominent: a low-interest rate environment stemming from concerted zero interest rate policies (or ZIRP) and expanded central bank balance sheets, stubbornly sluggish Western economies, and elevated sovereign-debt risk. Concern and uncertainty abound with respect to the effectiveness of the current policy mix to address these issues and put the global economy back on a sustainable course. Against this backdrop, demand is growing for high quality, liquid assets that can serve as a foundation for investor portfolios. Gold is one such asset that meets all three of the criteria.

In the prevailing low-interest rate environment, the search for yield is driving investors to look into more aggressive strategies, and some investors have begun to rotate into risk assets – notably equities, emerging markets and alternative assets, including commodities related to the growth cycle. This approach requires the deployment of prudent hedging strategies, as a move into risk assets in the current environment leaves investors exposed. Such a strategy necessitates allocations to assets which offer diversification benefits, hedge currency risk and unexpected market turns. Hedging investments in foreign assets entails a cost, and gold can mitigate certain risks, in particular those related to emerging market currencies. In this edition, we explore some of the benefits gold can provide from a currency-hedging perspective.

We also examine the role of gold for emerging market central banks from a local-currency perspective and look at optimal gold-allocation ranges for foreign reserve portfolios. Currently, these banks own on average approximately 4.6% of foreign reserves in gold, well below the 22% allocation of their developed-market counterparts. A shift towards higher allocations in the future could have significant impact on the long-term demand for gold.

Finally, we examine gold's role in mitigating the impact of tail-risk events – unpredictable events that might be considered unlikely but nonetheless can cause considerable damage to investors' capital when they do occur. The advantages of gold's role in portfolio risk management have, over the past decade, become better understood in Western markets. In Japan, the role of gold in a portfolio context has only recently gained recognition, yet has advanced substantially in the past 18 months. This emerging trend is being driven by the continued weakness of the Japanese economy, deteriorating government fiscal conditions, unfavourable public and corporate pension reforms, growing concern over tail-risk events, regulatory changes in pension management, and the volatile performance of traditional assets. Gold is increasingly being considered by Japanese institutional investors as offering a solution that meets today's needs.

Investors across the globe are concerned about the prospects for sustainable economic growth and the future of our financial and monetary systems. It is imperative that such systems evolve to manage the complexities of an increasingly intertwined global financial market, polarised by debt in the West and rapid growth in the East. In times such as these, gold becomes more and more relevant due to its universally recognised value and unique characteristics as a currency and monetary asset, thus providing a strong foundation to investor portfolios.

Marcus Grubb
Managing Director, Investment

I: Investment commentary: Q4 and full year 2012

This commentary summarises gold's price performance and relevant statistics in various currencies and the macroeconomic factors that influenced gold's behaviour during the fourth quarter and 2012 as a whole. It also discusses likely future developments ahead that will underpin the fundamental drivers of gold in 2013, as well as others that may provide challenges.

Q4 and full year 2012 in summary

- **2012 marked the 12th consecutive year of annual gains.** Despite a weak fourth quarter, gold in US dollars ended 2012 up 8.3% at US$1,657.50/oz on the London PM fix, marking the 12th year of annual gains.
- **Low volatility despite continued uncertainty.** The fall in gold prices in the last quarter came amidst low volatility. Gold in US dollars had an annualised volatility of 11.5%, well below its long-term average of 16% and the third lowest quarterly volatility in the past 10 years, in line with a drop in volatility seen in many other assets classes.
- **Correlations drop on lack of activity and lower systemic risk.** Correlations fell during Q4 2012 as a dearth of macroeconomic events during the quarter left gold's other fundamental drivers and speculative positioning in charge. Gold's correlation to the trade-weighted US dollar, global bonds and equities were all lower than in Q3 2012 and Q4 2011.

Macroeconomic developments likely to influence gold in 2013

- **Global growth – brighter but fragile.** Q4 provided welcome signs of economic recovery in several countries, most notably in the US and China. Yet there are still lingering economic difficulties, which may keep market risks elevated, constrain efforts to reduce sovereign- and private-sector indebtedness, and act as a brake on corporate-sector profit growth. But the role of sentiment should not be underestimated as it could provide an additional boost to economic activity in 2013.
- **Policy normalisation?** Recent releases of positive economic data and some utterances from the Federal Reserve (Fed) have caused some investors to question whether the era of low interest rates and unconventional policy might be drawing to a close. However, while things look less uncertain than during the first half of 2012, the underlying environment suggests a return to normal[1] is some way off in the US, and further still in Europe and Japan.

1 Normal policy is commonly identified as the interest rate determined by a variation of the Taylor rule. However, the Fed regularly refers to its current policy as extraordinary – referring to both the level of policy rates and the use of unconventional quantitative easing.

Macroeconomic events: support and challenges

Over the fourth quarter, gold prices across multiple currencies edged lower. Macroeconomic events were sparse and mixed in their support for gold (see **Chart 1** and **Table 1**), and with year-end approaching, selling pressure dominated.

The re-election of President Obama provided some support for gold apparently securing the continuation of existing Fed monetary-policy programmes – through an extension of Chairman Bernanke's term.

A softening in Indian demand may have been expected by some – though anecdotal evidence suggests otherwise – as the largest gold consumer saw a resumption of currency depreciation (3.7% in the fourth quarter).[2] India's continuing struggle with a trade deficit in 2012 led to regulatory action intended to curb gold imports.

Continued support from central banks' quantitative-easing programmes came in the form of the 12 December statement from the Fed. With the end of "Operation Twist", the Fed's monetary policy committee (FOMC) announced a transition from its yield-curve-adjustment programme to a new round of monetary expansion. This will take the form of straight purchases and continues the Fed's four-year programme of unconventional easing. However, exercising caution, the Fed also announced thresholds for policy normalisation in addition to the existing date-based thresholds. Although this was not the first time markets had to digest the finite nature of unconventional monetary policy, the additional bitter pills precipitated a sharp reactionary rise in longer-term interest rates. These dynamics elicited a mixed response from gold. On one hand, the continued debasement of the US dollar and the longer-term risks of higher inflation played into the hands of some investors. On the other hand, some market participants were concerned that the Fed's more reticent support for open-ended and unlimited support would signal an approaching end of current monetary accommodation – reducing systemic risk and inflation fears.

National elections were held in the world's third largest economy, Japan. The Liberal Democrat Party, led by Shinzo Abe, returned to power with tough rhetoric on the economy and regional diplomatic crises – two themes that provide support for gold via expansion of unconventional policy and a rise in geopolitical tension.

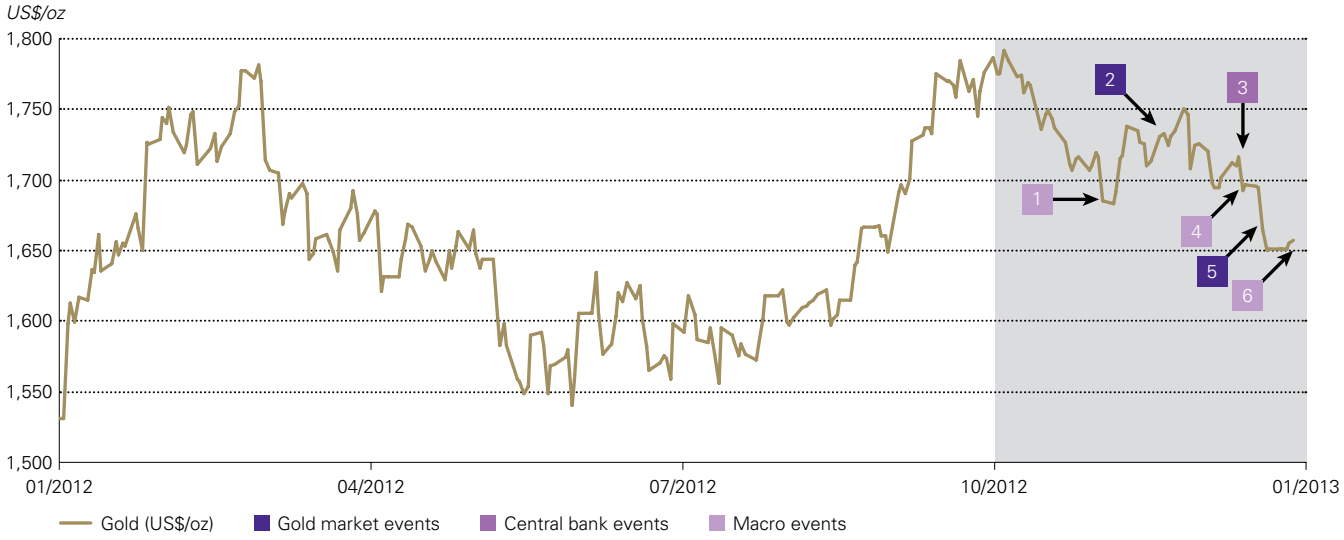
Central banks continued to add to reserves, as announced by the IMF in December, with a surprise resumption of purchases by Brazil's central bank after more than a decade of inactivity. A compilation of central banks' gold transactions can be found at https://www.gold.org/government_affairs/gold_reserves/.

As 2012 drew to a close, uncertainty surrounding the ability of Congress in the US to avert an immediate automatic spending and taxation hit to the economy, also known as the 'fiscal cliff', influenced gold positioning. However, as confidence of a resolution grew – even one that would not address some of the broader problems in the US – investors' minds were eased and flows into equities increased.

2 Please see *Gold Demand Trends,* released in February 2013 for an update on supply and demand trend developments.

Price performance: Gold ends the year on a bittersweet note, but annual performance is reflective of underlying drivers

Chart 1: Gold (US$/oz) performance and key events during Q4 2012



Source: Bloomberg, World Gold Council

Table 1: List of relevant events during Q4 2012

	Date	Event
1	6 November 2012	President Obama wins the US election setting the stage for more government spending
2	19 November 2012	RBI puts forth stricter guidelines on bank financing of gold purchases
3	13 December 2012	FOMC announces larger balance sheet expansion and unemployment linked-interest rate policy
4	16 December 2012	Landslide victory returns Shinzo Abe's Liberal Democrats to power in Japan
5	19 December 2012	IMF announces that Brazil, Russia and the central bank of Iraq purchased gold
6	31 December 2012	In a last minute deal, the US averts automatic spending cuts and tax increases

Source: World Gold Council

In US dollar terms, prices fell during the fourth quarter from US$1,776/oz to US$1,657/oz, a 6.7% drop, reminiscent of Q4 2011. Weakness was seen with regard to other currencies too, from the euro (-9.1%) and pound sterling (-6.7%) to Indian rupee (-3.2%) and Chinese yuan (-7.4%) **(Table 2)**. Gold in Korean won posted a double-digit fall, as the currency – worryingly for exporters – saw a rapid appreciation in the latter half of 2012.[3] At the top end of returns, Japan was the sole gainer, with a sharp currency depreciation courtesy of the new government's initiative, leading to a 3.1% local gold price gain over the period. On average across multiple currencies, gold prices fell 6.2% in the fourth quarter.

Despite price drops in the last quarter, gold prices etched out an 8.3% gain for the year (+6% in euro, +3.2% in pound sterling). This was the 12th consecutive annual gain for gold priced in US dollars – a feat mirrored in Turkish lira, Indonesia rupiah, Thai baht, Vietnamese dong and Egyptian pounds across the currencies that the World Gold Council monitors. Average cross-currency returns posted their 15th consecutive annual gain.

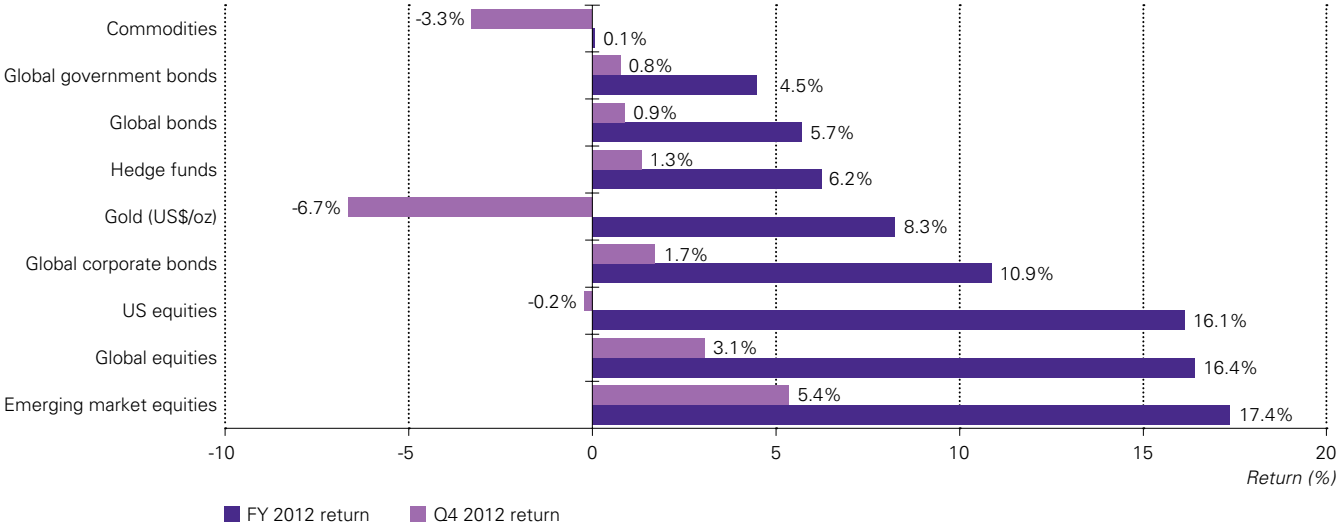
This performance, demonstrating gold's resilience and appeal as a unique asset class, came amidst a range of gains among other assets **(Chart 2)**. For the year, both developed and emerging market equities saw impressive gains (MSCI World: +16.4% and MSCI EM: +17.4%) with better economic data from the US and China and lower financial-sector stress globally.[4] Among alternative assets, commodities as a group performed poorly, with the S&P GSCI total return index gaining just 0.1%, largely as a result of weak demand from China and other emerging consumers for crude products and industrial metals. Hedge funds managed a 6.2% gain – lagging behind broader markets for the fourth year in a row,[5] while global REITs posted a strong 23% return year-on-year supported by continued accommodative policy and tentative strength in US housing. In fixed income, aggregate global bonds etched out a 5.7% gain with unconventional policy and slow growth not only promoting safe government paper, but also riskier high-yield bonds, which enhanced performance. The US dollar, on a broad index basis, remained flat for the year (+0.1%).

3 Korea has been one of the prominent buyers of gold for reserves during the last couple of years as its central bank seeks to diversify foreign security holdings.

4 The Markit Global Banks 5Y CDS Index fell almost 50% in 2012.

5 Hedge Fund Research.

Chart 2: Price performance of various asset classes in 2012*



*Computed in US$ using MSCI equity indices, S&P GSCI commodity, Barclays bond indices and HFR hedge fund index.

Source: Bloomberg, World Gold Council

Table 2: Performance of gold with respect to various currencies

	Gold price			Return				
Currency	30 December 2012	2012 average	Q4 average	QoQ close	QoQ[1] average	Full year return	YoY[2] average	Volatility Q4
US$/oz	1,657.5	1,669.0	1,647.0	-6.7%	2.3%	8.3%	-3.3%	11.8%
€/oz	1,253.6	1,298.4	1,317.9	-9.1%	5.0%	6.0%	9.2%	12.1%
£/oz	1,025.7	1,052.9	1,043.3	-6.7%	2.5%	3.2%	-1.4%	11.7%
¥/gram	4,587.2	4,278.9	4,165.3	3.1%	0.4%	19.9%	-2.0%	13.3%
Yuan/gram	332.2	338.6	336.5	-7.4%	2.7%	6.8%	-4.2%	12.6%
Rupee/10 gram	29,208.2	28,632.7	29,239.8	-3.2%	4.5%	11.9%	16.4%	12.6%

1 QoQ average represents the % change between prices during Q4 2012 and Q3 2012.
2 YoY average represents the % change between prices during Q4 2012 and Q4 2011.

Source: Bloomberg, World Gold Council

Volatility: low levels belie nervous markets

Gold volatility recorded one of its lowest quarterly levels over the last 10 years though this feat was not confined to gold alone. The fourth quarter was a quiet period for most markets. Historical volatility across various assets reached decade lows, with implied volatility not far behind **(Chart 3)**. This finding is somewhat surprising given that uncertainty still appeared to preoccupy investors.[6]

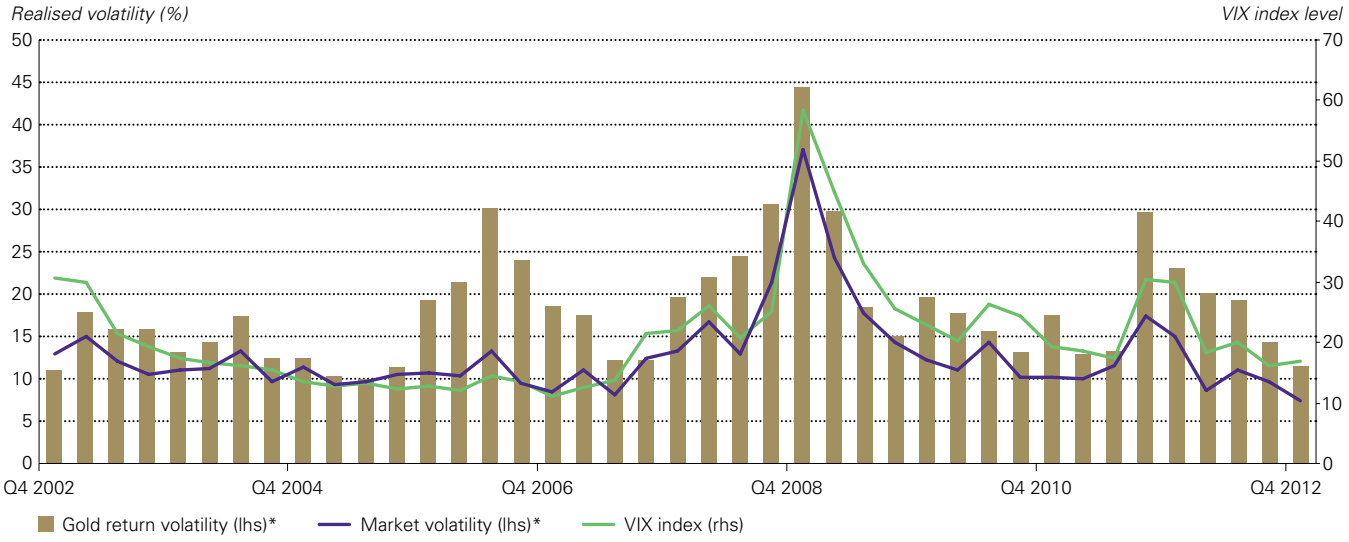
Low market transaction volumes were certainly a contributor, having shifted down year-on-year in 2012 as a whole and in Q4 relative to the rest of the year.[7] Low volumes could have been indicative of investors sidelining decisions until the 'fiscal cliff' deadline had passed. In addition, the combined efforts of the Fed, European Central Bank (ECB) and Bank of Japan (BOJ) to underwrite markets with promises of unlimited monetary support served to quell nervousness, as did the results of the US elections. A record net shorting of volatility futures and options (VIX derivatives) may have reflected this sentiment – that market volatility was now too high given the implicit 'put' provided by central bankers.

Whether this relative market calm persists rests on the outcome of a number of events in 2013.

Correlations fall in Q4 on lower systemic risk

Gold's correlation to other assets fell in Q4 **(Chart 4)**. The low number of macroeconomic developments, the fall in peripheral euro-area yields and the status quo in US politics with the re-election of the Obama administration, likely affected correlation as it had seemingly affected volatility. A lack of market-moving events and new fundamental developments – with the exception of central bank purchases – may have led to investors being more influenced by positioning ahead of the 'fiscal cliff' outcome. Certainly, the correlation between gold and the futures market non-commercial positioning, often representing the more speculative end of investment reached a multi-year high in Q4 **(Chart 5)**. It must be noted, however, that higher correlation between these two series only implies a closer association, not causality.

Chart 3: Market volatilities at multi-year lows



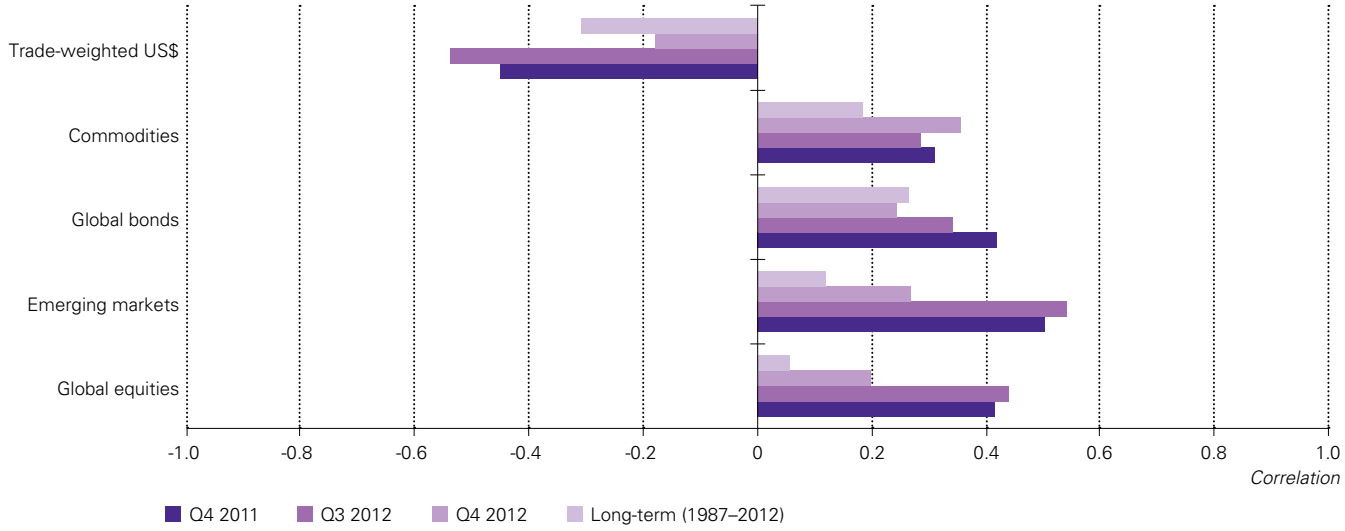
*Volatility = annualised standard deviation of daily returns per calendar quarter. Markets: Global developed market equities, Emerging market equities, Global bonds, Commodities, US broad dollar index.

Source: Bloomberg, World Gold Council

6 *IMF Global Financial Stability Report (GFSR)*, October 2012.

7 Total US market cash equities volumes, Barclays, US brokers, asset managers and exchanges. *2013 Outlook: Working out the funk*, January 2013.

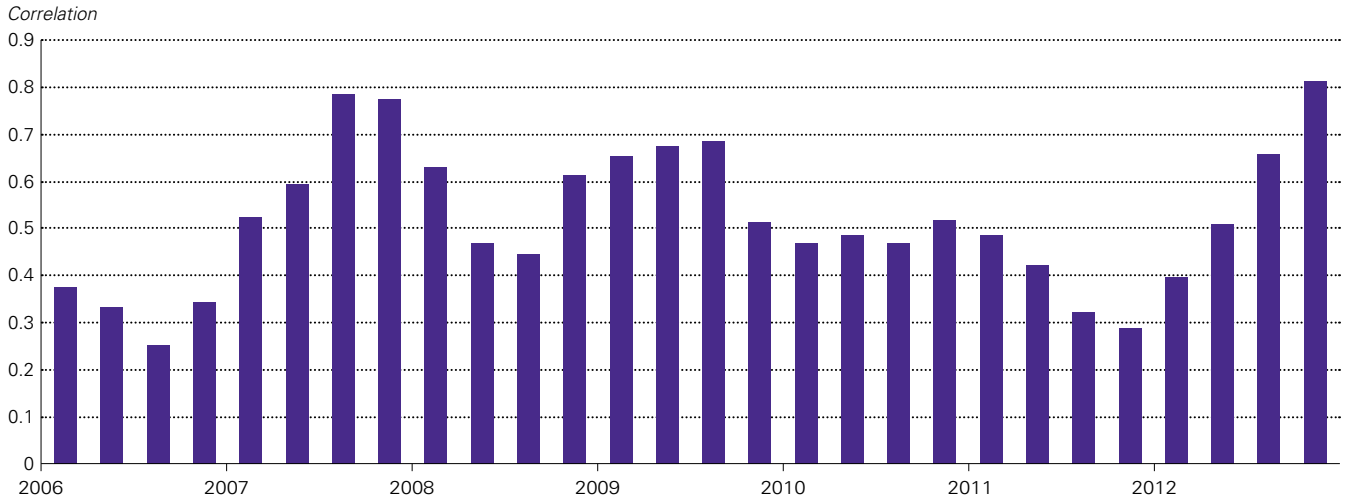
Chart 4: Gold's correlation to global assets*



*Computed using daily returns. Commodities: S&P GSCI commodity index, Global bonds: Barclays Global Treasury Agg, Emerging markets: MSCI EM, Global equities: MSCI World.

Source: Bloomberg, J.P. Morgan, World Gold Council

Chart 5: Correlation between net long futures positions and the gold price*



*52-week rolling correlation between weekly changes in net non-commercial longs as a % of open interest and weekly changes in the gold price, on a calendar-quarter average basis.

Source: Bloomberg, World Gold Council

The interaction of all assets on average – referred to as cross-correlations – dropped sharply in Q4. Elevated cross-correlations assets are sometimes coincident with markets reacting in concert to a small number of factors, perhaps even a single factor – such as a data release or a central-bank announcement. When correlations fall, one would expect asset prices and, by extension, returns, to be influenced more idiosyncratically by their individual fundamentals. As **Chart 6** shows, gold's correlation to other assets was negative during the recession of 2002[8] and the global financial crisis of 2008-2009, while cross-correlations between other assets increased during sell-offs. The period between 2010 and 2013 has witnessed a closer relationship between gold's correlation to assets and their cross-correlations – but this has been a relatively strong period for most asset classes. This highlights gold's unique ability to act as a hedge when higher correlations are caused by market stress rather than generally positive sentiment.

Developments likely to influence gold in 2013

Global growth looks brighter but abundant risks warrant only cautious optimism

- The biggest threat to global growth appears to have dissipated with the preliminary agreement by US Republicans and Democrats in early January to avert an immediate US$600bn in spending cuts and tax increases – which would have shaved almost 5% off GDP in 2013 and pushed the economy back into recession. A combination of a pickup in spending by consumers, investment by firms, and the aversion to public spending cuts, may position the US as one of the brighter economies in 2013. Positive growth, lower consumer uncertainty and greater business visibility all lend themselves to increasing the propensity for discretionary spending – a driver of gold demand in the jewellery and technology sectors, which together account for over 50% of annual gold demand.

  A preliminary agreement on the 'fiscal cliff' may have been reached, but the Houses of Congress still have to agree on details. This includes a likely raising of the federal debt ceiling, a discussion which will now take centre stage in the middle of Q2. Whatever agreements are put in place, the government's fiscal position will remain far from balanced; with an 8.5% deficit and a 4% target, the drop in public sector spending will undoubtedly have an impact on aggregate demand. Deleveraging and deficit reduction will create a negative feedback loop for growth.

- Europe's resilience in 2012 surprised many commentators. A steep fall in peripheral European bond yields in the latter half of 2012 was largely a result of the European Central Bank's promise of 'unlimited' purchases of bonds to secure the euro's future. While the fall in yields has reduced exit and or default fears, it is likely that markets will test whether the ECB is willing to follow up its words with action in the coming year as further peripheral-European funding requirements fall due. In addition, fiscal austerity appears to have had a much greater negative impact on growth than originally expected.[9] Contraction in non-bank credit (decreasing in 8 out of the last 10 months), rising unemployment, falling German production, and poor retail sales continue to point to a regional economy heading the wrong way. While the lit fuse fizzled out in the last quarter of 2012, euro area problems may be set to reignite during 2013. Spain's €100bn funding requirement was argued by some market participants to be too large for the investor base to absorb, in which case funding via Outright Monetary Transactions (OMT)[10] would be necessitated.

- Following the election of a new government, Japan's announcement of a higher inflation target weakened the yen and rallied equities, but had a marginal impact on yields, suggesting some bond-market scepticism. Unlimited quantitative easing with an inflation target of 2% is a bold step for a country battling with deflation, a gross debt ratio more than twice its GDP, a 10% budget deficit, a rising exchange rate and a falling current account balance. An emerging trend of gold investment by a number of pension funds may still be a trickle, but should the country's fiscal credentials deteriorate further and central bank credibility come into question, this could underpin investment demand in 2013 and beyond.

8 The 2001–2002 recession was shallow, slowing global growth to around 2.5% (affected primarily US, Japan and Germany). However slower growth would have been exacerbated by the 9/11 terrorist attacks – likely raising overall market anxiety.

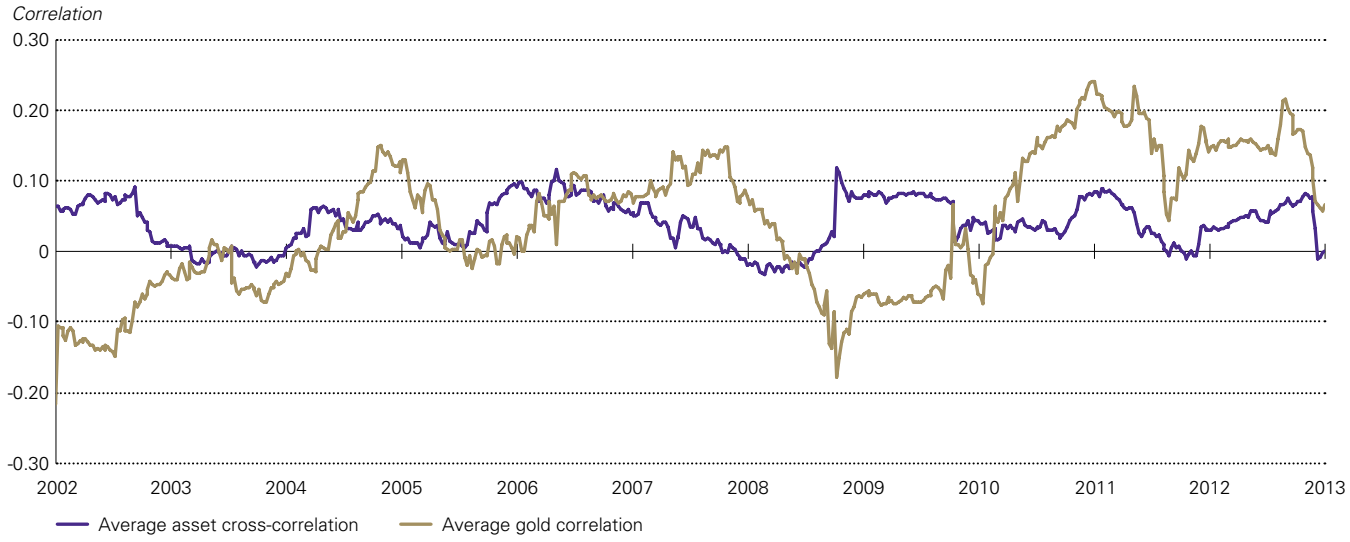
9 http://www.imf.org/external/pubs/ft/wp/2013/wp1301.pdf

10 http://www.bloomberg.com/news/2012-06-09/spain-seeks-125-billion-bailout-as-bank-crisis-worsens.html.

- Despite numerous headwinds, emerging markets, responsible for the majority of physical gold demand are showing signs of improvement. The MSCI Emerging Market Index has continued to perform well through the latter half of 2012. Strong equity market performance indicates investor expectations about prospects but also feeds through to domestic sentiment – creating a positive feedback loop in these economies. The largest of these, China, has seen improvements in a number of areas. Equities, exports and imports, as well as manufacturing and services indices, have been doing well. Resumption of growth appears to be on the cards for China, where the corrosive effects of inflation indicate strong supportive factors for higher gold demand – both for wealth creation and wealth protection.

China's boom appears to coincide with India's gloom. The latter's government still faces hurdles as it attempts to return the economy to stable and manageable growth. Sticky inflation continues to concern the Reserve Bank of India (RBI). Although 'core' inflation, as measured by the non-food manufacturing WPI, has receded from 7% at the beginning of the year, both headline WPI and CPI remain well above the RBI's comfort level. As the government and central bank battle with uncomfortable inflation and lower levels of economic activity, it is likely that investors will remain cautious until signs of uncertainty dissipate. However, currency volatility has been falling since October. Notwithstanding weak growth, a more stable foreign exchange-rate should provide some comfort to gold investors who typically shy away from purchases during periods of elevated rupee volatility.

Chart 6: Average asset cross-correlation and gold's average correlation to assets*



*Average 52-week rolling correlation: Global equities ex US, US equities, Global Treasury bonds, Global corporate bonds, Commodities and US dollar broad trade-weighted index.

Source: Bloomberg, World Gold Council

- Strong global equity market performance, which typically leads and sometimes ignores the state of the underlying economy, may well continue into 2013. An allocation shift by investors from bonds to equities may, at first, appear to disadvantage gold as risk aversion declines. However, general risk aversion does not preclude prudent risk management and portfolio diversification. If investors reduce safe-haven bond exposure, gold may play a larger role in value preservation within portfolios. Recent data shows that margin debt **(Chart 7)** and hedge fund leverage have hit multi-year highs in the US, suggesting that market risk measures may not yet reflect these exposures.[11]

Policy normalisation?

Demand for gold is diverse, both geographically and across sectors. While gold demand in the US is small relative to China and India, US central bank policies exert an important influence on gold investment. As the world's largest economy, the issuer of global benchmark bonds, and the backer of the world's reserve currency, developments in the US have clear global implications. An understanding of US policy is critical, therefore, as it affects many aspects of the global economy.

Investors appears to have grown accustomed to unconventional policy in recent years – as can be seen in negative market reactions to the FOMC meeting announcement on 12 December 2012 and the recent Fed minutes on 3 January 2013. Both emphasised that unconventional policy must have an end, and that end may be desirable sooner than previously anticipated.[12] With growth indicators in reasonable health, in the US at least, investors may be concerned about the prospects of an early end to the low interest-rate environment in the US and the likely impact it will have on gold.

Although recent data may point to a pickup in activity and an improvement in economic health, there are a number of remaining structural issues that are likely to reveal policy normalisation optimism to be just that – optimistic. An end to unconventional policy and a rise in interest rates will need to be very carefully orchestrated and are unlikely to occur for some time.

- The statement on 12 December did not deviate from previous iterations that "a highly accommodative stance of monetary policy (will) remain appropriate for a considerable time after the asset purchase programme ends and the economic recovery strengthens."[13]
- While the US may, at the margin, be closer to unwinding unconventional policy, this appear to be far from the case for the other three major economies to have embarked on a similar path:[14] Europe, UK and Japan. Given that unconventional policy appears to have been conducted in concert to achieve a unified and more global impact, it would seem odd for the US to unilaterally reverse this policy.

  Policy normalisation may be indicative of improving economic health, but is also a double-edged sword as higher interest rates can lead to higher debt-service costs for governments, corporations as well as households – shifting the burden from lender to borrower. It is therefore a transition that will have to be managed with extreme caution – particularly as there is no useful precedent for such a process.
- As detailed in the FOMC meeting in December, the end of quantitative easing – a first step towards normalisation – is conditional upon unemployment and inflation. The threshold for unemployment was set at 6.5% and tolerated inflation at 2.5%. It is uncertain when these targets might be reached.
- Richmond Federal Reserve President Jeffrey Lacker, recently put the timeframe for reaching this target at "up to three years".[15] Employment data (payrolls) surprised to the upside in the US for the better part of H2 2012, yet the recovery in employment remains in its infancy **(Chart 8)** and even more so on the broader measure that includes temporary, discouraged and marginally attached workers (U6). Small businesses (500 or fewer employees) are the lifeblood of employment in the US. The NFIB optimism index, which captures this sector's view about the current and expected environment, remains immutably weak.

11 *Hedge-fund leverage rises to most since 2004 as margin grows*, Bloomberg News, 14 January 2013.

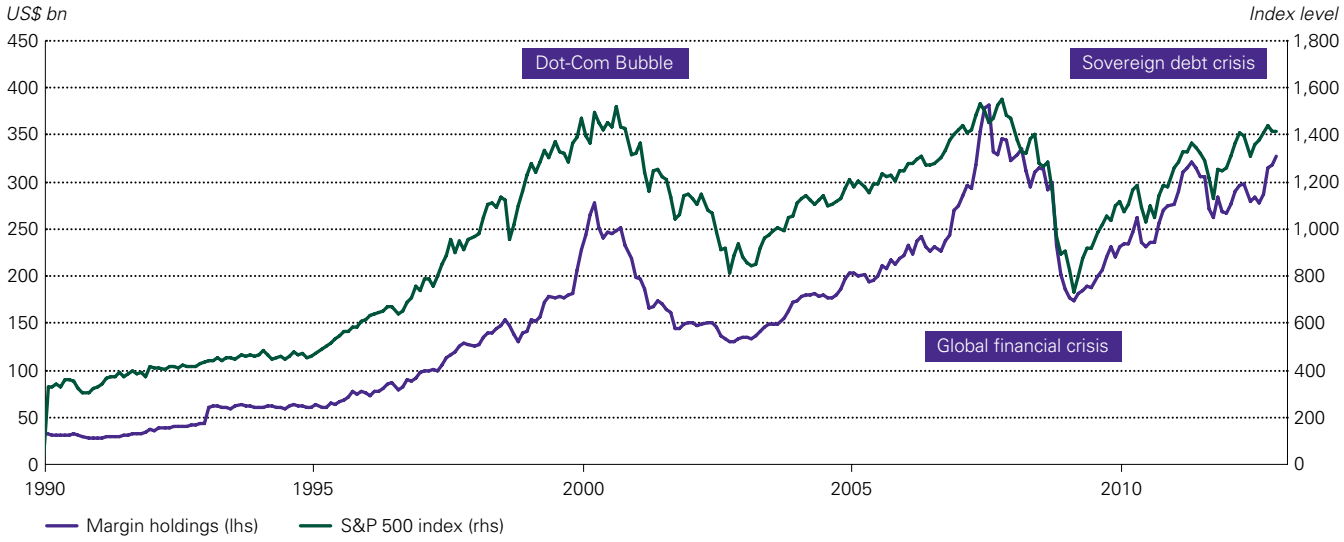
12 It has been noted by some that the more hawkish views from the Fed minutes released 3 January were from outgoing members. Therefore, the late January meeting may better represent the incumbent board's views.

13 http://www.federalreserve.gov/newsevents/press/monetary/20121212a.htm

14 Excluding Switzerland, South Korea and Hong Kong which have also employed unconventional measures to deal with appreciating currencies.

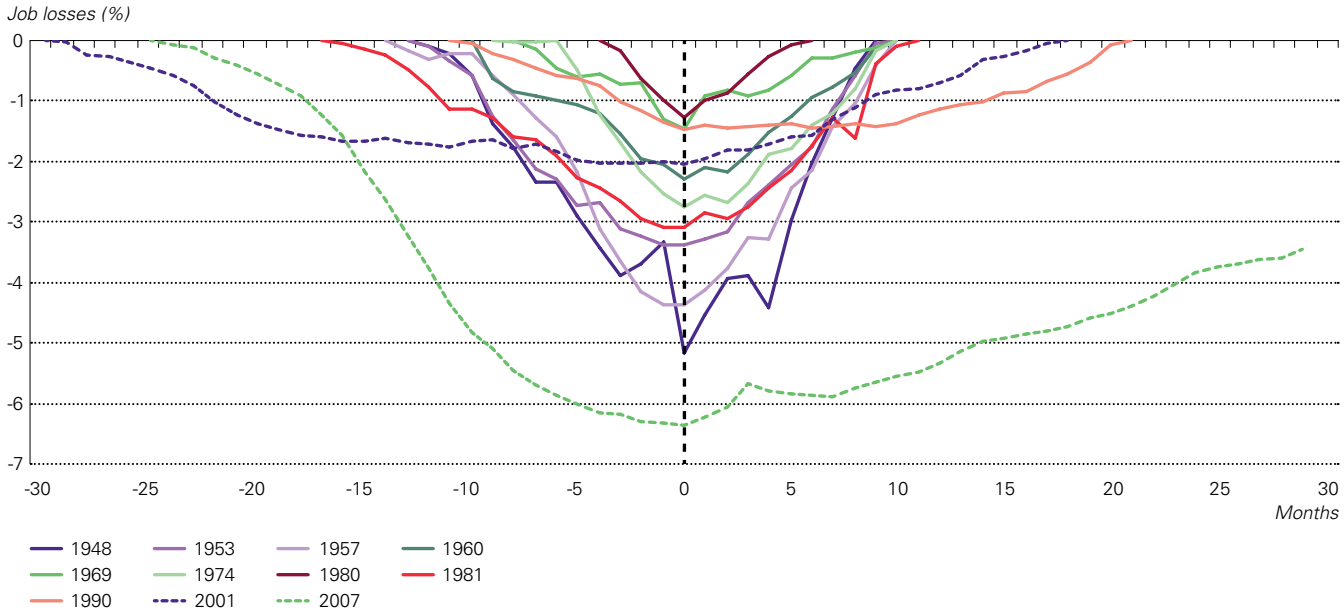
15 http://www.bloomberg.com/news/2012-12-17/fed-s-lacker-says-reaching-6-5-unemployment-may-take-3-years.html

Chart 7: Securities margin balance among NYSE member firms



Source: Bloomberg, World Gold Council

Chart 8: Post WWII US recession job losses (% from peak) and recovery*



*Months aligned at peak of job losses, data to 31 December 2012. Referenced from Businessinsider.com, courtesy of TIS Group.

Source: Bloomberg, World Gold Council

- The Fed's preferred measure of inflation, the Personal Consumption Expenditure price index (PCE), is currently languishing at 1.5%. It has not breached 2% since October 2008, despite extensive easing and high commodity prices. Average hourly earnings, barely off an all-time low, suggest that the inflationary pressure from wages is currently non-existent.
- The markets may digest news of a 'premature' ending to quantitative easing with a rally in the US dollar. A strong dollar will not help the economic recovery, so is likely to be watched carefully by the Fed.

What does this mean for gold?

A premature end to quantitative easing in the US and other developed economies may concern gold investors who invested solely on the notion that such policies are eventually inflationary and low rates are gold-supportive from an opportunity cost perspective. While gold prices are linked to inflation and, by extension, real rates (through the compensation for inflation), the relationship is neither linear nor symmetrical. Furthermore, even though policy-rate normalisation will eventually come to pass, this path must go hand in hand with substantial structural reform and careful withdrawal of monetary stimulus.

Gold will continue to serve as a capital preserver during times of market stress as it tends to perform well when other assets are languishing or when investors are anxious. Its role in this regard will transcend the economic fortune of any one country or region. In the long-term, demand for gold is determined by a globally diverse set of drivers not least of which is economic expansion, as evidenced by the massive demand for gold in emerging-market economies.

II: Gold and currencies: hedging foreign-exchange risk

Executive summary

The case for hedging foreign-exchange rate exposure is empirically and theoretically compelling – yet remains a fringe activity for many investors, especially in the US. With current prospects for domestic equity returns uncertain and bond yields low across most developed economies, the interest among investors in allocating a greater proportion of assets in new markets has been growing. In fact, investors who eschew international investment face not only the prospect of high correlation risk among domestic assets, but also the effect that inflation and/or capital outflows can have in their own currency.

The potential for enhanced returns on investments in a diverse set of international assets is significant, provided risks are managed carefully. For example, emerging markets weathered the global financial crisis of 2008-2009 and its aftermath better than developed countries, and they are likely to form a larger share of most investors' portfolios going forward. However, emerging-market investments go hand in hand with higher risks, particularly those associated with foreign exchange, as emerging-market currencies have historically been affected by periods of extreme volatility. The rationale for managing this risk is clear, but it is a strategy undermined by costs. With interest rate differentials between emerging and developed markets high and unlikely to subside, hedging costs can be a significant drag on returns. This presents investors with a dilemma: how can the risks associated with currency exposure be managed without incurring the higher costs?

Gold has been used as a universally accepted currency throughout history.[1] Because it cannot be debased and it is no one's liability, gold can help investors hedge some of the risks associated with foreign assets, especially in those countries with highly volatile currencies and structurally higher interest rates.

This paper explores the advantages and costs associated with hedging foreign-exchange exposure, and shows that gold can improve the effectiveness of currency-hedging strategies, in particular with emerging-market investments. Gold has a positive correlation to emerging-market growth, a negative correlation to the US dollar (and other developed-market currencies), and has a low investment cost as well as a proven application as a tail-risk hedge. Results show that compared to traditional foreign-exchange hedging, a strategy incorporating gold has distinct advantages. First, it lowers portfolio drawdown risk: adding gold to an unhedged emerging-market investment achieves a lower drawdown than a 100% currency-hedged strategy. Second, a gold overlay has lower costs than traditional emerging-market currency hedges. Consequently, while gold is not a perfect substitute to emerging market currencies, adding gold produces higher risk-adjusted returns than either a fully-hedged or an unhedged foreign-exchange position.

1 For a more detailed discussion of the use of gold as a currency, please refer to Appendix I.

Introduction

The outlook for the global economy remains as uncertain at the start of 2013 as it has been since the onset of global financial crisis. While there are some bright spots in the economic recovery, continued central bank intervention in major markets highlights how economies the world over are in need of ongoing life support. Advanced-country GDP growth is stuttering along at 1.3%, well below the average rate over the last 20 years of 2.2%.2 Real-income growth is stagnant and unemployment remains well above target levels in most major developed economies. It can be argued that it will be difficult to attain the rates of growth seen before the crisis as structural unemployment takes hold, industries undergo upheaval, and most importantly, the ability and willingness to fund growth through debt declines.

As economic growth – the backbone of equity market performance – languishes and bond yields remain near historic lows, the outlook for developed equity and fixed income markets is poor. Earnings growth will be restrained in many countries by low potential growth and fiscal austerity while fixed income faces a skewed risk-return profile. The effect for investors has been an increased need to look beyond traditional markets for income, returns and diversification.

Developing markets have emerged from the crisis in better shape than developed ones, notwithstanding their export dependence and problematic inflation. Nevertheless, the increasing share of the pie represented by these economies means that they will inevitably form a larger share of investors' global portfolios. While prospects in emerging markets are clearly brighter, they are not without risk.

Of the risks that developing markets expose investors to, exchange-rate risk has to be one of the most challenging to manage. Emerging-market currencies have experienced a streak of steady appreciation, but are prone to violent pullbacks. These types of risks can be difficult to manage for investors who are heavily engaged in foreign-exchange markets; they are even more difficult for investors who are not. But these dynamics are not restricted to emerging markets. Currency crises can befall any market and history is littered with them.[3]

Additionally, one consequence of central banks' focus to providing liquidity to the market is the so-called global "capital superabundance" – an elevated ratio of financial assets to real assets. This is likely to create a more volatile environment over the next decade as investors chase yields and overinflate markets that lack breadth, depth and maturity.[4] It is therefore critical that as investors diversify further into new markets, they make risk management a priority.

Hedging foreign-exchange risk is an established activity for corporations, but one that remains relatively neglected by many investors.[5] While not hedging is understandable for investors who wish to take a view on currencies, many investors are not equipped or willing to do so. In fact, research suggests that hedging exchange-rate risk is generally a superior alternative.[6] Foreign-exchange hedging has been proven to lower portfolio risk, especially for volatile currencies and those that are positively related to the business cycle. However, it comes at a cost.

As we examine gold's unique properties as a complement to a foreign-exchange hedging strategy in a portfolio, we concentrate our focus on emerging market equities and assume the perspective of a US investor. However, the conclusions we draw can be adapted to other foreign investments where structurally higher borrowing costs make traditional currency hedging expensive. They can also be extrapolated to the perspective of investors in other developed markets, including the UK and Europe. The rationale for focusing on US investors is that other major currency investment perspectives introduce additional complexities – particularly when including gold, which is typically priced in US dollars. Our focus on emerging markets is not only topical given the recent, current and foreseeable macroeconomic environment, but is also worthy of investors' attention because of the often overlooked issue of hedging costs.[7]

2 Developed world categorised as 'Advanced Economies' by IMF WEO, October 2012.

3 Krugman, P., *A model of balance-of-payments crises,* Journal of Money, Credit and Banking. Vol. 11, No. 3, August 1979; and Eichengreen, B, et al., *Contagious currency crises,* CEPR Discussion Papers 1453, 1996.

4 Bain & Company, *A world awash with money*, 2012.

5 The Survey of Asset and Geographical Allocations by Asset International. www.ai-cio.com revealed that in the US, only 39% of managers hedged their international exposure, compared to 72% for non-US managers. Furthermore, half of managers in all jurisdictions believed exchange-rate exposure to be a 'zero-sum game'. In another survey by Bank of New York Mellon, 47% of respondents deemed execution and settlement costs to be important, but only 33% viewed interest rates and currency rates as key factors. In other words, even among professional investors, there appeared to be a disconnect between perceived cost and actual cost. BNY Mellon, *Currency hedging – Impact of FX risk on the investment process and its effect on performance.* Thought Leadership Series, May 2010.

6 Eun, C.S. and B.G. Resnick, *Exchange rate uncertainty, forward contracts, and international portfolio selection,* The Journal of Finance, Vol. 43, 1988; and Schmittmann, J., *Currency hedging for international portfolios,* IMF Working Papers, Vol., pp. 1-44, June 2010.

7 See Footnote 5 and its reference to a survey by Bank of New York Mellon.

The role of currencies in international portfolio management

Foreign-exchange is a key area of focus within portfolio risk management due to the fact that international allocation as a source of diversification has become a well-established practice – especially after the 1970s and the adoption of modern portfolio theory. But every foreign investment exposes an investor to exchange-rate risk – whether large or small.[8]

In the 1990s, international diversification began to incorporate emerging markets alongside the more traditional developed markets. The trend toward global portfolios led to a drop in domestic equity bias among developed-market investors between 1997 and 2010, from 78% to 48%.[9] From an exchange-rate perspective, allocation to assets denominated outside the major currencies – namely the US dollar, euro, pound sterling, Swiss franc and Japanese yen – albeit still small, doubled between 2002 and 2011.[10] Emerging markets have been beneficiaries of internationalisation over the last decade.

A number of reasons underlie this trend including better growth opportunities, access to new products and new markets, and increased issuance of government and corporate bonds. In addition, the lack of opportunities in developed markets, due to low sovereign and corporate bond yields, lower potential economic growth, downgraded risks from high indebtedness and debt-service ratios, are enhancing the appeal of emerging markets.

The benefits of international investment should be viewed against the backdrop of the risks. In fact, currencies, especially during crises, have the potential to fall sharply over short periods of time. For example, the Brazilian real depreciated by 53% in 2002, converting a 1.5% local equity gain into a 33.7% loss for unhedged US dollar based investors. In 2008, the real fell once more against the US dollar, this time by 33%.

8 This even includes currencies that are officially pegged to the investor's own domestic currency. There is a non-quantifiable politically-derived risk that a peg is adjusted or removed.

9 MSCI Barra, *Global Equity Allocation*, March 2012.

10 IMF CPIS database. Currency allocations outside the majors have grown from an average of 3.4% to 6.5% in the last 10 years for investors from the US, Europe, Switzerland and Japan.

The impact of foreign-exchange exposure

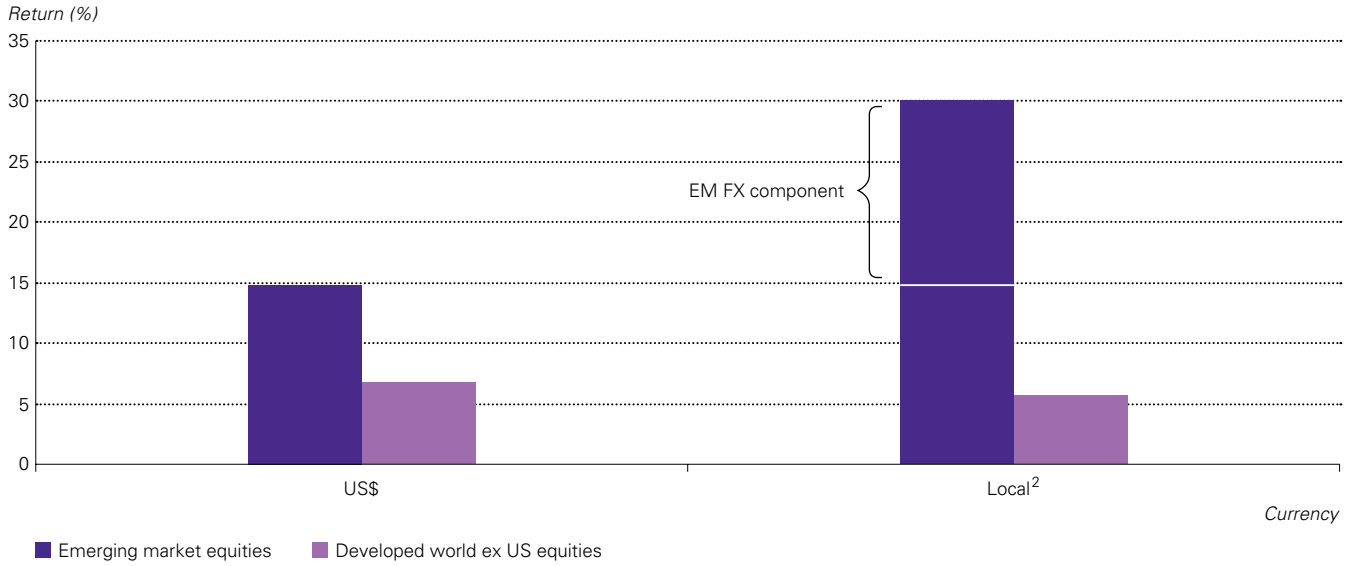
Investors in developed markets take on additional volatility by investing abroad. A growing body of research is supportive of exchange-rate hedging as a superior strategy for most investors. Almost universally, the results show that exchange-rate hedging reduces volatility in global equity and bond markets, with fixed-income assets seeing the most significant reduction.

Chart 1 compares the performance of emerging- and developed-(ex-US) market equities over the past 25 years as seen from a US-dollar and local-currency perspective. The local-currency return represents what domestic investors in each constituent currency area would have earned during the period. The foreign-exchange effect on returns is mixed. A basket of developed market equities in local-currency terms underperformed the same basket in US-dollar terms by approximately 1% per annum, between 1987 and 2012. For emerging markets the opposite effect is visible. The performance of a basket of emerging market stocks in local-currency terms was twice that of the unhedged US-dollar based basket. These results are a natural consequence of a slight depreciation of the US dollar against other major developed currencies, but a more visible appreciation against emerging-market currencies.

However, this stark difference belies a mixed underlying currency story. The 1990s saw a period of exchange-rate upheaval for many emerging markets, particularly those that represent sizeable weights in commonly used indices such as the MSCI EM index, or FTSE EM index. South American defaults and the Asian financial crisis saw sharp falls in regional currencies during the decade. Subsequently, since 2002, a large proportion of those losses have been reclaimed as the emerging-market growth story has played out without any significant currency-led crises. Moreover, it is important to note that foreign investors cannot really achieve local emerging-market returns, as these do not incorporate the costs of hedging, as we will discuss in detail later.

Chart 2 shows volatility performance of the same set of indices over the same time period. For developed and emerging-markets, volatility in local-currency terms was lower. Volatility was reduced by more than one percentage point for emerging-market equities, and by 2.3 percentage points for developed-market (ex-US) equities when hedging the foreign-exchange component from a US-dollar perspective. Incidentally, gold's volatility across currencies is very similar, a by-product of its often overlooked unique correlation structure to other assets and currencies (see Appendix I).

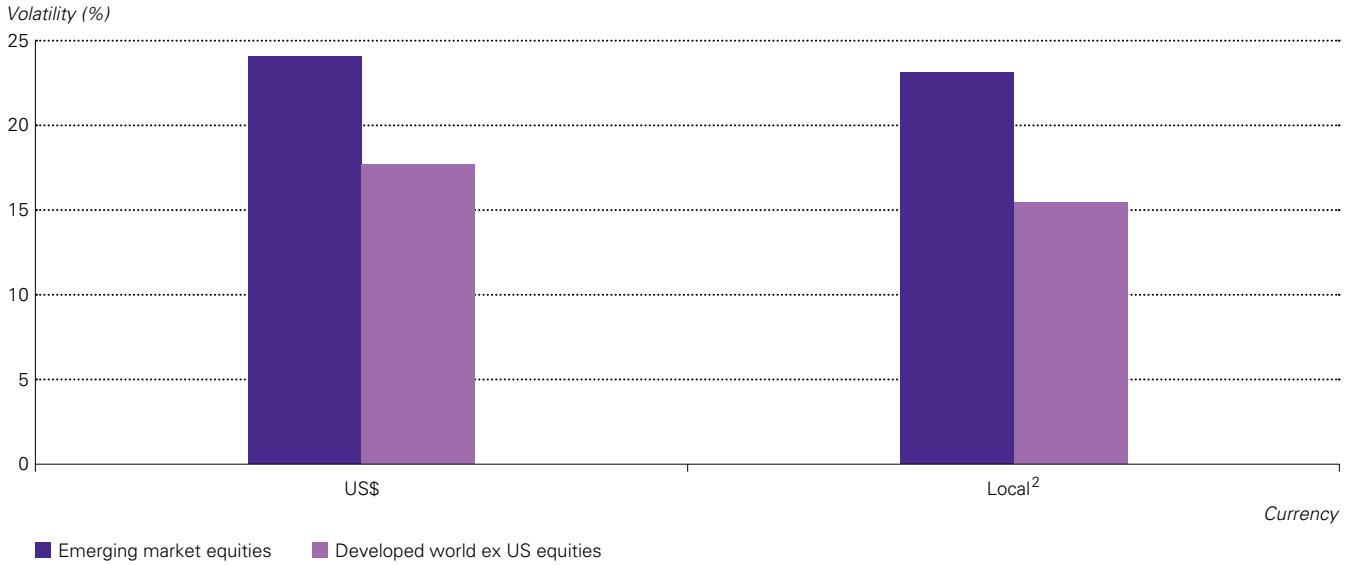
Chart 1: Average annual return of emerging and developed market equities[1]



1 Computed using gross monthly total returns from December 1987 to October 2012. MSCI EM and EAFE indices used.
2 'Local' represents the equity return without any currency-translated gains or losses.

Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

Chart 2: Annual volatility of emerging and developed market equities[1]



1 Computed using gross monthly total returns from December 1987 to October 2012. MSCI EM and EAFE indices used.
2 'Local' represents the equity return without any currency-translated gains or losses.

Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

Finally, exchange-rate hedging tends to improve portfolio diversification by lowering cross-correlations within an investor's portfolio. Lower cross-correlations in the portfolio lead to lower risk at the portfolio level. **Charts 3** and **4** show that exchange-rate-hedged global equity indices have a lower cross-correlation than their unhedged counterparts. This lower cross-correlation stems from the currency components' economic relationship with other assets in the portfolio.

Exchange-rate hedging reduces risks related to cross-correlations among assets. When market-wide selloffs occur, currencies often depreciate in tandem compounding the impact on cross-asset correlations. The removal of foreign-exchange fluctuations leads to lower correlations and better diversification results.

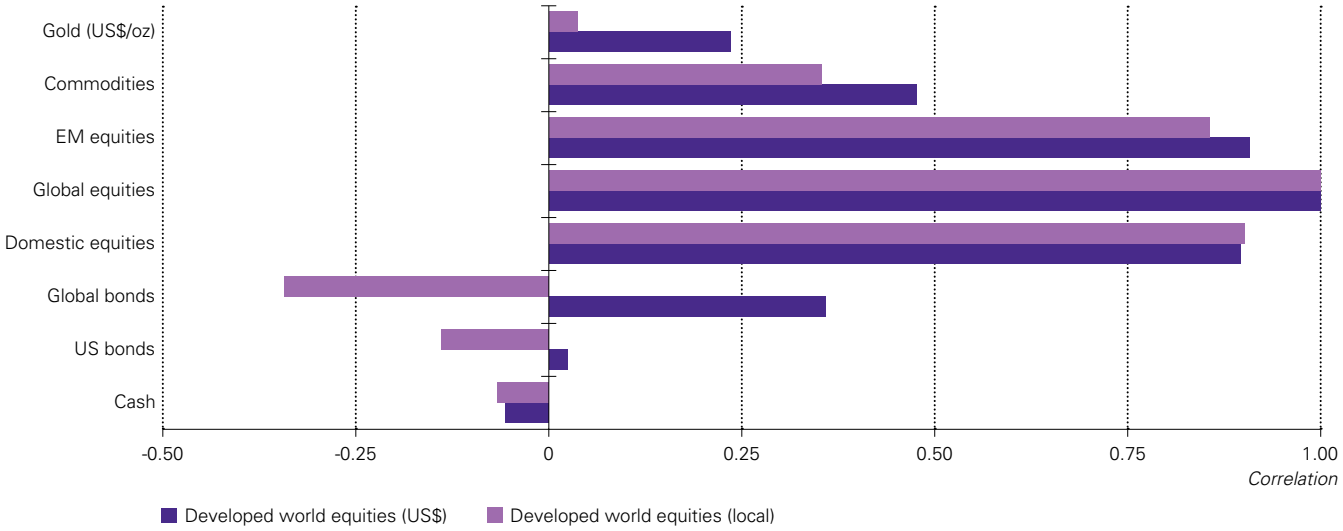
Most importantly, the motivation for exchange-rate hedging comes from increasing expected currency risk in the future. Historical risk, as measured by the average volatility of major currencies, almost doubled during the recent financial crisis and remains well above the pre-crisis average **(Chart 5)**. In addition, investors remain nervous about currency prospects in the major markets: the euro, yen and to perhaps a lesser extent, the US dollar. Indebtedness at record levels and the continued reliance on quantitative easing has added downward pressure on many developed markets. The global imbalances that led to the spike in exchange-rate volatility during the financial crisis remain. Higher quantities of cross-border fund flows in an environment with elevated tail-risk potential are bound to keep exchange-rate volatility elevated in the foreseeable future.

As emerging markets evolve and foreign-exchange intervention loosens, volatility may increase. Furthermore, as discussed in a recent note by Bain & Company, the current global "capital superabundance" increases the occurrence of bubbles in markets that do not have the market depth to cope with such conditions. A withdrawal from these markets would be compounded by exchange-rate falls as capital flowed back to relatively safer developed markets.

Cost of foreign-exchange hedging

The previous analyses omitted a very important detail: cost. While costs are often excluded from historical analysis because they can be difficult to quantify, some costs can have a material impact on performance.[11] In the case of foreign-exchange hedging, the predominant cost arises from interest-rate differentials. To understand how this cost arises, please see Appendix II.

Chart 3: Developed world equity correlation to various assets*

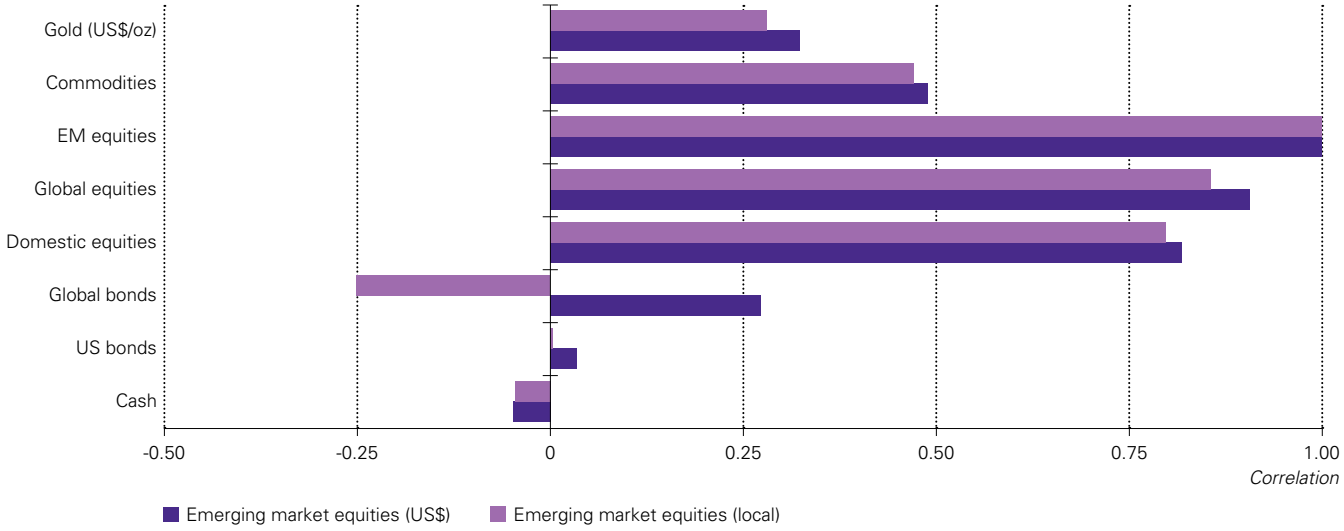


*Please refer to Table 4 in Appendix III for the list of indices used for these assets.

Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

11 There are other more subtle costs to consider as well including margin calls on the overlay. A hedged US dollar based investor, in the case of a US dollar rise, sees no mark-to-market FX impact on international positions, but will have to service the loss on the hedge. There is therefore a cash flow impact. This occurs whenever the duration of the hedge does not match the holding period of the asset under consideration. In addition, tracking error and re-balancing leaves investors either over- or under-hedged depending on the return on the underlying asset. This discrepancy represents an inefficiency cost. Finally, transactions costs such as trading fees and bid ask spreads can compound if the portfolio is rebalanced frequently. A higher rebalancing frequency mitigates the inefficiencies of hedging but increase transaction costs. These costs apply to any hedge.

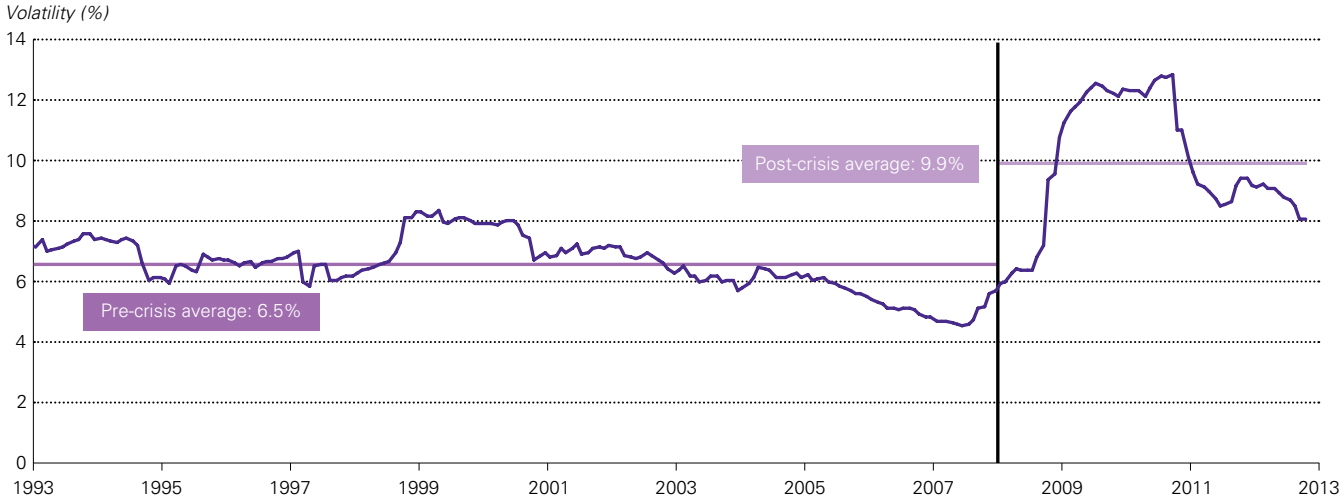
Chart 4: Emerging market equity correlation to various assets*



*Please refer to Table 4 in Appendix III for the list of indices used for these assets.

Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

Chart 5: Rolling trade-weighted currency volatility*



*Computed as the average of major trade-weighted currency index using 24-month rolling annualised standard deviation: US dollar, yen, pound sterling, Canadian dollar, euro, Australian dollar.

Source: Bank of England, World Gold Council

Emerging-market investment incurs particularly hefty costs. This is due to structurally higher interest rates in emerging markets.[12] The current environment also accentuates this cost as developed market rates are exceptionally low. The differential between the two exerts strong downward pressure on hedged returns. For example, as of 31 December 2012, an investor wishing to hedge Indian rupee/US dollar exchange-rate risk would have to commit to paying approximately 5% over the following year. In other words, if an Indian equity investment generates 11% over the coming year, around half of the return will be wiped away if the investor hedges the exchange-rate risk. On the other hand, the decision not to hedge exposes the investor to other unforeseen risks to the currency. The Indian rupee, as an example, has depreciated by approximately 20% between July 2011 and December 2012 on the back of a high current account deficit and capital outflows.

It is critical to note that our definition of developed markets throughout this discussion of interest-rate differentials encompasses the four major currencies: US dollar, Japanese yen, pound sterling and euro. However, it is conceivable that other developed market currencies could face periods of structurally high interest-rate differentials and be subject to dynamics similar to those of emerging markets.

Chart 6 shows the costs of hedging for various developed- and emerging-market currencies as of 31 December 2012 from a US investor perspective. While hedging the Indian rupee incurs one of the highest costs, many other countries have costs in excess of 1% per annum. **Chart 7** details the historical cost of currency-hedging a constructed proxy for the MSCI Emerging Markets equity index. Calculations show that an investor would have paid, on average, almost 6% per annum to hedge the currency exposure of this emerging-markets basket for the past two decades.

As a result of the costs of hedging, many of the returns in local emerging-market currencies illustrated above are unachievable for foreign investors. **Table 1** shows the returns on emerging-market and global-equity assets using unhedged, hedged and local-currency indices. Results show that currency-hedged returns have been lower for emerging markets but higher for developed markets over the 1987–2012 period. For example, for a US investor, a currency-hedged developed equity index generated an additional 0.5% return per year over the return on the local index. For an emerging-markets equity index, the annual return on a currency-hedged position was 6.4% lower than the local index.

Thus, a common sentiment is that hedging foreign-exchange risk undermines the very reason for holding emerging-market assets. The persistent higher real yields in emerging markets drive up their currencies, but hedging exchange-rate risk of a high-yielding country reduces gains due to the relative cost of borrowing in the foreign currency. It is precisely this dilemma that highlights the case for gold as an effective complement to emerging-market investments. As will be discussed in the next section, the depth and stability of the gold market ensures low transaction and carry costs while also offering many of the benefits of hedging currency exposure including reduced volatility. Gold can thus diversify currency risk while keeping costs down, and reduce volatility without increasing the opportunity cost incurred by hedging.

Table 1: Performance of global equity indices in unhedged, hedged and local terms*

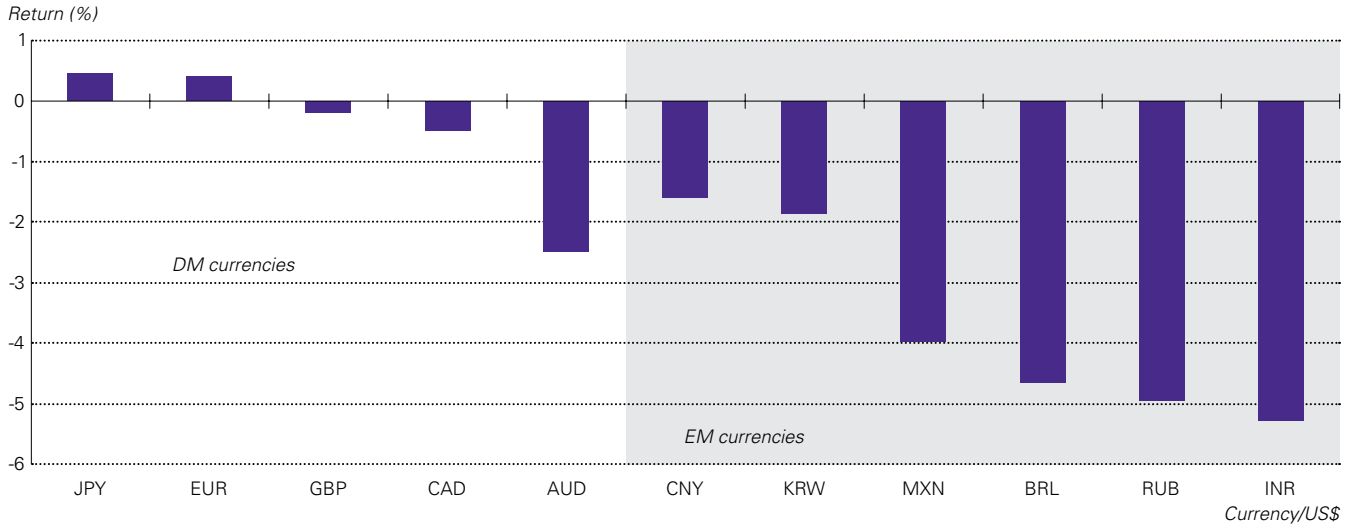
		Annual return			Annualised volatility		
Country	Asset	Unhedged	Hedged	Local	Unhedged	Hedged	Local
US	MSCI World ex US	4.6%	4.0%	3.5%	17.5%	15.2%	15.1%
US	MSCI Emerging markets	14.9%	23.7%	30.1%	24.1%	23.1%	23.1%
Europe	MSCI World	6.0%	6.2%	5.4%	15.7%	17.3%	14.3%
Europe	MSCI Emerging markets	15.1%	24.2%	30.1%	24.8%	24.9%	23.1%
UK	MSCI World ex UK	6.6%	7.5%	5.4%	15.9%	14.6%	14.5%
UK	MSCI Emerging markets	15.7%	24.7%	30.1%	24.9%	24.8%	23.1%

*MSCI Emerging Markets used for the emerging-market equities for all three countries. MSCI World ex US, MSCI World and MSCI World ex UK were used for US, Europe and UK respectively. Due to the lack of an MSCI World ex Europe hedged index, MSCI World was used as a proxy. Due to data availability, MSCI EM Gross Total Return (TR) was used for the unhedged calculation, while a portion of the currency-hedged index provided by MSCI is calculated using a Net TR methodology. Index levels, not total returns, were used for developed-world equities. Monthly returns from December 1987 to October 2012 was considered to compute annualised returns and volatilities.

Source: Bloomberg, World Gold Council

12 Emerging markets experience higher structural levels of interest rates due to higher natural inflation rates, stronger growth and economic inefficiencies.

Chart 6: The expected loss from hedging FX risk for 1 year*



*The expected loss is the percent difference between the spot rate and the 1-year forward rate as indicated by futures contracts or non-deliverable forwards.

Source: Bloomberg, World Gold Council

Chart 7: Estimated annualised cost of hedging currency exposure in an emerging-markets equity index*

*Cost is computed by multiplying a constructed proxy for the MSCI Emerging Markets Index respective country weights by the corresponding interest-rate differentials. Please see Appendix II for methodology. Computations are made from a US$ perspective, but results are similar for euro and pound sterling investors given the relatively similar domestic interest-rate environments investors have experienced.

Source: Bloomberg, Global Financial Data, Thomson Reuters, World Gold Council

The case for gold as a foreign-exchange hedge

Investors in developed markets are increasing their allocation to emerging markets, motivated by the prospects of higher returns and portfolio-diversification benefits. In this context, foreign-exchange hedging is an important strategy. However, it comes at a substantially high cost to investors. Furthermore, as **Table 2** shows, analysts strongly believe that emerging-market currencies will appreciate over the next few years due to higher rates of income growth, increased investment and higher real interest rates – a scenario which may undermine the case for hedging exchange rate risk.

Investors consequently face a dilemma. The impact of exchange-rate hedging, as proven historically, might not be as relevant or clearly beneficial in the future. The marginal decrease in volatility, weighed against potentially large losses in returns, may not be attractive to all investors. However, having no currency hedges in place exposes the investor to harmful currency swings and tail-risk events in emerging markets.

Gold offers a potential solution to these issues. Gold exhibits a number of characteristics that allow investors to hedge part of the currency-related risk while reducing costs, adding diversification and protecting against tail risks. These include gold's positive correlation to emerging markets' growth, its negative relationship with the US dollar and other developed market currencies, its low correlation to most developed-market assets and its ability to protect against tail-risk events. Consequently, investors can benefit from including gold in their portfolios as part of their currency-hedging strategy for emerging-market investments.

Gold's economic relation to emerging markets growth

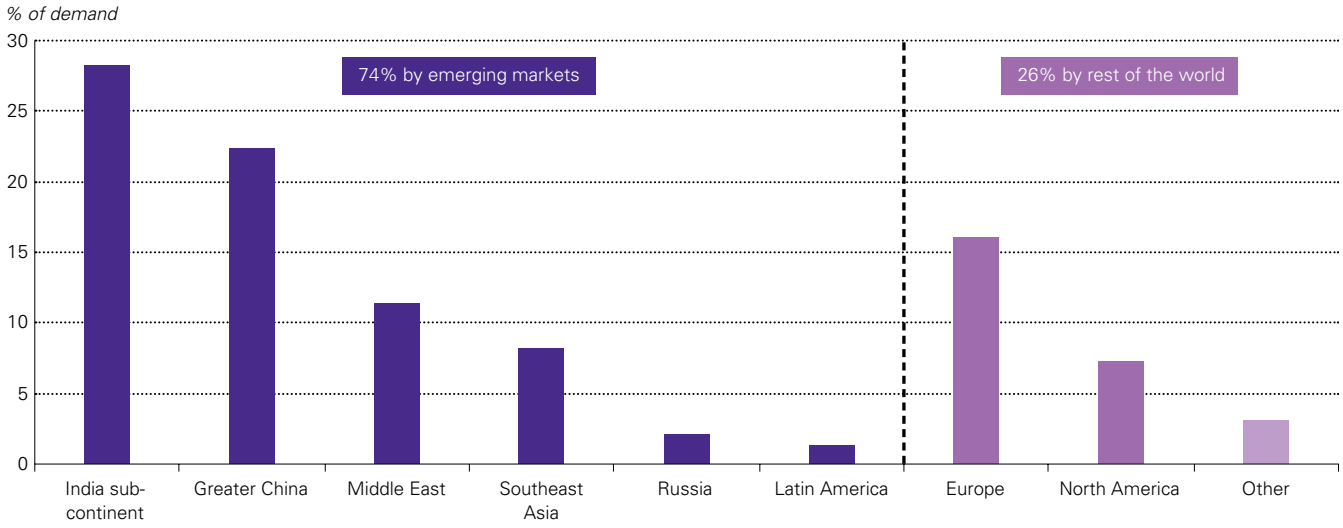
An important part of the rationale for using gold as a solution to foreign-exchange risk hedging is the increasing relevance of emerging markets in the gold market, particularly over the past 12 years. In fact, the correlation between gold and emerging-market equities is significantly higher than that of gold and developed-market equities. For example, in the period between 2001 and 2012, gold had a correlation of 0.28 to emerging-market equities in US dollar terms (compared to a much smaller 0.11 correlation to developed-market equities).

This should not come as a surprise to those familiar with gold-market fundamentals. Countries like India, China, Turkey, Vietnam and the entire Southeast Asia region have a cultural affinity to gold.[13] Physical gold demand coming from developing countries has contributed to over 60% of annual demand since 2000 and represented more than 70% of global demand in 2011 **(Chart 8)**.[14]

13 A detailed analysis of gold demand in these countries can be found in the following World Gold Council reports: *India: heart of gold*, May 2011; *China gold report: The year of the tiger*, April 2010; *Gold Demand Trends Q2 2011*; *Gold Demand Trends Q1 2012*; and *Gold Demand Trends Q2 2012*.

14 Source: Thomson Reuters GFMS

Chart 8: Regional distribution of gold demand in 2011*



*Gold demand includes bar and coin, jewellery and ETFs. Middle East includes Turkey. Other category aggregates country demand for which no individual country data is available.

Source: Thomson Reuters GFMS, World Gold Council

Table 2: Analysts' median forecast of currency returns between now and 2015*

Currency	Q1'13	Q2'13	Q3'13	Q4'13	Q4'14	Q4'15
Brazilian real	↓	↑	↑	↑	↓	↓
Chinese renminbi	↑	↑	↑	↑	↑	↑
Russian rouble	↓	↓	↓	↓	↓	↓
Indian rupee	↑	↑	↑	↑	↑	↑
Korean won	↓	↑	↑	↑	↑	↑
Mexican peso	↑	↑	↑	↑	↑	↑
Taiwanese dollar	↑	↑	↑	↑	↑	↑

*Up arrows denotes an appreciation in the currency, down arrows denotes a depreciating currency. Bloomberg composite takes the median of analyst estimate of future exchange rates.

Source: Bloomberg, World Gold Council

Furthermore, structural changes experienced by all developing economies coupled with a robust financial, economic and social expansion will likely provide a consistent source of gold demand in years to come. The combination of population and disposable income growth will likely lead to direct gold purchases in the form of jewellery and investment, and indirectly via electronic goods, many of which contain gold components **(Chart 9)**. Further, an increase in commodity prices stemming from emerging-market demand can lead to higher local inflation rates. In turn, higher inflation may then lead to gold purchases as a result of inflation-hedging activities. Providing additional support are emerging-market central banks that are likely expand their foreign reserves and, as they look to diversify, continue to acquire gold as they have done over the past five years.

Gold's negative correlation to the US dollar

While the strength of the relationship between gold and the US dollar – measured against a trade-weighted basket of other currencies – has fluctuated over time, it has remained persistently negative in the longer term. At times the relationship is complicated by periods where the US dollar and gold move in the same direction, often driven by a flight of capital to quality assets. However, barring the effect of gold's uses beyond a store of value, gold functions like any other currency.

The relationship between the US dollar and gold has been well documented. In particular, a World Gold Council commissioned study found a consistently negative correlation between gold and the US dollar over various time periods.[15] Put simply, depreciation in the US dollar against a basket of currencies typically translates into higher gold prices. However, this relationship can be extended to the other major developed-market currency baskets and could become increasingly apparent if the US dollar's main trading currency status were to diminish. When the value of a major currency falls against other currencies, gold prices in that particular major currency are consequently boosted by its depreciation.[16]

Chart 10 highlights the persistence of the negative correlation between returns on various trade-weighted currency indices and returns on gold in that currency. Correlations over the whole period are negative. For the 12-month rolling window charted, positive correlations occur less than 10% of the time.

Gold's negative correlation to developed-market currencies, not just the US dollar, provides part of the investment rationale for those concerned with weaknesses inherent in the global monetary system.

Gold's conditional correlation protects against extreme moves

As has been shown in previous research, gold's capital preservation qualities come to the fore during extreme events.[17] Its low correlation to traditional risky assets such as equities and commodities forms part of its 'foundation asset' credentials. However, the negative correlation gold has with risky assets during extreme market moves[18] further enhances its status as a capital preserver.

Currency drawdown risk, or losses generated by peak-to-trough declines in the underlying currency, is thus a key issue facing emerging-market investments. Historically, many emerging-market economies have battled with weak currencies as a result of high inflation stemming from the imports of commodities and durable goods priced in western currencies. As has been seen during a number of episodes over the past two decades, emerging markets are prone to crisis. In fact, during the past 25 years, emerging-market currencies fell by more than two standard deviations (or 3.6%) slightly over 3% of the time, as measured by monthly returns. In 1.3% of the instances, the drop was greater than three standard deviations (or 5.4%) while the worst monthly return saw emerging-market currencies shed 8.2%. In other words, while such events do not seem frequent, they occur more often than would be expected from a 'normal' distribution, and tend to be fairly severe. These results are particularly disconcerting given that currency is only part of the risk associated with emerging-market investing.

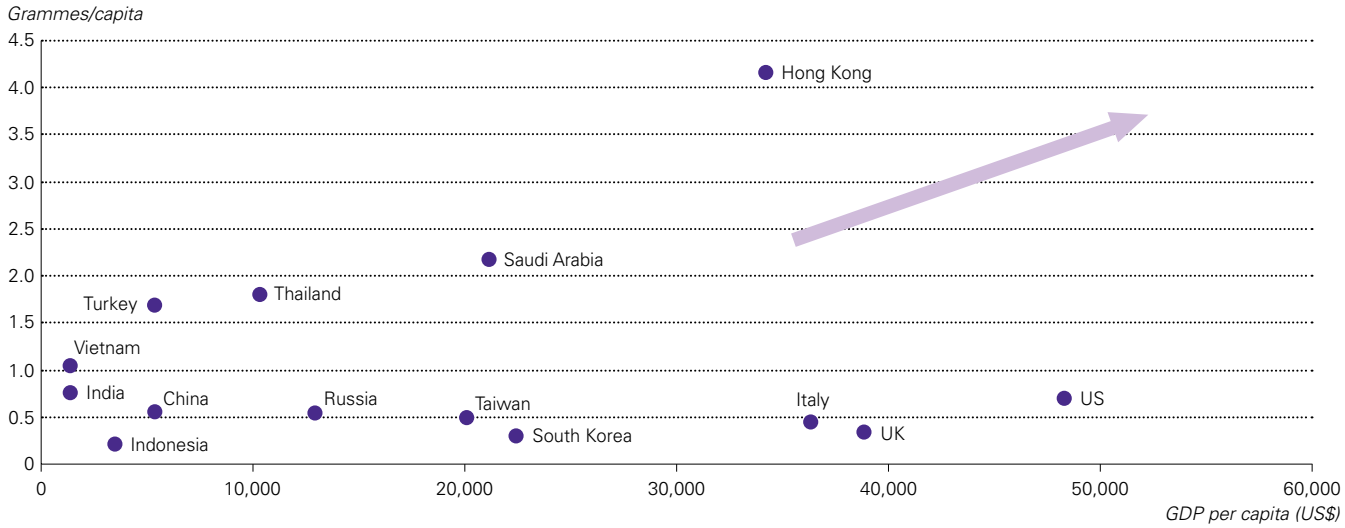
15 Capie, F., Mills, T., Wood, G., *Gold as a hedge against the US dollar*, September 2004. https://www.gold.org/download/get/rs_archive/rs_30.pdf

16 O'Connor and Lucey (2012) *Gold's negative relationship with the US dollar*, The Alchemist, Issue 66.

17 http://www.gold.org/download/rs_archive/WOR5963_Gold_Hedging_against_tail_risk.pdf

18 Measured as a low probability (2+ standard deviation) move in the market.

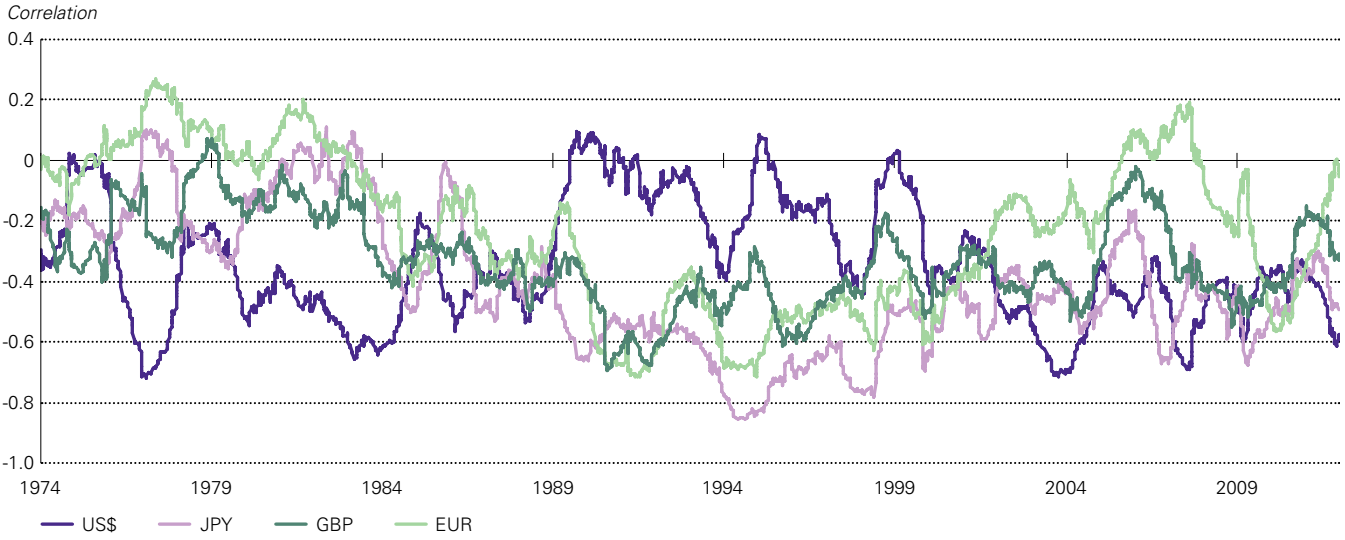
Chart 9: Gold consumption per capita of various countries in 2011*



*Gold demand includes bar and coin, jewellery and ETF demand but excludes central bank purchases and technology.

Source: IMF WEO, Thomson Reuters GFMS, World Gold Council

Chart 10: Gold's negative correlation with major trade-weighted currency baskets*



*Daily return data from December 1974 through October 2012 used for this computation.

Source: Bank of England, Thomson Reuter GFMS, World Gold Council

For example, the Mexican peso crisis of 1994 was sparked by a failed currency-management strategy that resulted in the sudden devaluation of the Mexican currency and the subsequent debt-driven crisis. The Asian financial crisis in 1997 was in part driven by the Thai government's failure to support the Thai baht/US dollar-pegged exchange rate after the government had issued large amounts of debt. Destabilisation in Asia later evolved into the Russian financial crisis of 1998. Additionally, Argentina's crisis in 2001, after the government was forced to relinquish their US-dollar peg, is another example of the currency-related tail-risk events faced by investors. **Chart 11** provides the performance of emerging-market equities in local (hedged) and US-dollar (unhedged) terms alongside gold's performance during these tail events, as well as the effect the recent global financial crisis had on emerging markets.

While most of these crises started in a particular country and were linked to its currency, they later spread to others, negatively impacting the benchmark 20-country emerging-market equity index. For example, the Asian and subsequent Russian financial crises of 1997 and 1998 shaved 25% off the emerging-markets index during their respective periods. Investors hedging their currency exposure would have reduced some of the losses but would not have completely eliminated them as the crises led to steep selloffs in equity markets. Gold on the other hand, outperformed versus emerging-market equities and, with the exception of the Asian financial crisis of 1997, saw gains during all these periods. As crises hit, the local economic effects are compounded by withdrawal of developed-market investment back to safer but lower yielding markets, as seen during the recent financial crisis in 2008-2009. Consequently, systemic effects of currency devaluations led to flight-to-quality outflows that benefitted gold.

Some of these emerging market-led crises were relatively well contained, with little long-term effects on the developed world. However, in the early 1990s, emerging markets represented just 20% of global GDP, a figure that has risen to 45% today and is expected to surpass 50% by the middle of this decade.[19] What may have been regionally contained crises in the past are more likely to have global implications in the future.

An important consequence of adding a gold overlay to an emerging-market investment is a lower drawdown on the investment. As **Chart 12** shows, gold-hedged emerging-market equity exposure dramatically decreased portfolio drawdown (peak-to-trough declines) during the period from 2002 to 2012. This was particularly evident during the global credit crisis of 2008-2009 and the subsequent European sovereign-debt crises, which began in 2011.[20] Adding a 50% gold overlay to a partly-hedged emerging-market-equities position achieves a lower drawdown than a 100% exchange-rate-hedged emerging-market investment.[21] Similarly, as **Chart 12** shows, the average pullback on a 50/50 gold/currency-hedged position at 9.2% was lower than both a fully currency-hedged and fully-unhedged emerging markets' position.

The cost advantage of gold as a foreign-exchange hedge

As discussed in the previous section, the costs of foreign-exchange hedging using currencies with higher rate differentials and less liquidity can exert a considerable drag on returns. In contrast, gold allocations and overlays can be implemented in rather simple and cost effective ways. For example, the cost of vaulting allocated physical gold ranges from 5-15 basis points while the cost of owning an ETF ranges from 15-50 basis points, a fraction of the cost of hedging emerging-market currencies.

The gold market is extremely liquid. With an estimated average trading volume of US$240bn per day,[22] it not only ranks fourth relative to major currency pairs behind the US dollar/euro, US dollar/yen and US dollar/pound sterling, but dwarfs any other non-US dollar cross currency pairs, surpassing all emerging-market currencies combined.[23]

The funds needed to implement a gold overlay can be obtained at the prevailing interest rate of the investor's home country, thus eliminating the additional costs created by rate differentials.

19 Economist Intelligence Unit, *Brave New World*. 2012.

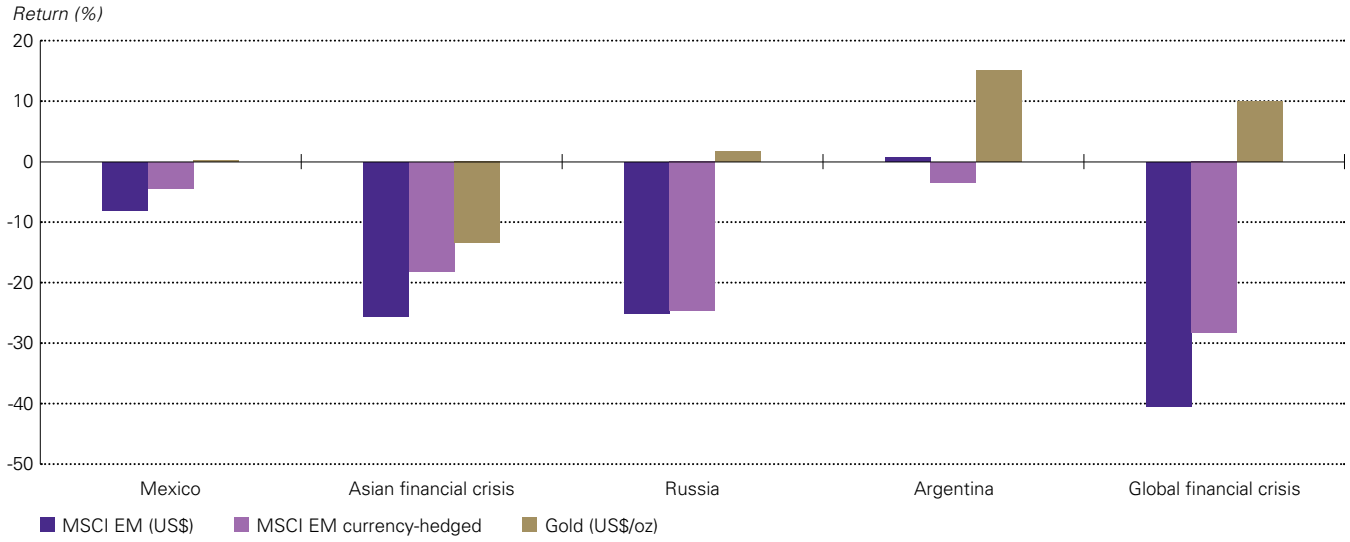
20 We restrict our analysis to emerging-market equities. While capital markets have expanded both for equities, credit and sovereign debt, the latter markets remain small in relation to developed markets. In fact, emerging-market corporate and sovereign debt is about ten times smaller than that of developed markets as discussed by the Mckinsey Global Institute in their *Mapping capital markets 2011* report.

21 The 50% hedge ratio was used as it is a common approach for investors (FT, Hyman Robertson, State Street Global Advisors). While there is a good amount of literature on hedging ratios, many of them disagree to a large extent and optimal ratios can be time dependent (Black, 1989a).

22 London Bullion Market Association, *LBMA gold turnover survey for Q1 2011*, The Alchemist, August 2011.

23 Bank of International Settlements,*Triennial Central Bank Survey: Report on global foreign-exchange market activity in 2010*, December 2010.

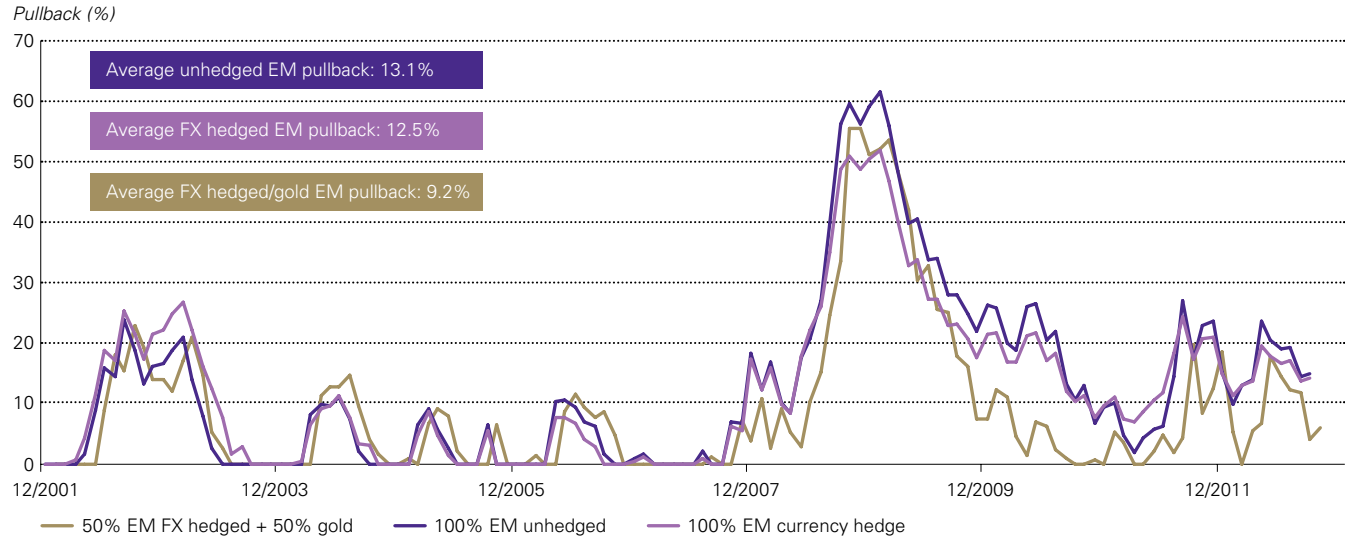
Chart 11: Performance of emerging-market equities and gold during tail events*



*Mexico (1994): November 1994 – December 1994, Asian financial crisis (1997): June 1997 – December 1997, Russia (1998): July 1998 – September 1998, Argentina (2002): December 2001 – June 2002, Global financial crisis (2008): August 2008 – March 2009

Source: Bloomberg, Thomson Reuters, World Gold Council

Chart 12: Drawdown of unhedged, currency-hedged and gold-hedged EM indices*



*The 50% EM FX hedged + 50% gold drawdown analysis assumes that gold is an overlayed position.

Source: Bloomberg, World Gold Council

Portfolio impact of hedging exchange-rate risk and using gold

As we have seen, there is a compelling case for gold to complement a currency hedge on foreign investments, particularly emerging-market equities. However, the broader effects of a gold allocation can only be analysed in the context of other assets held by investors.

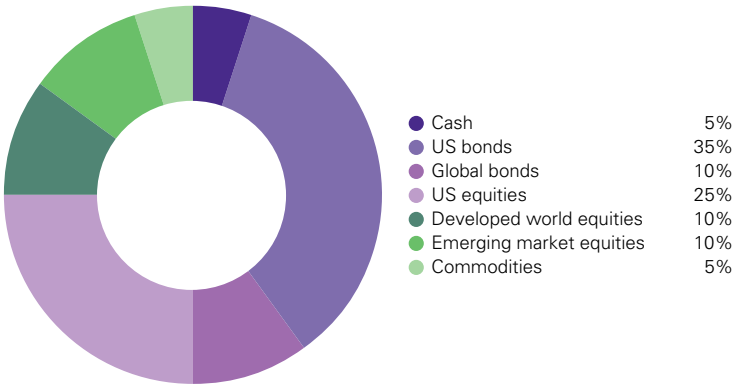
Asset and period selection

We analysed the impact on a typical portfolio of an emerging-market currency strategy using gold. The portfolio described in **Chart 13** includes a 10% allocation to emerging-market equities.[24] A complete list of the corresponding indices used throughout this study can be found in Table 4 in Appendix III.

Based on data availability, and following similar methodology to previous World Gold Council research, our analysis focused on the period between 1987 and 2012.[25] However, from an emerging-market perspective, the period can be split into two distinct parts.

The first period, between 1987 and 2001, was characterised by emerging-market currency depreciation, at least two notable regional emerging-market crises and significant interest-rate differentials. This suggests foreign-exchange hedging would have been a prudent choice for investors throughout this period, given depreciating currencies and violent currency swings during the crises. However, mitigating the case for hedging would have been the significant cost drag from executing a hedging strategy.

Chart 13: Portfolio breakdown by asset class



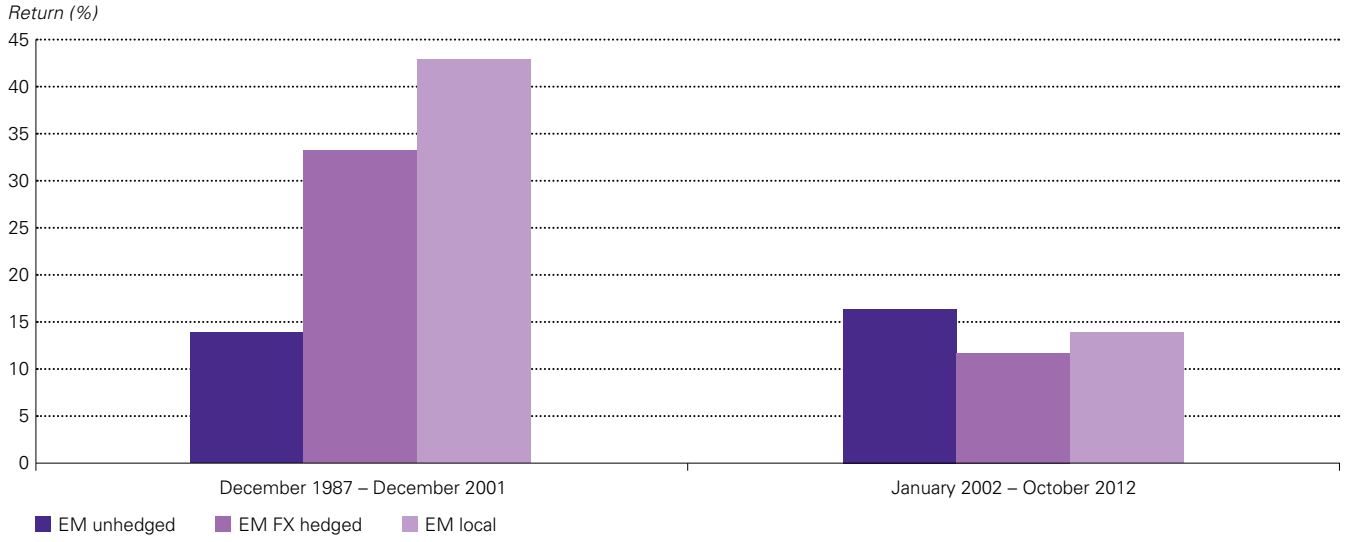
Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

24 While a 10% allocation is indicative, the conclusions of this analysis can be adapted to different portfolio compositions depending on the asset allocation and the foreign asset exposure.

25 These include *Gold: hedging against tail risk*, October 2010; *Gold: alternative investment, foundation asset*, October 2011; and *The strategic case for gold for UK investors*, June 2012.

The second period, between 2002 and 2012, was also characterised by high interest-rate differentials but emerging market currencies that were generally appreciating. This period would have made the case for foreign-exchange hedging weaker as emerging market currencies were, on average, strengthening and costs would have clawed back a sizeable portion of performance (as seen by a 218 basis point reduction in return in **Chart 14**. Further, the period of 2002-2012 was marked by stabilisation in emerging market economies and increased inflows. For most investors, this period is more relevant as it coincides with the period when major inflows into emerging markets began. Splitting the period in two is also important because the case for hedging foreign-exchange risk prior to 2001 was compelling, but was less so thereafter. This underlines the need to hedge currency risks but poses the question of how to do this in the most effective manner.

Chart 14: Returns of emerging market indices during 1987 – 2001 and 2002 – 2012



Source: Bloomberg, World Gold Council

Portfolio construction and gold effect

In order to isolate the portfolio impact of a decision to hedge emerging-market exposure with gold, we compare three portfolios: 1) with an unhedged emerging market index (in US dollar terms); 2) with a currency-hedged emerging-market index; and 3) with an emerging market hedge strategy split 50/50 between a currency hedge and a gold overlay.[26] That is to say, gold is a borrowed asset added on top of the existing portfolio. It does not therefore reduce allocations to existing assets or the original capital invested, in keeping with the way overlay hedges are commonly constructed. Thus, a 50% gold overlay to the 10% emerging market equity exposure resulted in a net exposure of an additional 5% allocation to gold, at the portfolio level, funded by a 5% borrowed cash position. So as not to surpass the total capital available for investment, gold must be borrowed to construct the overlay – for which there naturally is a fee. We have penalised gold returns over the period using a short-term cash rate as a benchmark for borrowing costs.

Table 3 summarises the return, volatility and information ratios of the three portfolios under consideration. The full-period results show the net effect of these contrasting dynamics. In particular, the results show that a combination of gold and foreign-exchange hedging would have provided the best return per unit of risk over the 2002 to 2012 period. The case for adding gold to the overlay between 1987 and 2001 was slightly less compelling as the period experienced both a decline in the price and only a modest reaction to regional crises.

While including a gold overlay increased volatility as a result of leverage (more capital put to work financed by a very low volatility instrument), the portfolio return obtained compensated investors for the additional price volatility. Consistent with aforementioned findings, a foreign-exchange hedged portfolio decreased portfolio volatility significantly during the full period between 1987 and 2012, but only increased returns during 1987-2001, and not during 2002-2012. However, the information ratio of the portfolio containing the currency-hedged emerging-market equities was higher than the portfolio containing an unhedged emerging-market index during the period from 1987 to 2001. In summary, the 50/50 combination of local-currency hedging and a gold overlay stood as the most compelling strategy, especially considering the structural shift observed in emerging markets over the past decade.

26 To provide the comparison with foreign-exchange hedges on equal terms, we have introduced gold here as an overlay and have set the strategic allocation to gold at 0%. However, previous research by the World Gold Council has shown that long-term strategic optimal allocations to gold can range from 2% to 10% and are significantly different from zero.

Table 3: Summary of portfolio performance across multiple periods*

Portfolios (December 1987 – December 2001)	Return	Volatility	Inf. Ratio
Portfolio with unhedged EM	9.65%	7.19%	1.342
Portfolio with 100% FX	11.59%	7.17%	1.615
50% FX hedged + 50% gold overlay	10.18%	7.15%	1.462
Portfolios (January 2002 – October 2012)	**Return**	**Volatility**	**Inf. Ratio**
Portfolio with unhedged EM	6.80%	8.84%	0.769
Portfolio with 100% FX	6.33%	8.30%	0.762
50% FX hedged + 50% gold overlay	7.39%	8.88%	0.833
Portfolios (December 1987 – October 2012)	**Return**	**Volatility**	**Inf. Ratio**
Portfolio with unhedged EM	8.40%	7.95%	1.058
Portfolio with 100% FX	9.29%	7.71%	1.206
50% FX hedged + 50% gold overlay	8.96%	7.95%	1.128

*The portfolios used for comparison are similar in all respects except for the EM asset – which changes from unhedged to currency-hedged to a 50/50 mix between currency hedging and a gold overlay. The returns for the 50/50 hedged EM asset are computed by weighing a 50% unhedged EM index with a 50% currency hedged EM index and a 50% overlay to gold. Assuming there is a 10% allocation to emerging market equities, the 50% gold overlay would result in a 5% cash borrowing to arrive at a 5% allocation to gold, creating a 105% long, -5% cash portfolio. Unhedged EM is represented by a gross TR index while the FX hedged EM is represented by a net TR index which has a slight difference in return.

Source: Barclays, Bloomberg, World Gold Council

Currency tail-risk hedging using gold

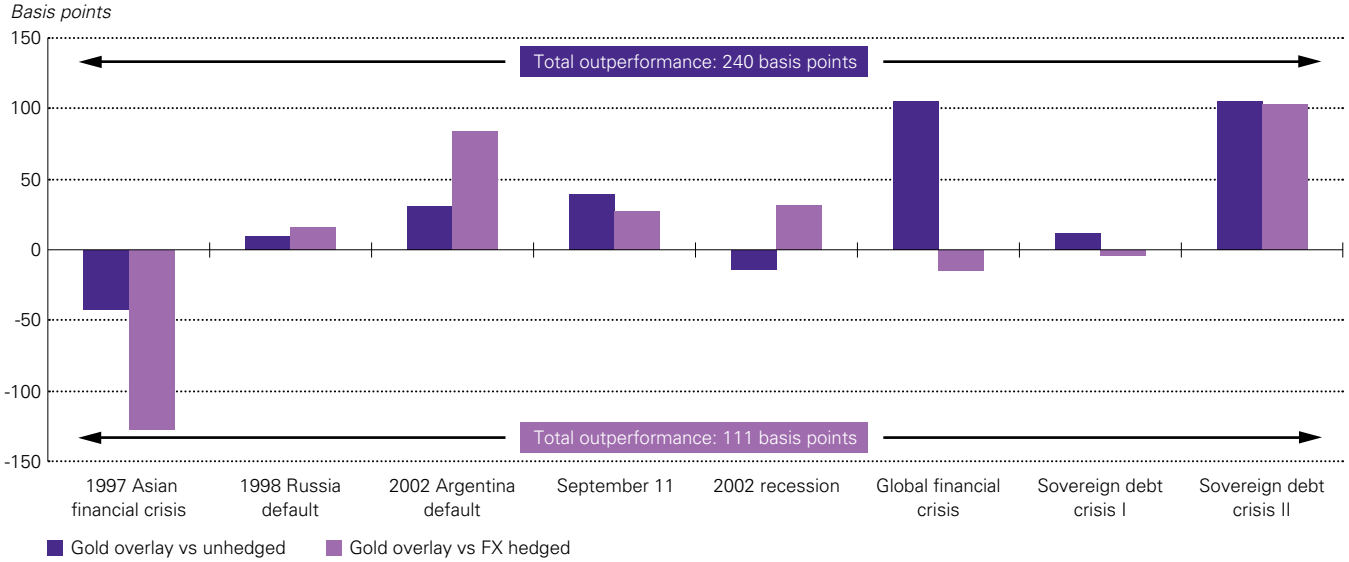
A currency-hedging strategy including gold also proves beneficial for portfolios during historical tail-risk events. Gold, during times of crises, typically reduces the losses experienced by risky assets, including emerging market equities. These events include crises that are systemic in nature. For emerging markets, such events are often either related to or caused directly by the country's currency and debt markets.

Chart 15 shows the improvement in portfolio performance that a 50/50 combination of gold and an emerging market currency-hedging strategy had over fully-hedged and fully-unhedged strategies during the eight tail-risk events under consideration. The 50/50 combination portfolio outperformed the unhedged portfolio during six out of the eight events and outperformed the currency-hedged index during five of the events. Moreover, the 50/50 combination hedged portfolio outperformed an unhedged strategy by an average of 30 basis points, and collectively by a total 240 basis points over the eight events under consideration. Similarly, it outperformed a fully currency-hedged strategy by an average of 14 basis points, and 111 basis points collectively over the same period. Consistent with previous World Gold Council research, gold is shown to reduce losses or improve gains during times of market stress.[27]

Using gold as a currency-hedge overlay going forward

What type of environment do investors expect going forward? Interest rate differentials are set to remain high for some time due to a combination of low rate policies in developed markets and structurally higher rates in emerging markets. These policies are likely to see emerging market currencies continue to outperform as global imbalances, which were partly the cause of the global financial crisis, are righted. This outperformance will also go hand in hand with economic growth – a key long-term fundamental driver of gold demand. Also, given the macroeconomic and financial events of the past few years, it would be foolhardy to believe that future crises are unavoidable. Given the emerging markets' growing share of global trade, global wealth and investors' global portfolios, it is logical to expect that any crises emanating from these economies are likely to have a greater global impact. Based on its characteristics as a tail-risk hedge and liquid unit of exchange, gold should strongly react during periods of crisis. The case for gold as a complement to a foreign-exchange hedge overlay remains strong – mitigating the cost drag from hedging while providing protection from tail events.

Chart 15: Outperformance of portfolios with a 50% gold overlay on EM index*



*This chart shows the outperformance of a portfolio with 50% FX hedge/50% gold overlay EM index relative to two other portfolios: one with an unhedged EM index and another one with a currency-hedged EM index. Please refer to Table 5 in Appendix III for event dates.

Source: Barclays, Bloomberg, World Gold Council

27 World Gold Council, *Gold: hedging against tail risk*, April 2010.

Conclusion

Exchange-rate risk is a significant issue for investors allocating assets abroad. Empirically, back tests show that exchange-rate hedging provides benefits to developed market investors through higher returns on emerging-market holdings, as well as lower volatility across all global assets. However, the past decade has brought significant changes in the global economic landscape that have altered conventional wisdom about exchange-rate hedging. As a result of robust growth in emerging markets and ongoing problems in developed markets, interest-rate differentials have once again been expanding and consequently exchange-rate hedging costs have increased. Given the current trade-off between costs and benefits of hedging, many investors might opt to leave their allocations unhedged. After all, as globalisation expands, systemic risks may appear as likely at home as abroad. However, while emerging-market crises were regionally contained in the past, the increasing weight of these markets in global GDP, trade and investor portfolios suggests a greater risk of contagion in any future crisis. In that context, there is a strong argument for substituting or complementing existing exchange-rate hedging strategies using gold.

Gold's foreign-exchange-hedging characteristics are unique and represent an additional benefit to a strategic allocation. It is critical to note that our body of research has shown that an allocation to gold in the range of 2-10% is optimal for investors across a band of risk appetites. Gold's foreign-exchange hedging capabilities further emphasise its versatility as a portfolio component.

Given the low cost of a gold allocation – from transaction, monitoring and carry perspectives – its positive relationship with the emerging-market growth cycle and its application as a tail-risk hedge, gold makes an attractive alternative to traditional exchange-rate hedging programmes. Results of our analysis show how gold can reduce portfolio drawdown for investors with emerging-market allocations relative to a foreign-exchange hedge. In addition, gold as a discrete allocation increases risk-adjusted returns by lowering volatility. The most effective period for this strategy has been the last decade, not merely because gold has been in a rising price environment, but because global crises have garnered a greater response from gold than before. Emerging-market currencies have been rising and interest-rate differentials have been growing. This environment seems set to stay for the foreseeable future but, most importantly, with emerging markets becoming an increasing feature on the landscape, investors need to protect their holdings against unforeseeable risks. Gold's proven tail-risk hedging properties make it a powerful complement to a foreign-exchange hedge for emerging markets.

Appendix I: Gold and currencies

History

Gold is the world's oldest global currency, having played a role in most currency systems for more than two thousand years. Gold's use as a unit of exchange can be traced back to the ancient Kingdom of Lydia, present-day Turkey, c. 500 BC. Croesus, King of Lydia, is credited with issuing the first gold coins containing a standardised amount of pure gold, which was subsequently adopted by other civilizations across the Mediterranean region.

Gold's physical properties make it ideal for use as a currency. It is scarce, it doesn't tarnish or corrode, it is malleable and its nearly uniform status across civilizations as a valuable possession has made it a rationale unit of exchange. Charles de Gaulle famously asserted: "there can be no other criterion, no other standard than gold. Yes, gold which never changes, which can be shaped into ingots, bars, coins, which has no nationality and which is externally and universally accepted as the unalterable fiduciary value par excellence".

Over the centuries, the use of specie money was overtaken by a gold and silver standard, where the metals backed the value of fiat money. As the world's monetary system evolved, metallic coins were given up in favour of gold-backed bank notes where banking institutions took deposits and made loans backed by gold. This allowed consumers to use currencies to purchase goods with the guarantee that one could exchange bills for gold or silver.

Great Britain was the first country to move to a pure gold standard in 1717, when the government linked the currency to gold at a fixed rate. By the turn of the 20th century, most countries were on a pure gold standard. Most countries left the gold standard after World War I in order to monetise their ballooning debts, but the US chose to remain with the standard. A new monetary system, commonly referred to as Bretton Woods, was put in place after World War II, whereby a country's currency was linked to the US dollar and ultimately backed by the US government's gold commitment to buy gold at a fixed price.

After years of trying economic times and numerous costly wars, US President Nixon decided to suspend the direct convertibility between the US dollar and gold, ending the gold-exchange standard. This decision effectively set the stage for the floating (fiat) currency system that we know today.

Gold's use in the monetary system

While gold's use as a currency has diminished since the gold standard era, it has become increasingly relevant in the global monetary system, particularly over the last few years. For example, investors who access securities through the Chicago Mercantile Exchange (CME) and the Intercontinental Exchange (ICE) are able to use gold as high-quality collateral for the purchase of other assets. These exchanges rank gold's collateral value on par with some other foreign currencies and major-government bond markets.

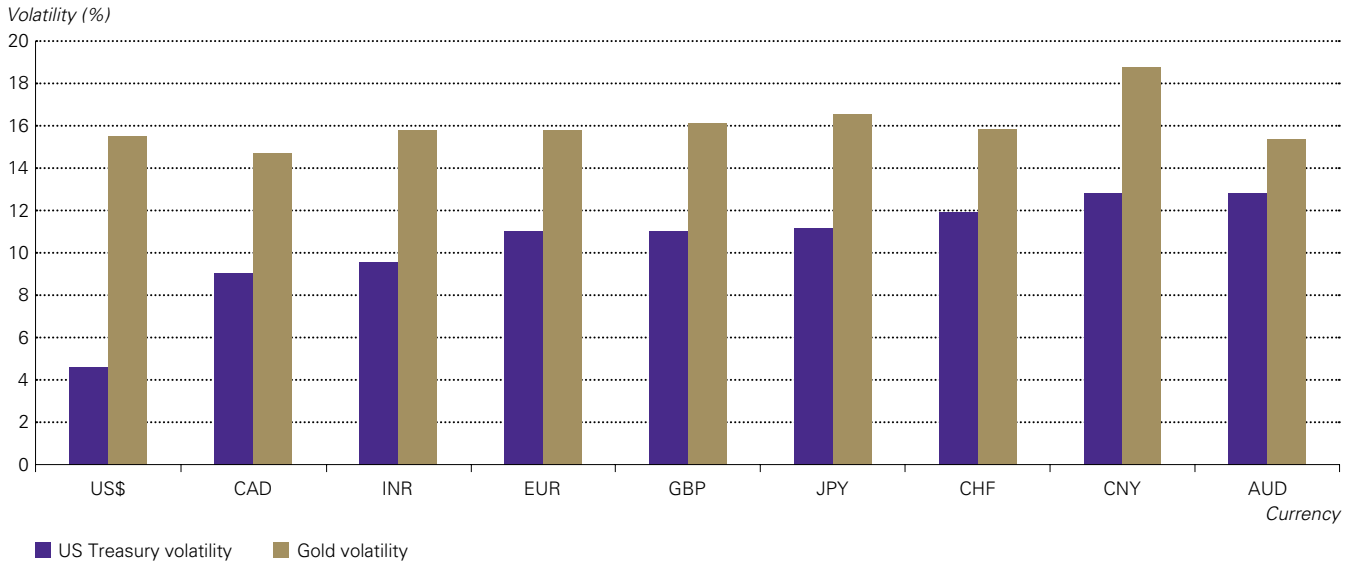
Gold is also used to lower the cost of borrowing for banking institutions. In fact, the central banks from Italy, India and Sweden have used their official gold holdings to achieve lower borrowing costs than market rates would have suggested.[28] Today, academics propose that gold be used to lower the borrowing costs of indebted European nations such as Italy, Portugal and Spain as a possible alternative to austerity measures.[29]

Commercial banking institutions are also accessing gold to reduce borrowing costs and strengthen their capital positions. In fact, Turkey's central bank has passed banking regulation allowing commercial banks to hold gold on their balance sheets as part of their capital requirements. This enables Turkish citizens to deposit their gold in banks and receive a return. In turn, the banks are able to use the deposited gold as collateral for their loan programmes.

Gold's consistent volatility across currencies

Gold's correlation with currencies is relatively low and becomes negative during extreme moves, which helps keep its volatility structurally stable across many currencies **(Chart 16)**. The volatility of US treasuries, on the other hand, could vary considerably between countries, depending upon the stability of the currency. While many consider US treasuries to be a safe asset, international holders of treasuries experience a markedly higher volatility than domestic holders.

Chart 16: Gold and US Treasury volatility in different currencies*



*Monthly return data from December 1987 – October 2012 used for this computation. Barcap US Treasury aggregate index was used for US Treasuries and London PM fix for gold.

Source: Bloomberg, World Gold Council

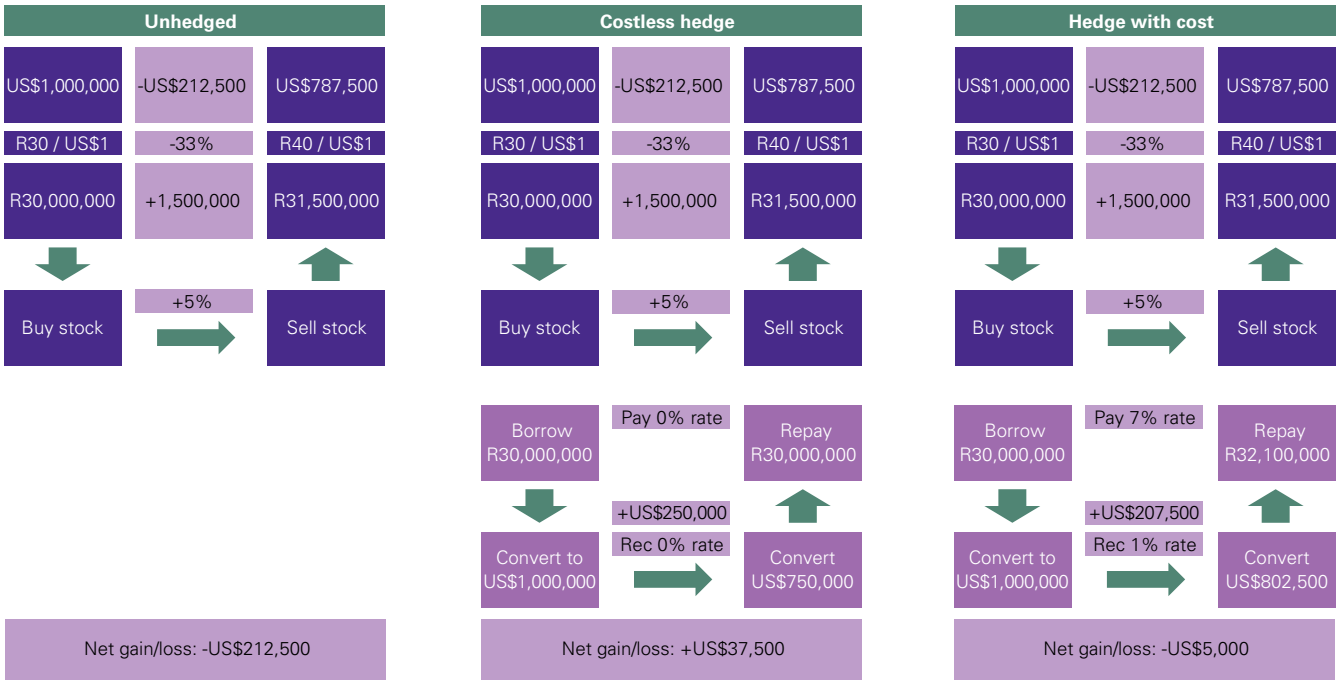
28 *Liquidity in the global gold market*, World Gold Council, 2011.

29 A more effective Euro-zone monetary policy – gold-backed sovereign debt, November 2012.

Appendix II: Mechanics of a foreign-exchange hedge

Chart 17 provides an illustrated and simplified example of how a foreign-exchange hedge works from the perspective of a US investor buying Russian stocks. It is worth noting that in addition to the cost of the hedge, no foreign-exchange hedge can perfectly eliminate risk. This is because a perfect hedge would need perfect foresight, as only the initial amount can be hedged with certainty. Any subsequent gains will be subject to exchange-rate fluctuations. Conversely, a loss on the position will mean that the position has been over-hedged.

Chart 17: Mechanics of a foreign exchange hedge – gains and losses on a Russian rouble stock purchase from a US$ perspective



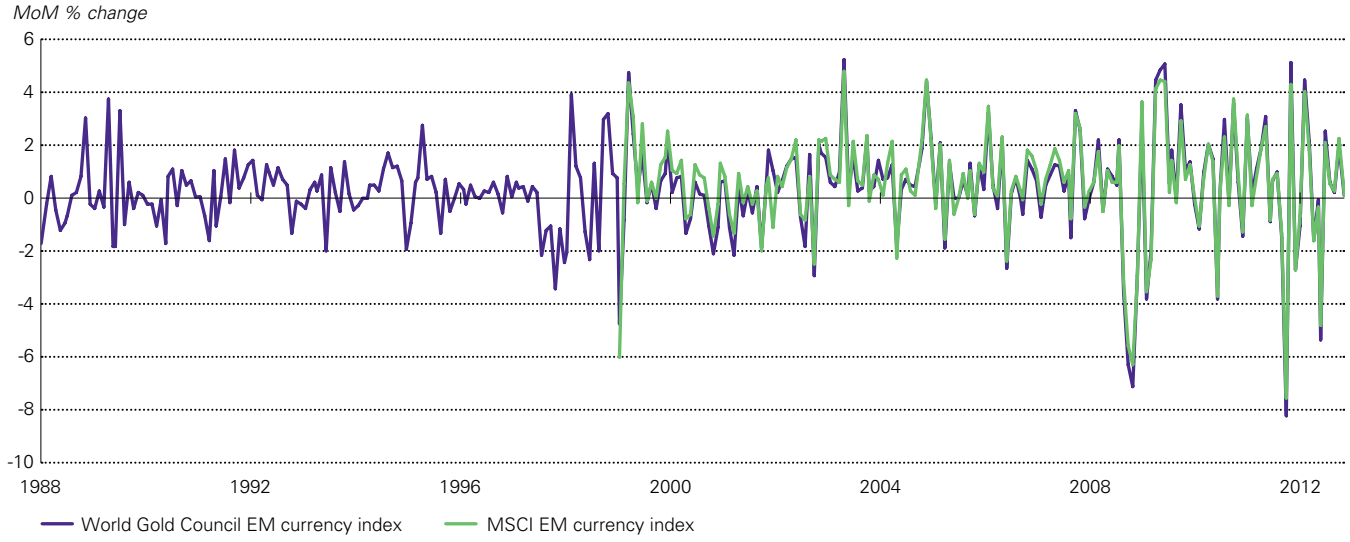
R = Russian rouble.

Source: Bloomberg, Thomson Reuters, World Gold Council

Currency-hedged index construction
Due to data limitations in the MSCI Emerging Market Index, we constructed a proprietary index to determine currency performance, index performance and cost of hedging. Our monthly-frequency data series runs from December 1987 to October 2012.

The currency and cost indices (conversely a return index) are built bottom-up using MSCI Index methodology.[30] **Chart 18** shows monthly-return performance of the MSCI Emerging Markets Currency Index and the World Gold Council-constructed proxy used in our analysis.

Chart 18: MSCI vs constructed emerging-market currency index



Source: Thomson Reuters, World Gold Council

30 MSCI Hedged, FX Hedge and Global Currency Index Methodology.

Appendix III: Referenced indices and tail risk events

Table 4: Key of corresponding indices to assets mentioned in the paper

Asset	Index
Cash	JPM 3M cash
US bonds	Barclays US Agg
Global bonds	Barclays Global Treasury Agg ex US
Domestic equities	MSCI USA net
Developed world equities	MSCI EAFE net or MSCI World ex US
Emerging market equities	MSCI EM gross
Emerging market currency hedged	MSCI EM currency hedged net
Commodities	S&P GSCI
Gold	Gold (US$/oz)

*MSCI EM TR gross was used instead of net due to data unavailability. All indices are total return except for gold.

Source: Bloomberg, World Gold Council

Table 5: List of tail risk events examined and corresponding dates of analysis

Tail Risk table	Start date	End date
1997 Asian financial crisis	June 1997	December 1997
1998 Russia default	July 1998	September 1998
2002 Argentina default	December 2001	June 2002
September 11	August 2001	September 2001
2002 recession	February 2002	July 2002
Global financial crisis	August 2008	March 2009
Sovereign debt crisis I	April 2010	July 2010
Sovereign debt crisis II	February 2011	October 2011

Source: World Gold Council

III: Tail-risk hedging: an international perspective

Executive summary

Gold plays many roles within an investor's portfolio. It serves as a portfolio diversifier: it tends to have low correlations to most assets usually held by institutional and individual investors. It preserves wealth: gold is typically considered a hedge against inflation, but it also acts as a currency hedge, in particular against the US dollar and other developed-market currencies with which gold correlates negatively. Particularly important to investors, gold also helps to manage risks more effectively by protecting against tail-risk events[1] – namely, unpredictable events sometimes considered unlikely which cause considerable damage to investors' capital. Notably, these events are likely not only to continue but also to increase their frequency as interconnected global economies raise the possibility of spill-over effects to other markets.

The advantages of gold's role in portfolio risk management have, over the past decade, become better understood in Western markets. In Japan, the role of gold in a portfolio context has only recently gained recognition, yet has advanced substantially in the past 18 months. This is influenced by such developments as the continued weakness of the Japanese economy, deteriorating government finances, unfavourable public and corporate pension reforms, growing concern over event/tail risk, change of needs in pension management resulting from demographic shifts, adoption of international financial-reporting standards (IFRSs), and volatile performance of traditional assets. All these factors call for a stronger focus on wealth preservation and performance stability in pension fund management. Gold is increasingly considered by Japanese institutional investors as a solution that meets today's needs.

The country has experienced a prolonged weak economy, described by many as the "lost 20 years of Japan". Deflationary pressures, declining disposable income, reduced savings rates, and a dim corporate earnings outlook have prevailed. The government has not yet been able to turn the economy around. The national debt is now more than 200% of GDP, the worst among OECD countries.[2] The fast-ageing population has put further structural strains on the country's fiscal condition, forcing the government to cut back benefits owed under the universal public pension programme. Facing an uncertain operating environment, corporate pension sponsors have also reduced plan benefits, a significant move in a country known for its protective employment culture.

As in other markets, we believe gold's role in Japan extends beyond affording protection in extreme circumstances. In previous studies, the World Gold Council has shown that including gold in a portfolio can reduce the volatility of a portfolio without necessarily sacrificing expected returns. However, a more detailed analysis on the effect gold allocations have during tail-risk events shows that portfolios including gold not only deliver better risk-adjusted returns, but that they can also help to reduce extreme losses.

This article discusses the benefits of including gold as a tail-risk hedge from an international perspective and compiles research findings from previous studies.[3] We show that even modest allocations to gold between 2% and 10% – depending on the assets held by investors and their risk tolerance – can have a positive effect on portfolios. In particular, gold tends to reduce not only portfolio volatility but also losses that may be incurred during tail-risk events. Looking back at events including Black Monday, the LTCM crisis, and the recent global financial crisis of 2008 – 2009, our analysis shows that gold mitigated portfolio losses incurred by investors during almost all tail events under consideration. For example, investors in the US, Europe, and the UK who held a 5% allocation to gold, reduced losses by approximately 5% during eight tail risk events. Similarly, Japanese investors would have saved between 2.3% and 3.6% during nine tail-risk events by adding a 5% allocation to gold in a typical portfolio of foreign and domestic stocks and bonds.

1 Tail-risk events get their name from the fact that their occurrence results in extreme and unexpected changes in asset prices (typically negative) that fall in the 'tail' of the return distribution.

2 http://stats.oecd.org/

3 We concentrate on two previous research notes: *Gold: hedging against tail risk,* October 2010, and *The role of gold for Japanese investors during tail-risk events,* November 2012 – originally in Japanese – updating and contextualising their main findings.

The case for gold in portfolio risk management

A primary objective of portfolio management is to maximise returns and preserve capital. However, investments with higher expected returns bring higher risks. Put simply, risk is the cost investors incur in their quest for higher returns. While in its simplest form, risk is typically associated with volatility, there are various other kinds of risk that can prove very important, especially in times of economic distress: illiquidity, credit-worthiness, counterparty, market and event risk are examples.

While it is common for investors, in times of economic expansion, to seek higher returns for their portfolios at the expense of taking on more risk, there are economic events that can create structural shifts in the perception and acceptance-level of risk. These events give investors direct exposure to evironments that can cause severe losses. The global financial crisis of 2008-2009 is one example of these structural changes. After experiencing substantial losses in their portfolios, investors around the globe have increased their usage of risk management.

Risk management can be achieved, in part, using traditional portfolio-diversification strategies, but investors need to dig deeper when it comes to protecting against tail risks.[4] It is here that gold comes into play. Gold is a portfolio diversifier, given its low correlation to most other assets. The gold market is very deep and liquid – with an estimated US$3.2tn in bullion form in financial markets[5] and US$240bn in daily trading volume.[6] In addition, gold bullion has no credit or counterparty risk.

How does gold act as a hedge against tail risks?

When estimating the appropriate mix of assets that go into a portfolio, most investors assume that the distribution of asset returns is close to 'normal' (i.e., returns are symmetric and the majority of them – 95% to be precise – fall within two standard deviations). In practice, this is rarely the case. Many asset returns have skewed distributions and are commonly negatively skewed. So-called 'heavy tails', where investors experience returns beyond two standard deviations, occur more frequently than a normal distribution would predict. Additionally, correlations among assets are not necessarily constant, and while long-term average correlations can be used to compute the optimal asset mix in a portfolio, extreme conditions can change how assets interact with one another in unexpected and typically unwanted ways during periods of systemic risk.

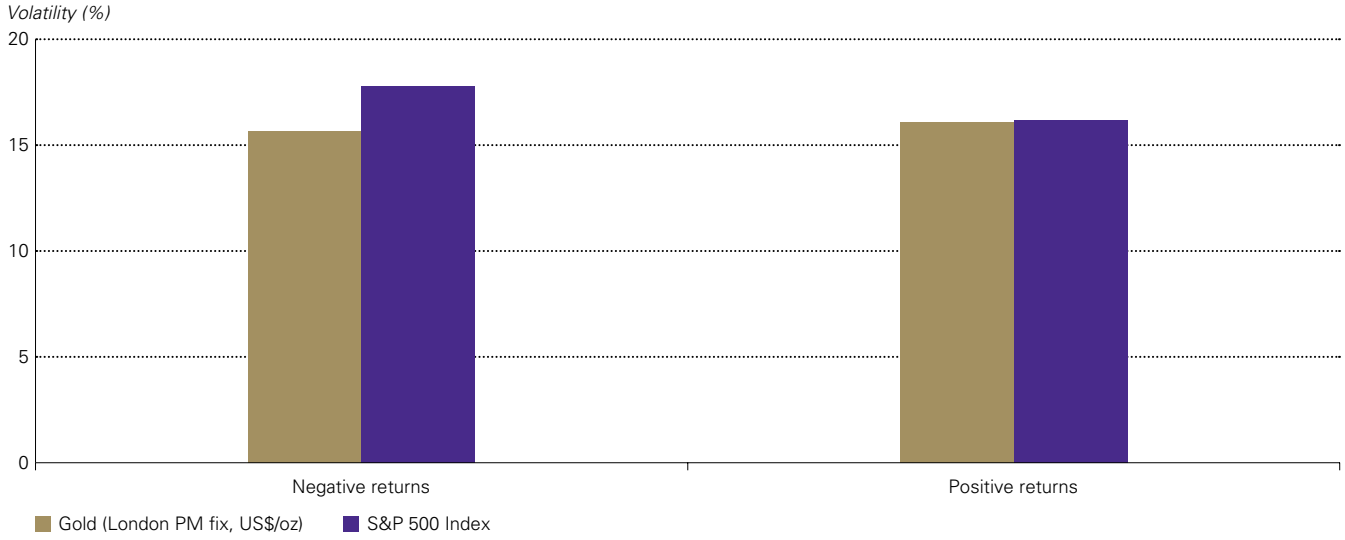
4 Depending on the likelihood of these occurrences (i.e., how far into the tail of the distribution they lie), they are known as 2-sigma (2σ), 3-sigma (3σ) or 6-sigma (6σ) events, where σ is the mathematical expression to denote standard deviation. While some definitions put tail risk as 3-sigma events, in this study, we concentrate on 2-sigma events to facilitate the statistical techniques used.

5 As of 2011, there were an estimated 62,500 tonnes of gold in the hands of individual and institutional investors, as well as central banks. Based on an average gold price of US$1,668.98/oz for 2012 based on the London PM fix.

6 London Bullion Market Association, *Gold turnover survey for Q1 2011*, The Alchemist, August 2011.

Unlike other assets, gold tends to exhibit lower negative return volatility than positive return volatility **(Chart 1)**. Between January 1987 and December 2012, gold's annualised volatility was 15.9%; however, during this period, volatility stemming from negative returns only was lower. During the same period, the S&P 500 had an annualised volatility of 16.8% in which negative return volatility was 17.8% while positive return volatility was 16.1%. In other words, based on historical performance, gold is less likely to fall by more than two sigma ($2\sigma = 2 \times 15.9\% = 31.8\%$) in a year than it is to rise by more than the same return. This is contrary to what tends to happen with equities. The economics behind this phenomenon are in part due to what is commonly known as 'flight to quality'. As negative news hits the market, especially the equity market, and risk aversion increases, investors usually retreat from equity and other risky assets into assets that tend to protect wealth, such as US Treasuries and gold.[7]

Chart 1: Annualised volatility of positive and negative returns for gold (US$/oz) and S&P 500*



*Computed on weekly return data from December 1987 to December 2012.

Source: Bloomberg, LBMA, World Gold Council

7 For a more in depth analysis on negative economic news and gold, see Roach S.K. and M. Rossi, *The Effects of economic news on commodity prices: Is gold just another commodity?,* IMF Working Paper, 2009.

Because gold tends to have little correlation with many asset classes, it is a strong candidate for portfolio diversification. Unlike other assets typically considered diversifiers, gold's correlation to other assets tends to change in a way that benefits portfolio returns. For example, while gold correlation to US equities is on average not statistically significant, it tends to decrease as US equities fall and increase when they rise.

This behaviour is more evident when one compares the correlation of equities to gold and commodities in periods when equity returns fall by more than two standard deviations from zero **(Chart 2)**. From December 1987 to December 2012, the average weekly-return correlation of the S&P 500 and the S&P Goldman Sachs Commodity Index was 0.16; while this correlation changed to 0.41 in periods during which equity returns rose by more than 2σ, it increased even more to 0.55 when equities faltered. Put simply, in economic and financial downturns, most industrial-based commodities and equities have tended to follow a similar pattern. On the other hand, history shows that gold's correlation to equities became more negative during these same periods. Between December 1987 and December 2012, the average correlation between gold and the S&P 500 stood at -0.04. In periods during which equity returns rose by more than 2σ, the correlation turned positive to 0.41, but when equities fell by more than 2σ, the correlation coefficient dropped to -0.29. This is by no means a strong negative correlation but it serves to exemplify the benefits that gold can offer when managing the overall risk of a portfolio.

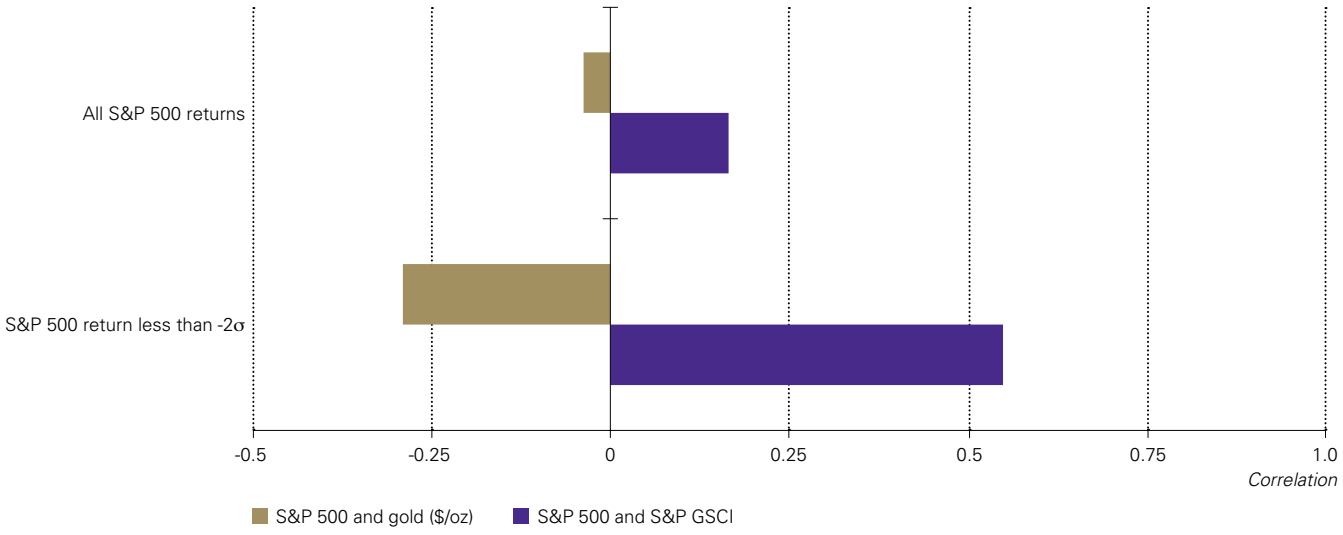
Optimal allocations to gold

The performance of an investor's portfolio is driven by its individual components and the interactions between these assets. In previous studies, the World Gold Council has found that gold allocations are statistically significant and can improve the efficiency of the portfolio.[8] Put simply, investors benefit by having a long-term positive exposure to gold, which can be adjusted up and down as a response to the macroeconomic environment and the risk aversion of investors.

Optimal allocations to gold typically range between 2% and 10% across multiple currencies **(Chart 3)** and are based on conservative expectations for gold returns – at either 0% or 2% in real (inflation-adjusted) terms.[9] These ranges are a function of the portfolio composition and the desired level of volatility. In other words, gold's appropriate weighting varies depending on what other assets are held in the portfolio and the riskiness of those assets. In general, the riskier the portfolio, the higher the gold allocation. Further, in *Gold: a commodity like no other*, April 2011, we demonstrated that gold brings unique benefits to investors in terms of portfolio efficiency and diversification that cannot be replicated solely by an allocation to a commodity basket.

Additionally, Oxford Economics found that[10] – through an analysis on US-dollar-based assets – investors who are more concerned with the prospect of a higher inflationary or a deflationary environment benefit from higher average allocations to gold **(Chart 4)**.

Chart 2: Long-term weekly-return correlation between equities, gold and commodities to S&P 500 during extreme moves*



*Conditional correlations computed using weekly returns from December 1987 to December 2012.

Source: Bloomberg, World Gold Council

8 For more details see the following papers from the World Gold Council: *Gold: hedging against tail risk,* October 2010; *Gold: a commodity like no other,* April 2011; *Gold: alternative investment, foundation asset,* October 2011; *Gold as a strategic asset for UK investors,* July 2012; *Optimal allocation to gold for Japanese investors,* July 2012; as well as those jointly published with New Frontier Advisors: *Gold as a strategic asset,* September 2006; and *Gold as a strategic asset for European investors,* December 2011.

9 To find the optimal weights employed to construct different sample portfolios, we used *Resampled Efficiency (RE) optimisation* developed by Michaud and Michaud.

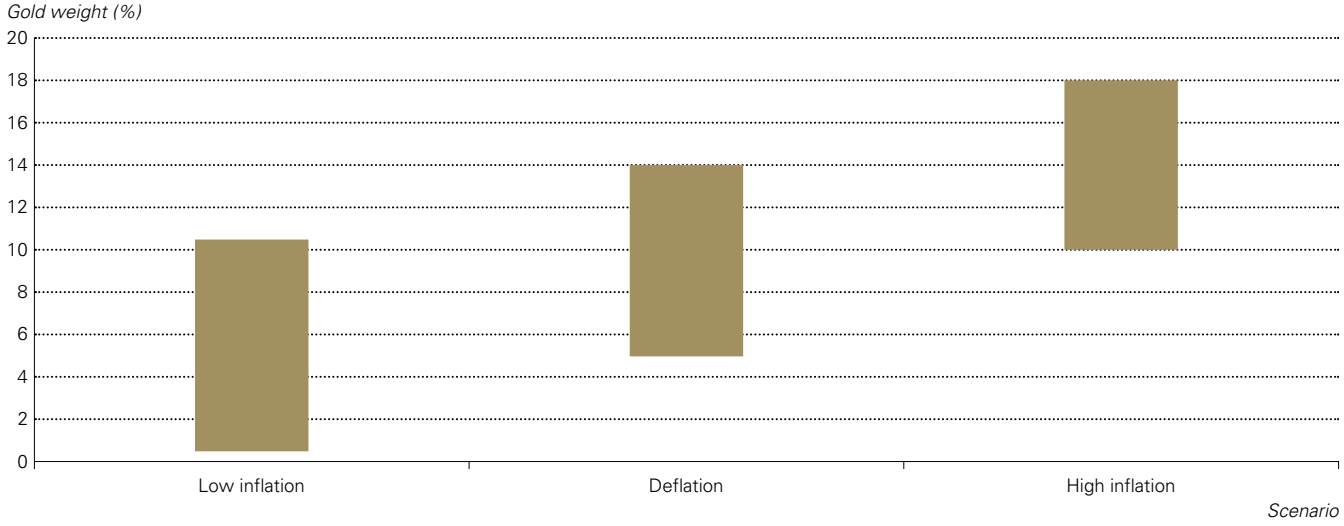
10 Oxford Economics, *The impact of inflation and deflation on the case for gold,* July 2011.

Chart 3: Research findings for optimal gold allocations for various portfolios*

*These ranges depend on investor risk tolerance and portfolio composition. Assets include cash, domestic and global bonds and equities, gold, commodities, and in some cases other alternative investments. Results based on research conducted by the World Gold Council and New Frontier Advisors.

Source: World Gold Council

Chart 4: Impact of inflation and deflation to optimal gold allocations*



*Allocation ranges to gold are a function of investor risk tolerance.

Source: Oxford Economics, World Gold Council

The role of gold in reducing extreme losses for Western investors

Intuitively, the characteristics that gold exhibits in terms of its performance, volatility and correlation to other assets discussed in section I, should also help reduce potential losses in a portfolio, but is this the case in practice?

To answer this question, we looked back at periods of financial stress and analysed a collection of assets representative of typical investment portfolios for US dollar, pound-sterling, and euro-based investors.[11] These include cash, government and corporate bonds, international debt from developed markets, domestic and international equities, and commodities as well as gold as separate asset class.[12] The portfolios under consideration had a benchmark 60/40 moderate composition with 5% allocated to cash, 35% to bonds, 50% to equities, 5% to commodities, and 5% to gold. When gold was not included, other assets were re-weighted proportionally. We analysed periods going back to 1987,[13] when financial markets experienced an unexpected and negative shock that affected more than one asset class.

The eight events under consideration included:

1 The market crash around October 1987, also known as "Black Monday";

2 The 1998 Long-term Capital Management (LTCM) crisis;

3 The Dot-com bubble burst in the period surrounding the dramatic drop in the NASDAQ index between March 2000 and April 2001;

4 The 9/11 terrorist attacks in 2001;

5 The 2002 market downturn;

6 The financial crisis of 2007-2009, also referred to as the Great Recession;

7 The first phase of the European sovereign-debt crisis between April and July 2010; and

8 The second phase of the European sovereign-debt between February and October 2011.

Our analysis shows that portfolios including gold tended to perform better in most cases (either by boosting gains or reducing losses) than those without **(Chart 5)**. We found that, by adding a 5% allocation to gold, European and UK investors would have reduced their losses during all tail-risk events under consideration, while US investors would have saved capital in all events except for the Dot-com bubble burst. A possible explanation is that the Dot-com bubble sector concentration reduced the market-wide impact and subsequently the move into gold. By holding gold during all tail events under consideration, investors in the US, Europe and the UK would have saved approximately 5.5% in total. This would have translated to savings of almost US$54,800 for every US$1mn in assets held in a portfolio. Equivalently, it would translate to €55,200 or £54,600 for every one million euro or pounds in holdings.

Moreover, long-run average returns for the portfolios with and without gold were similar. In other words, average gains remained consistent but extreme losses were, on most occasions, reduced. Thus, gold not only helps to manage risk for expected or theoretical losses, but on multiple occasions it was shown to reduce the observed loss of an investment while keeping a similar average return profile.[14]

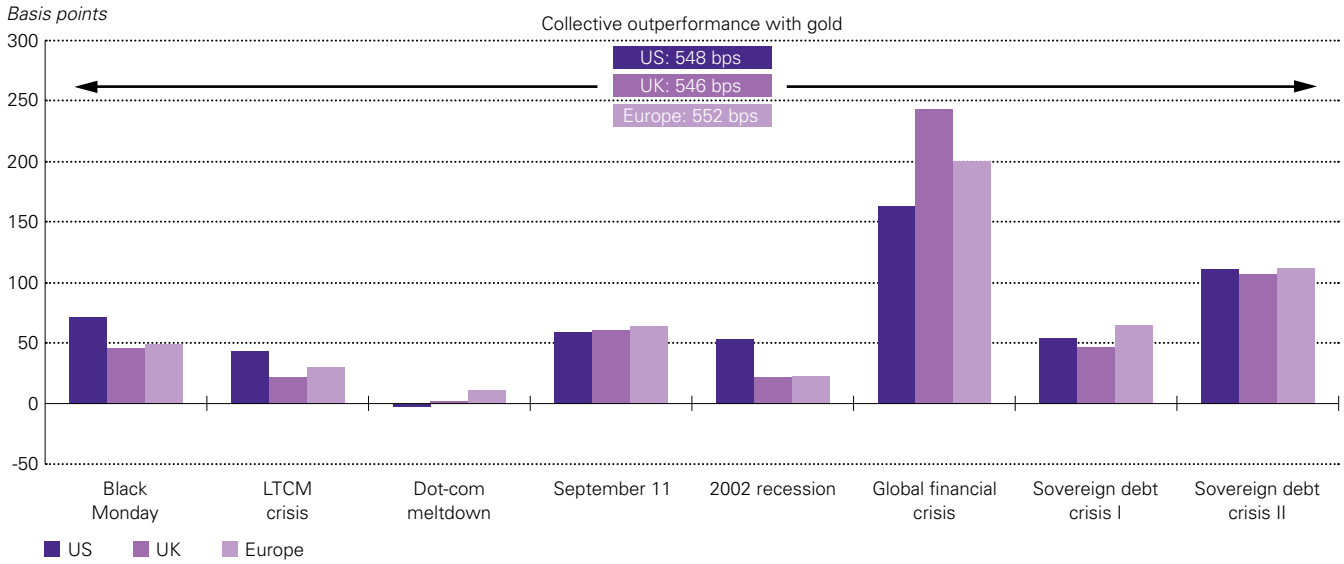
11 This section summarises (and updates) some of the key findings in *Gold: hedging against tail risk,* October 2010, where details on methodology and additional results can be found.

12 See **Table 2** in the Appendix for more details on representative indices/securities used for each asset class.

13 Ideally, we would use series going back as far as 1972, the year by which the gold window had been closed and gold was allowed to float freely. However, a modern investor typically holds many more assets in a portfolio than those available in the 1970s and early 1980s, or for which data are unavailable or unreliable, such as high-yield bonds or emerging-markets sovereign debt and equities. Moreover, the period starting 1987 is sufficiently relevant as it contains at least three business cycles and includes multiple market crashes < http://www.nber.org/cycles/cyclesmain.html.>

14 A constraint of this analysis is that the portfolios used to show the properties of gold as a tail-risk hedge were constructed using information that may not have been available to investors prior to the event's occurrence. In other words, we are using an "in-sample" approach to compute returns, volatilities and expected losses. This does not invalidate the analysis, but it does raise the question of whether selecting a portfolio allocation using only information available during a specific period of time will still deliver similar results (i.e., if adding gold to the portfolio mix allows investors to manage risk more effectively) for events that happen outside of that period. The answer is that it does. Gold can be shown to reduce losses even in out-of-sample analysis for most cases. We estimated average correlations and volatilities using weekly returns between January 1987 and June 2007, excluding the most recent period. We found optimal portfolios using the same methodology as before: with and without gold. We selected the portfolio with the maximum information ratio, as well as a portfolio with allocations similar to a typical benchmark portfolio for a total of four portfolios.

Chart 5: Improvement in performance resulting from a 5% gold allocation*



*Portfolio contains 30% in domestic equities, 10% in global equities, 10% in EM equities, 25% in domestic bonds, 10% in global bonds, 5% in cash, 5% in commodities and 5% in gold. Black Monday: September 1987 – November 1987, LTCM crisis: July 1998 – September 1998, Dot-com meltdown: March 2000 – March 2001, 11 September: August 2001 – September 2001, 2002 recession: March 2002 – August 2002, Global financial crisis: August 2008 – March 2009, Sovereign debt crisis I: April 2010 – August 2010, Sovereign debt crisis II: February 2011 – October 2011. See table 2 in the appendix for a list of the indices used for each asset.

Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

The role of gold for reducing extreme losses for Japanese investors

Most gold-related literature discusses the effects that gold holdings have on Western investor's portfolios, but a natural question for Japanese investors is whether these benefits can also be extended to yen-based portfolios. To answer that question, we first determined which events qualify as tail-risk events from a Japanese perspective.[15] Subsequently, we examined these major tail-risk events based on their underlying drivers and analysed the performance of traditional assets – such as stocks and bonds – and gold during these periods.[16] Finally, we analysed the effect gold has on portfolios that include it, relative to those that do not.

Tail events can be defined by looking at abnormal returns in a given market when asset prices fall sharply, typically on the back of a macroeconomic or financial shock. For investors, it is not only the performance of a particular asset class that is relevant to studying tail-risk events, but also the interaction among assets that causes a significant overall drop in investors' capital. We analysed the performance of Japanese equity and bond markets (referenced by the Nikkei 225 and Japanese Government Bond indices) to determine the periods that qualified as tail-risk events from the perspective of a Japanese investor.[17]

The nine events under consideration included:[18]

1 The market crash around October 1987, also known as "Black Monday

2 The Japanese market bubble burst, known in the West as the Nikkei crash, in 1990

3 The 1998 Long-term Capital Management (LTCM) crisis

4 The Trust Fund Bureau shock between the end of 1998 and beginning of 1999

5 The Dot-com bubble burst as the NASDAQ index dropped sharply in 2000

6 The VaR shock in 2003

7 The first phase of the financial crisis stemming from the subprime crisis in 2007 and 2008

8 The second phase of the financial crisis , during the credit-crunch, which occured after the collapse of Lehman Brothers between the end of 2008 and beginning of 2009

9 The Japanese earthquake and tsunami of 2011

In almost every case, Japanese equity prices fell steeply alongside global equities. In contrast, gold (in US dollar terms) typically outperformed domestic and global equities, and delivered positive returns during five of the nine tail-risk events under consideration **(Chart 6)**.Gold in US-dollar terms also outperformed Japanese bonds when the tail events originated from a shock to yields.

Gold in US-dollar terms outperformed gold in yen-terms in all but two tail-risk events. Exceptions were the bursting of the Dot-com bubble and the earthquake and tsunami disasters in eastern Japan. This was the result of a flight-to-quality to the yen, which increased gold prices in local-currency terms relative to its US-dollar price. While Japanese investors may have benefited the most from holding gold in US-dollar terms, gold in yen terms still outperformed versus many other assets in most tail-risk events providing investors with relief during periods of financial stress. In fact **Table 1** shows that gold, in US dollar terms, outperformed all traditional assets collectively during the nine tail events under consideration, while gold in yen terms outperformed collectively against all assets except JGBs. Most investors would expect JGBs to have outperformed, as they are typically seen in Japan (and across the globe) as an asset of last resort.

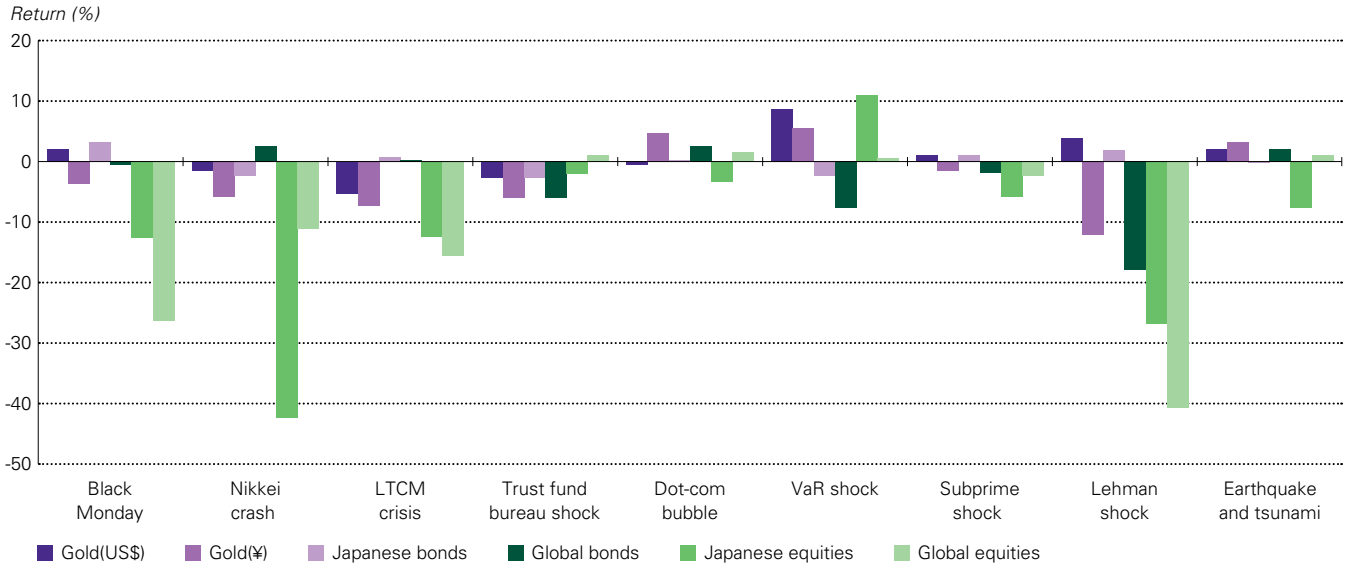
15 This section summarises some of the key findings in from *The role of gold for Japanese investors during tail-risk events*, November 2012, where details on methodology and additional results can be found.

16 See **Table 2** in the Appendix for more details on representative indices/securities used for each asset class.

17 A period of shock, generated by a tail event, is determined here by the duration of a severe impact on the assets prices, with acute fluctuations in stocks, interest rates and other assets. To identify the length of these shocks, we measured asset returns and marked beginning and end by periods in which market prices had fallen by more than 2.5 standard deviations. For example, while the impact from the Lehman shock continues to this day, only the period from October 2008 to January 2009 saw equity returns falling by more than 2.5 standard deviations.

18 Some of the tail-risk events considered for the purpose of a Japanese-based investor analysis differ from the Western investor analysis perspective.

Chart 6: Performance of portfolio assets during select tail-risk events*



*Black Monday: October 1987, Nikkei crash: February 1990 – September 1990, LTCM: August 1998, Trust Fund Bureau: December 1998 – February 1999, Dot-com bubble: April 2000, VaR shock: July 2003 – August 2003, Subprime: August 2007, Lehman: October 2008 – January 2009, Earthquake and tsunami: March 2011. All assets measured in Yen (¥), except gold shown in US dollar terms.

Source: Bloomberg, Citigroup, Nomura, World Gold Council

Table 1: Cumulative individual asset performance during the nine tail-risk events under consideration

	Gold (¥/g)	Gold (US$/oz)	Japanese bonds	Global bonds	Japanese equities	Global equities
Cumulative asset performance	-23%	7%	0%	-26%	-102%	-92%

*Performance is computed by adding the returns for each asset for all nine tail-risk events in consideration.

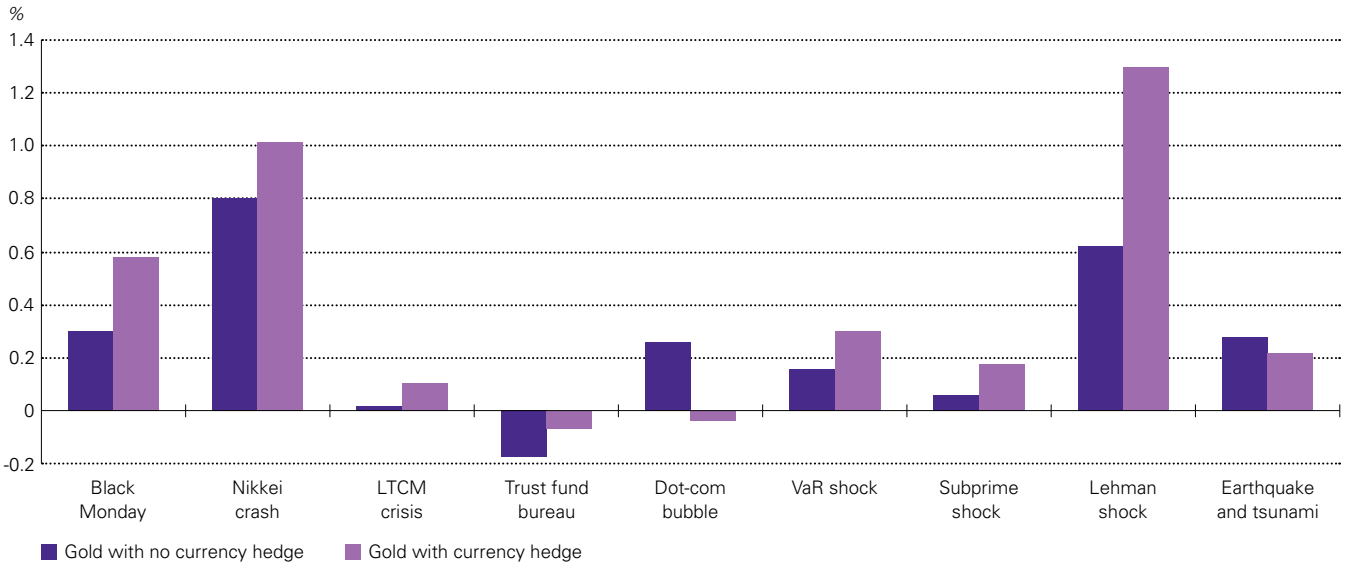
Source: Bloomberg, Citigroup, Nomura, World Gold Council

As previously discussed, gold's benefits are even more evident at the portfolio level when seen in conjunction with other assets. We analysed assets typically held by Japanese pension funds and compared the performance of two portfolios,[19] one which included a 5% allocation to gold, and one with no allocation to gold.[20] Further, we considered two cases: the first one from the perspective of a Japanese investor holding gold in yen terms, and the second where the investor holds gold in US-dollar terms (i.e., by hedging the yen-US$ foreign-exchange exposure).

Chart 7 shows the difference between the portfolio returns with and without gold during tail-risk events. Similar to results obtained for Western investors, Japanese investors generally benefitted from holding gold in their portfolios, either by reducing losses or increasing gains. The results show that a 5% allocation to gold in yen terms mitigated losses during all tail events except during the Trust Fund Bureau shock. Japanese investors would have saved a cumulative 2.3% over the nine tail-risk events under consideration. For investors currency hedging gold (and holding it in US dollar terms), the collective loss reduction rose to 3.6%, despite the fact that the portfolio with gold underperformed during the Trust Fund Bureau shock and the bursting of the Dot-com bubble. The underperformance during the Dot-com bubble was due to the fact that the shock was primarily limited to the technology industry, and gold tends to benefit more in periods of broad-reaching, systemic events. The reason the portfolio holding gold in yen terms outperformed was a by-product of a strengthening yen. During that period, the rate differential between the US and Japan mitigated the positive effect of the gold allocation in US dollar terms.

The study shows that during past tail-risk events even a small 5% gold allocation in a portfolio would have mitigated losses and its effect would, on average, have been even greater where gold was held in US dollars. Interestingly, despite the fact that as an individual asset, gold may not have performed so strongly in yen terms, when analysed as part of a portfolio it clearly demonstrates that it can play a role in hedging tail-risk events. Thus, whether in yen or US-dollar terms, gold can benefit investors during periods of systemic risk.

Chart 7: Improvement in portfolio performance from a 5% gold allocation*



*Black Monday: October 1987, Nikkei crash: February 1990 – September 1990, LTCM: August 1998, Trust Fund Bureau: December 1998 – February 1999, Dot-com bubble: April 2000, VaR shock: July 2003 – August 2003, Subprime: August 2007, Lehman: October 2008 – January 2009, Earthquake and tsunami: March 2011.

Source: Bloomberg, Citigroup, Nomura, World Gold Council

19 For our analysis, we created a typical portfolio, taking as our point of reference the average asset allocation held by Japanese pension funds at the time, as detailed by the Japanese Pension Fund Association.

20 For the hypothetical portfolio, the 5% gold allocation was made as a substitution, replacing in the average portfolio of the time 1% Japanese bonds, 2% Japanese equity, 1% global bonds, and 1% global equity. Optimal allocation to gold is 4.9% for a conservative portfolio as discussed in *Optimal allocation to gold for Japanese investors,* July 2012.

The role of gold during possible future tail-risk events
The recent financial crisis has made it ever more evident that tail-risk events are not a theoretical construct but a harsh reality that investors should consider when making portfolio risk-management decisions. So far, we have shown that gold mitigated losses during past tail-risk events. But what kind of tail-risk events could Japanese investors experience in the future, and what would be gold's contribution to portfolio performance during those events?

While there are a myriad of possibilities, we concentrated on the following three scenarios that a Japanese investor might encounter, and then estimated the effect on asset performance and the role gold would have in such environments. These scenarios included:

1 A sharp rise in Japanese government bond yields
Interest rates in Japan have remained low for over a decade – below 1% since late 2011. The fear of a rise in long-term interest rates in the country is a topic of discussion from various perspectives, but here we assume the possibility that such a rise occurs rapidly. However, we study a situation in which the Japanese economy recovers and interest rate levels normalize through a 'good rise' in interest rates – with stock prices rising according to expectations. While an equity bull market may not be categorised as 'negative' by most investors, a sudden and unexpected rise in rates result from a market rally, may indeed have negative consequences in Japanese pension fund portfolios, for which government bonds are an important component. For the purpose of this study, we assumed a parallel yield curve shift, with interest rates rising 100 basis points, and assessed the hypothetical portfolio using benchmarks commonly employed by investors. Long-term interest rates in Japan rose rapidly on two occasions between 1998 and 2003, yet the correlation between gold prices and interest rates during those times did not increase. Therefore, in theory, gold should be able to mitigate losses stemming from a shock to bond prices.

2 A Japanese market selloff
This scenario also assumes a rise in interest rates stemming from negative conditions. Under this scenario, concern over Japan's debt wreaks havoc on the local bond market and subsequently affects the Japanese stock market. Interest rates rise and stocks fall. The Japanese stock market has been in the doldrums for 20 years, whith the last 10 years seeing a decline of about 50%. It is not unthinkable to assume a further drop. While a Japanese-led selloff may translate into a weaker yen, we took a more conservative approach by assuming it remained flat in order to highlight the possibility of investors benefiting from holding foreign assets while hedging away the currency exposure. Under this second scenario, we assumed Japanese government bond yields rose by 100 basis points, and Japanese stocks fell by 50%.

3 A global shock impacting primarily developed markets
Given that more than half of the historic tail-risk events analysed in this study originated outside of Japan, yet had devastating consequences on the country, it is only natural to assume that potential risks to Japanese investors lie abroad. In this scenario, stock values in Japan, the US and Europe plummet simultaneously as a result of the European debt crisis, causing ripple effects into developed bond markets. This scenario was first proposed by the Bank of Japan in their *Financial System Report* published in April 2012. It assumes yields on German government bonds will rise by two percentage points, US Treasury bonds by 2.5 percentage points and Japanese government bond by 90 basis points. Further, it assumes European stocks lose about half their value, causing a similar drop in Japanese and US stock markets.

Portfolio impact stemming from potential tail-risk events

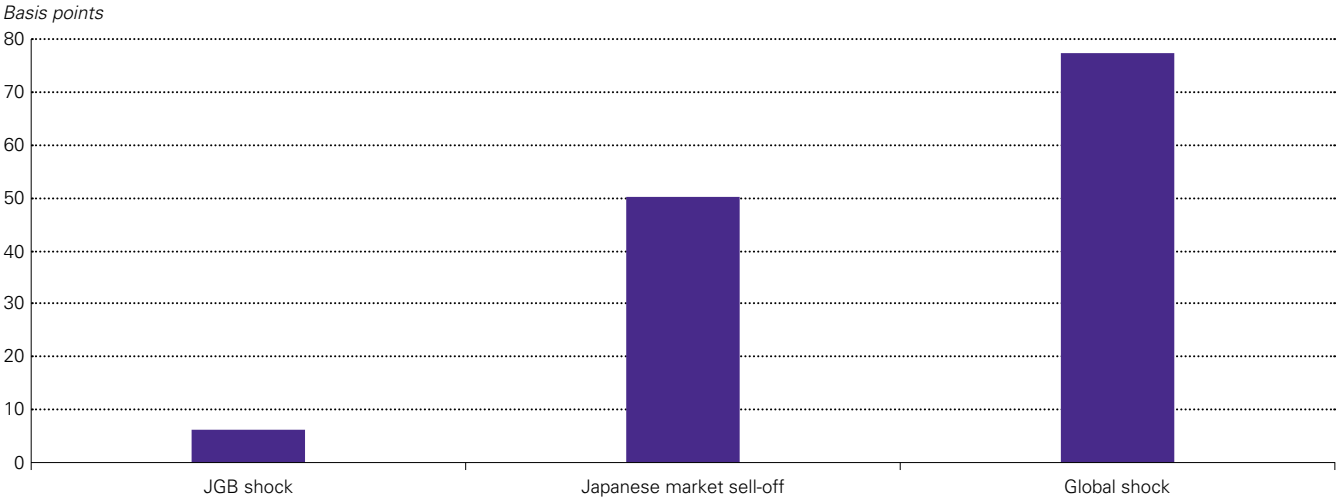
Based on current market expectations – in particular mid-term forecasts of asset managers[21] – and historical volatility and correlations, we constructed an optimal portfolio including cash, stocks and bonds – both foreign and domestic – to use a benchmark. Additionally, we constructed an optimal portfolio including gold – using the conservative assumption of 0% real returns to study the effect that gold would have during future tail-risk scenarios.[22]

The benchmark portfolio with the highest information ratio (risk-adjusted return) resulted in a fairly conservative allocation which included 5.7% in cash, 61.4% in Japanese bonds, 12.2% in global bonds, 10.4% in Japanese stocks and 10.3% in foreign stocks. With a volatility level of 4.5% and an expected return of 2%, this portfolio represents a typical asset mix that Japanese investors would hold if they based their allocation decision process on market expectations. The portfolio including gold was similar, shaving off a few percentage points across assets to accommodate for an optimal 4.6% allocation to gold.[23]

When subject to the three potential tail-risk scenarios, the benchmark portfolio, not surprisingly given the fairly high allocation to bonds, suffered losses of 3.9% under the first scenario, 9.3% under the second and 15.3% under the third.

Our study shows that adding gold to the portfolio reduced such losses for investors, even under the rather conservative assumption that gold prices would remain flat in real terms (go up 30 basis points nominally) during the shock. As seen in the previous section, gold investors may benefit even further as prices, especially in US-dollar terms, tend to rise during periods of tail risk. **Chart 8** shows that investors would have saved 6 basis points under the first scenario, 50 basis points under the second and 77 basis points under the third. While these reductions in losses may appear small at first sight, it is important to note that for pension funds, which hold large portfolios, a few basis points can make a big difference in meeting liabilities. For example, a five-basis-point reduction to a JPY100bn (US$1.25bn) portfolio translates into savings of JPY50mn (US$625,000). Further, considering that the average pension-fund portfolio return has been approximately 1.2% per annum over the past decade,[24] a five basis-point reduction is noteworthy.

Chart 8: Improvement in performance from a 5% gold allocation during three potential future tail-risk events*



*Assumes the same portfolio construction as the in-sample tail-risk analysis. JGB shock assumes yields increase by 100 bps, Japan market sell-off assumes a yield increase of 100 bps and Japanese stocks fall by 50%. Global shock assumes that a crisis in the West impacts global equities and bonds along with Japanese equities and bonds.

Source: Bloomberg, Citigroup, Nomura, World Gold Council

21 The calculations used values forecasted by Japanese trust banks, as reported in the 2 April 2012 issue of *Newsletter on Pensions and Investment*.

22 In comparison, the annual real return of gold between January 1985 and December 2011 was 2.5% in yen terms and 4.2% in US dollar terms based.

23 The optimal portfolio with gold included 5.4% in cash, 59.2% in Japanese bonds, 11.1% in global bonds, 9.7% in Japanese stocks, 10.0% in foreign stocks and 4.6% gold allocation.

24 Pension Fund Association.

Conclusion

Gold helps investors diversify their portfolios and preserve capital and effectively helps manage risk in a portfolio. It increases risk-adjusted returns and can help reduce losses incurred under extreme market conditions. As globalisation intensifies, one can expect to see greater correlation among stock and bond markets across various geographies and even greater linkages during tail events. Short- and medium-term investors, individual and institutional investors alike, can take advantage of gold's unique correlation to other assets to achieve diversification objectives in normal environments and better returns during times of turmoil. This is especially true given that gold's correlation tends to change in a way that benefits investors who hold it in their portfolios. Also, by including gold in their portfolios, long-term holders, including pension plans, endowments and other institutional investors, can manage risk without necessarily sacrificing much sought-after returns. This applies to investors in the major markets we have studied, including the US, UK, Europe and Japan.

Even relatively small allocations to gold, ranging from 2% to 10%, can have a positive impact on the performance of a portfolio. Further, during the eight tail-risk events analysed for Western investors and the nine events we studied in Japan, gold's performance reduced losses (or increased gains) for investors who held it in all but a few instances. In general, US, UK and European investors with standard allocations to stocks and bonds would have saved approximately 5.5% cumulatively during all the tail-risk periods examined. Japanese investors would have reduced their losses between 2.3% and 3.6% by holding gold in yen or US-dollar terms, respectively, during Japanese tail-risk events. We not only found that gold has been valuable to Japanese investors in the past but, that looking forward, it has the ability to protect against potentially devastating shocks to the Japanese market by reducing losses incurred by other assets in the portfolio.

We also note that investors who hold gold only as part of a broad commodity index are likely to be under-allocated. There is a strong case for gold to be allocated as an asset class on its own merits. It is part commodity, part luxury consumption good and part financial asset and, as such, its price does not always behave like other asset classes and especially other commodities.

Finally, while the analysis summarises optimal allocation to gold and concentrates on its function as a tail-risk hedge, gold has other unique characteristics that make it very useful in periods of financial distress. The gold market is highly liquid and many gold investments have neither credit nor counterparty risk, it is increasingly being accepted as source of collateral and is an integral part of the global monetary system.[25]

25 More information can be found in *Liquidity in the global gold market,* April 2011, and *Gold as a source of collateral,* May 2011, published by the World Gold Council and available on our website.

Appendix

Table 2: Name keys for assets used for research analytics

Perspective country	Short name	Index name
US	Cash	JPM US$ 3M
US	Domestic bonds	Barclays US Agg
US	Global bonds	Barlcays Global Tsy Agg ex US
US	Domestic equities	MSCI USA Gross
US	Global equities	MSCI World ex US
US	Emerging market equities	MSCI EM
US	Commodities	S&P GSCI
US	Gold	Gold (US$/oz)
UK	Cash	JPM sterling 3M
UK	Domestic bonds	JPM GBI Europe
UK	Global bonds	JPM GBI Global ex EMU
UK	Domestic equities	MSCI Europe
UK	Global equities	MSCI World ex europe
UK	Emerging market equities	MSCI EM TR
UK	Commodities	S&P GSCI TR
UK	Gold	Gold (GBP/oz)
Europe	Cash	JPM euro 3M
Europe	Domestic bonds	JPM GBI UK
Europe	Global bonds	JPM GBI global ex UK
Europe	Domestic equities	MSCI UK
Europe	Global equities	MSCI World ex UK
Europe	Emerging market equities	MSCI EM
Europe	Commodities	S&P GSCI
Europe	Gold	Gold (EUR/oz)
Japan	Cash	JPM yen 1M
Japan	Domestic bonds	Nomura bond performance
Japan	Global bonds	Citigroup world government bond
Japan	Domestic equities	Tokyo stock price index
Japan	Global equities	MSCI Kokusai
Japan	Gold	Gold (JPY/oz)

Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

IV: Foreign-reserve diversification for emerging-market central banks

Executive summary

In Q2 2009, central banks became net buyers of gold for the first time in two decades and have continued to purchase since then. Gold's lack of credit risk and market depth, and the fact that it is almost universally permissible in the investment guidelines of the world's central banks have made it an increasingly attractive investment alternative.[1] In addition, the deteriorating credit quality of government debt has been a catalyst for rising gold demand. Emerging-market central banks, which own on average approximately 4.6% of foreign reserves in gold – well below the 22% allocation of their developed-market counterparts[2] – have begun increasing their gold allocations. In 2012, as in years prior, a diverse group of central banks added to their gold reserves, including the central banks of Brazil, Russia, Mexico, Korea, the Philippines, Iraq, and Kazakhstan.

As these institutions picked up gold purchases, a natural question followed: what level of gold reserves is appropriate for emerging-market central banks? To answer this, we conducted a statistical analysis to determine optimal gold-allocation ranges for a foreign-reserve portfolio.[3] The study considered this question from multiple perspectives: it examined the appropriate allocation to gold when reserves are measured in US dollars and compared that to optimal allocations when foreign reserves are measured from a local-currency perspective. The study concentrates on nine different emerging-market currencies, including the Indian rupee, Singapore dollar, Brazil real, and Thai baht. Changing the numéraire, or currency in which assets are measured, is an important consideration since emerging-market central banks report their reserve asset performance in their domestic currency. As such, measuring foreign reserves in local currencies may be the most relevant benchmark for some of these institutions.

Our analysis shows that, when foreign reserves are measured in US dollars, optimal allocation to gold ranged between 4.6% and 7.0% for medium levels of risk, depending on portfolio mix. More importantly, we found that through the lens of local emerging-market currencies, optimal gold allocations were significantly higher than those from the US-dollar analysis. When viewed from a local perspective, optimal gold allocations increased to a range between 8.4% and 10.0%, almost four percentage points higher than the allocations suggested from a US-dollar perspective. This higher allocation to gold is not the result of gold's price appreciation over the past decade, as we used a conservative nominal price return of 4% for the analysis – compared to a historical 13.5%. Rather, it is a by-product of gold's low correlation to other assets, similar volatility across currencies, and a negative correlation to the US dollar.

As central banks reallocate their reserves and adjust their gold holdings to more optimal levels, we are likely to see a continuing trend of central-bank purchases. A four percentage-point increase to gold reserves among emerging-market central banks, based on the optimal allocations found in this study, could translate into an additional 6,000 tonnes of gold demand from the official sector.

1 For a comprehensive perspective on the size and depth of the gold market see our report *Liquidity in the global gold market,* April 2011.

2 IMF International Financial Statistics.

3 This research note contains a summary of the results in the study, which first appeared in *Optimal gold allocations for emerging-market central banks*, RBS Reserve Management Trends 2012 publication, as part of their Central Banking Publications journal. The full-length study can be found on our website, www.gold.org

Why consider a non-US dollar numéraire?

Past optimal-allocation studies have found a clear role for gold in central-bank reserve portfolios, although until now such studies have largely been confined to US-dollar-based portfolios.[4] However, a foreign-reserve manager could extend a US dollar-based optimisation to a domestic currency (non-US dollar) perspective in order to: 1) reduce the bias of their dollar-based analysis; 2) assess efficiency/robustness of the analysis in the domestic currency; and 3) consider how the changing nature of their domestic currency's relationship to the dollar may affect the results.

First, addressing the numéraire bias, the Reserve Bank of Australia has noted that a portfolio consisting of assets expressed in the study's numéraire would involve no currency risk and thus possess the lowest risk profile.[5] The results would lead to portfolio allocations biased to numéraire-denominated assets and, potentially, improper portfolio diversification.[6]

Second, reserve managers need to be mindful of their portfolio performance from a domestic-currency perspective. This may be due to concern or interest from government officials and the public in maximising profits, especially as central banks typically report foreign holdings in local-currency terms. It may also stem from the central bank's need to pay local-currency liabilities and/or rely on interest income or profits to sustain its operations.

Finally, a change in the numéraire in optimisation exercises helps reserve managers understand the potential changing role of their currency vis-a-vis other reserve currencies, with particular attention on the US dollar. A declining role for the US dollar as the primary reserve currency could lead to its increased volatility versus emerging-market currencies. This consideration is particularly relevant when changes to foreign-exchange policies lead to more flexible regimes. For example, moving from a fixed exchange rate (relative to the US dollar) to a more flexible regime will introduce greater volatility against the domestic currency and other reserve currencies. In this case, a domestic-currency analysis would be more fruitful, providing greater insight into how a foreign-reserve portfolio should evolve.

4 Several past studies have found some role for gold in a reserve asset portfolio with differing degrees of allocation. See: Scacciavillani and Saidi, *The case for gold as a reserve asset in the GCC* (Dubai: Dubai International Financial Centre, 2010); Natalie Dempster, *The importance of gold as a reserve asset*, World Gold Council, 2010; Carlos León and Daniel Vela, *Strategic asset allocation: non-loss constraints and long-term dependence*, in RBS Reserve Management Trends 2011, ed. R. Pringle and N. Carver (London: Central Banking Publications, 2011). Other studies have often excluded gold in their optimisation analysis for example: see Elias Papaioannou, Richard Portes and Gregorious, *Optimal currency shares in international reserves: The impact of the euro and the prospects for the dollar* (NBER Working Paper no.12333, June 2006).

5 Reserve Bank of Australia Foreign Reserves Management available from http://www.rba.gov.au/mkt-operations/mgmt-foreign-curr/perf-measuremt.html, accessed in December of 2011.

6 The analysis conducted in emerging-market currencies resulted in no significant allocation to any one particular asset/currency as was found in the US dollar analysis, with its bias toward US dollar assets.

Optimal allocations to gold

Methodology

The analysis concentrates on assets typically held by central banks in their foreign reserves. These include sovereign debt instruments from major markets such as US treasury and agency bonds, Japanese government bonds, German bunds, UK gilts and gold. Historical returns and volatility for primary reserve assets, over the period from 1998 to 2011, were measured in terms of the US dollar and the nine other emerging-market currencies **(Table 1)**. This period was selected to reflect a long history without including a period of unusual volatility in emerging-market currencies during the Asian financial crisis of 1997 and 1998. However, for the purpose of this analysis, and not to induce a price-appreciation-driven result, we assumed a more conservative 4% nominal annual return, compared to the 13.5% observed return between 1998 and 2011. This adjustment is consistent with gold's long-term nominal return and its 1%-2% historical spread to US inflation,[7] causing gold to exhibit the lowest information ratio, or return per unit of risk, of all of the reserve assets in the study. In other words, gold would appear to be a less desirable asset on a risk-adjusted basis.

Optimal portfolio allocations were found using Re-sampled Efficiency Optimisation, a methodology acknowledged by financial theorists to be more robust than classical mean-variance optimisation.[8] This study compares the results of an optimisation analysis conducted in two cases, based on: 1) US-dollar assumptions (return, volatility and correlations), and 2) nine selected emerging-market currencies. The nine currencies were selected based upon their prominence and the degree to which the currency is 'managed' by their respective central banks. For a detailed review of study methodology, please refer to *Optimal gold allocations for emerging-market central banks,* April 2012.

Results from a US dollar perspective

The results of the US-dollar-numéraire analysis showed that a gold allocation improved risk-adjusted returns for low, mid and high levels of risk. The analysis suggested an optimal gold allocation from a dollar perspective ranged between 1.4% and 16.8%, with the mid-risk range between 4.6% and 7%, consistent with aggregate reserve allocations based on the IMF COFER data.

Table 1: Return and volatility of select reserve assets*

Assets	Return	Volatility
Barclays Capital US Treasury Aggregate	5.6%	4.8%
Barclays Capital US Agency Aggregate	5.5%	3.5%
J.P. Morgan German Bund Index (Euro)	5.0%	3.7%
J.P. Morgan Japan Bond Index (Yen)	2.0%	2.9%
J.P. Morgan UK Gilt Index (Sterling)	5.8%	5.2%
Gold (London PM fix, US$/oz)	13.5%	16.5%
Gold inputs used for this study	4.0%	16.5%

*Computed using weekly return data from March 1998 to June 2011.

Source: Barclays Capital, Bloomberg, J.P. Morgan, LBMA, World Gold Council

7 The selection of 4% is consistent with marginal outperformance of gold over inflation of between 1% or 2% over a long-term horizon against inflation, which is estimated to be between 2% and 3% in dollar terms.

8 Invented by Richard Michaud and Robert Michaud. US patents 6,003,018, 6,928,418, 7,412,414, 7624,060: Israel 138018. Worldwide patents pending. New Frontier Advisors LLC is a worldwide licensee.

In addition, despite gold's return being adjusted downward to 4%, gold's low correlation with other reserve assets resulted in the optimiser finding statistical significance in a gold allocation.[9] Finally, as illustrated in **Chart 1**, the lowest risk portfolio did, in fact, skew allocations toward dollar assets, allocating 92.2% of the portfolio to US agencies and US Treasuries, due substantially to their lower dollar-based volatilities.

Results from a domestic-currency perspective

The results of nine distinct optimisation analyses in emerging-market currencies show that allocations to gold are significantly higher in each currency examined relative to the allocation suggested by a US-dollar analysis. Indeed, optimising a typical emerging-market central-bank portfolio from a domestic-currency perspective for the sample of nine revealed that the US dollar-based optimisation consistently under-allocated to gold. The optimal gold allocation ranged from 2.4% to 25.8%, with a median gold allocation for the group of between 8.4% and 10%,[10] as outlined in **Chart 2**. In all currencies examined, reserve portfolios exhibited improved risk-adjusted returns when gold was added to the portfolio.

The stability of gold, and why higher allocations may be optimal

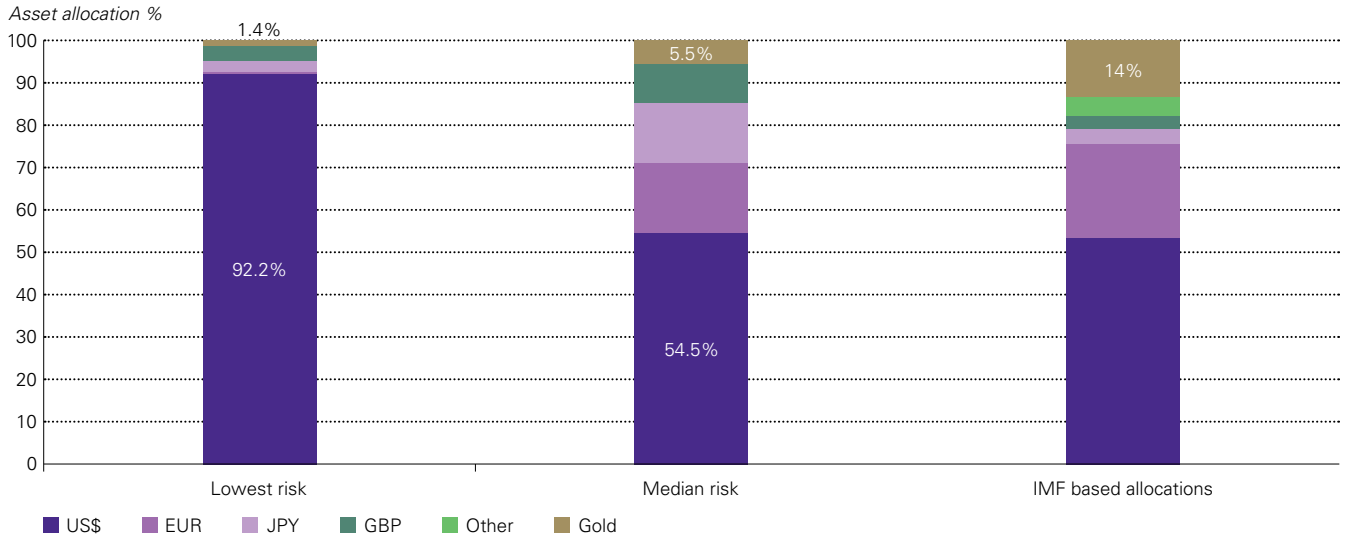
Another key finding was that gold exhibited relatively stable volatility when measured across a number of emerging-market currencies, in contrast to other primary reserve assets such as US Treasuries, European sovereign debt, Japanese JGBs, and UK gilts. This stability is underpinned by gold's negative correlation with the US dollar and supports higher optimal allocations to gold for most emerging-market central banks.

Comparing the optimal allocation to gold from a US dollar and domestic-currency perspective illustrates one of gold's intriguing qualities – and helps explain why, from a domestic-currency perspective, gold allocations should be higher in all nine currencies. The result is based on gold's behaviour, both as an asset and a currency. In US dollar terms, gold has the lowest information ratio and the highest volatility relative to all other reserve assets. However, when examined in each of these selected emerging-market currencies, gold's information ratio (while still the lowest) was far less affected by changes in the numéraire than other reserve assets.

9 Gold was statistically significant in 47 of 51 output portfolios at the 25% percentile level or at a 75% confidence level.

10 The majority of the results were significant at the 5% level. Furthermore, the minimum-risk portfolios for seven of the nine currencies were statistically significantly different from the minimum-risk portfolio conducted in US-dollar terms. Only the Korean-won and Polish-zloty portfolios were not statistically significantly different.

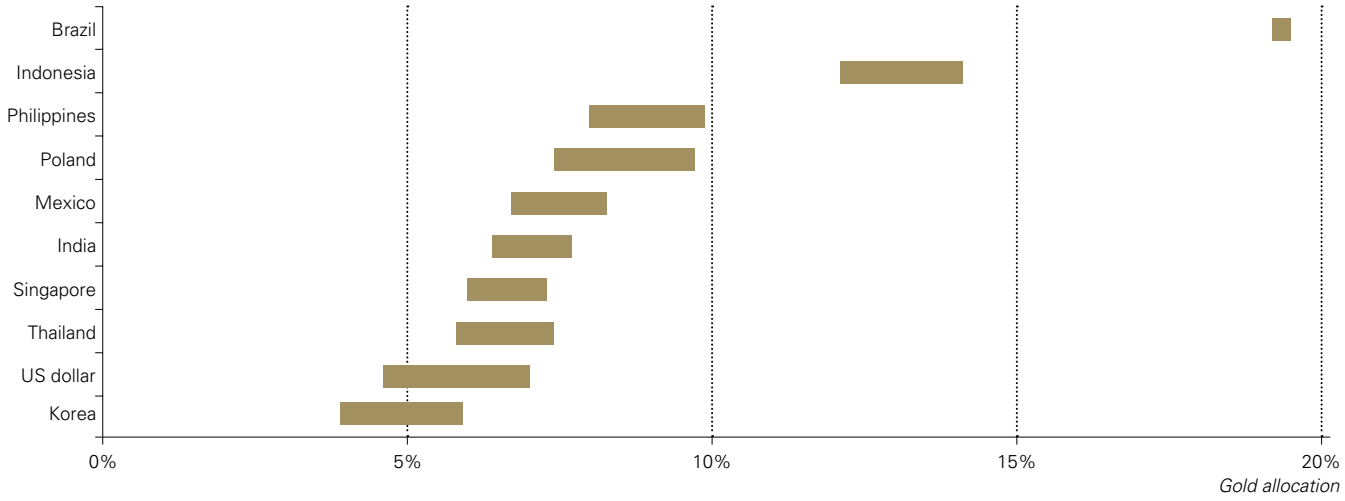
Chart 1: US dollar as numéraire – US-dollar bias in low risk portfolio versus median risk



*Foreign-reserves data as of Q3 2011. US agency bonds were constrained to a 25% maximum allocation.

Source: IMF data sourced from COFER, World Gold Council

Chart 2: Optimal gold allocation range by currency numéraire



Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

In fact, the average change in gold's information ratio when rebased in a foreign currency was zero. Meanwhile, the average decline in return per unit of risk for US Treasuries was approximately 0.6 and almost one full point for US agencies. Thus, despite having the lowest information ratio in US dollar terms, gold's information ratio is more stable across all currencies due to its relatively stable volatility contributing to improved risk-adjusted returns in reserve portfolios. **Chart 3** illustrates gold's similar volatility across a variety of currencies compared to the increasing volatility of US Treasuries.

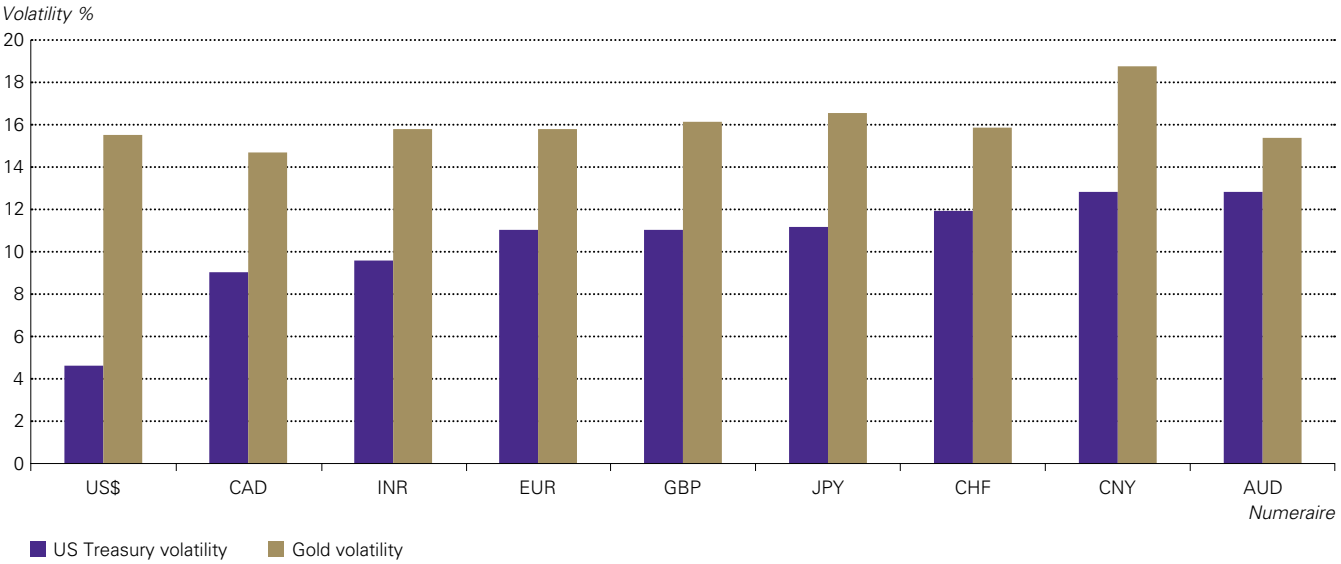
Gold's volatility is also significantly more stable than the volatility of other reserve assets in terms of the nine selected currencies. **Chart 4** shows changes in gold's volatility across emerging-market currencies compared to its US-dollar-based volatility, and illustrates that, on average, gold's volatility varied by only 1.7 percentage points. In addition, while sovereign debt is often considered a low-risk, low-volatility asset, the results of the study suggest it is much more volatile when considered from a non-US dollar perspective.

Gold's negative correlation with the US-dollar underpins its consistent volatility performance. Over the long term, gold has been negatively correlated to the US dollar, partly because gold's price is typically referenced in US dollar terms. The logic behind this phenomenon can be demonstrated as follows: when the Mexican peso appreciates against a weakening dollar, gold is likely to also appreciate given its negative relationship with the dollar, which means that the Mexican peso and gold will tend to move in the same direction – thus reducing the volatility of the Mexican peso/gold (MXNXAU)[11] pair. Gold's negative correlation with the US dollar is one of the reasons that many central-bank reserve managers consider it particularly attractive: it can serve as a hedge against dollar assets. Since 2000, gold has exhibited a -0.44 correlation coefficient with the trade-weighted US dollar index.[12]

Potential effect of central bank re-allocation on gold demand

Emerging-market central banks have an average allocation of approximately 4.6% to gold. A reallocation to the optimal levels shown in this analysis would represent at least a four percentage-point increase. In other words, assuming no growth in foreign-exchange reserves, emerging-market central banks need to almost double their gold allocation to achieve the optimal levels found in this study **(Chart 5)**. Thus, to increase gold allocations across all emerging-market central banks to an average 9% of total reserves, central banks would need to buy nearly 6,000 tonnes of gold – roughly 1.5 times the annual gold demand. This assumes that foreign-exchange reserves, which have grown by over 15% per annum over the past twelve years, stop growing. Factoring in a 15% growth in foreign reserves would increase gold demand by an additional 1,700 tonnes.[13] Clearly, central banks are unlikely to make any sudden or drastic redistribution of assets, but the results of this study and the continued interest from central banks for gold since 2009 are very supportive of significant ongoing demand from this sector.

Chart 3: Gold and US Treasury volatility in different currencies*



*Monthly return data from December 1987 – October 2012 used for this computation.
Barcap US Treasury aggregate index was used for US Treasuries and London PM fix for gold.

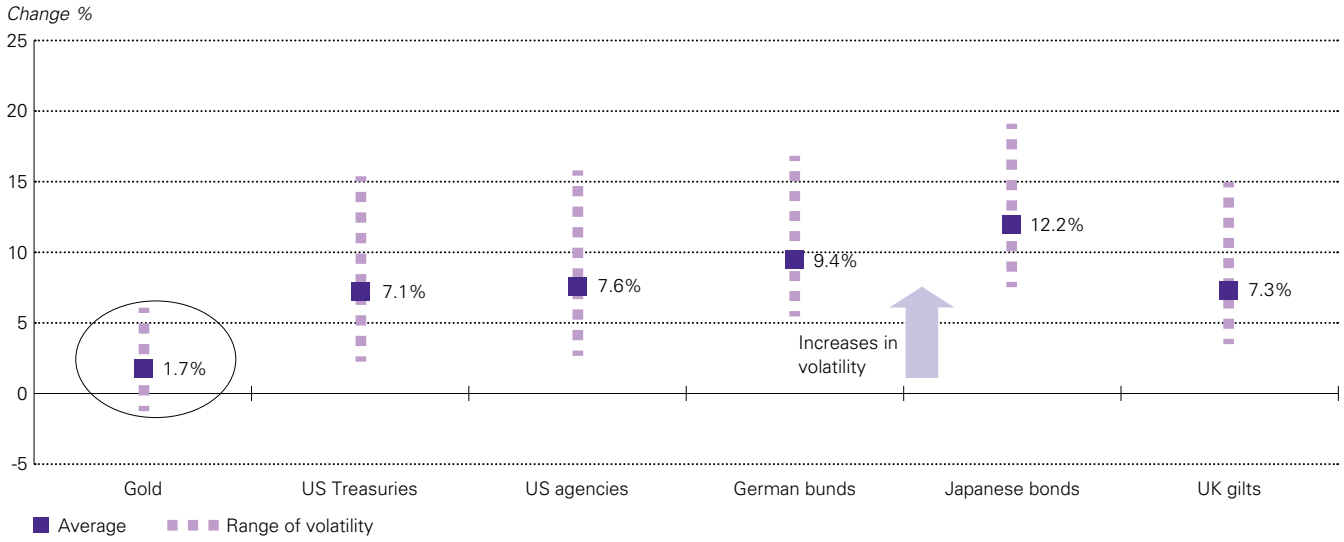
Source: Bloomberg, World Gold Council

11 MXNXAU is the common approach to quoting currencies, with MXN signifying Mexican peso and XAU signifying gold, thus gold in Mexican pesos.

12 Correlation computed utilising the daily gold price and dollar trade-weighted index sourced from Bloomberg, using monthly data between 2000 and 2011.

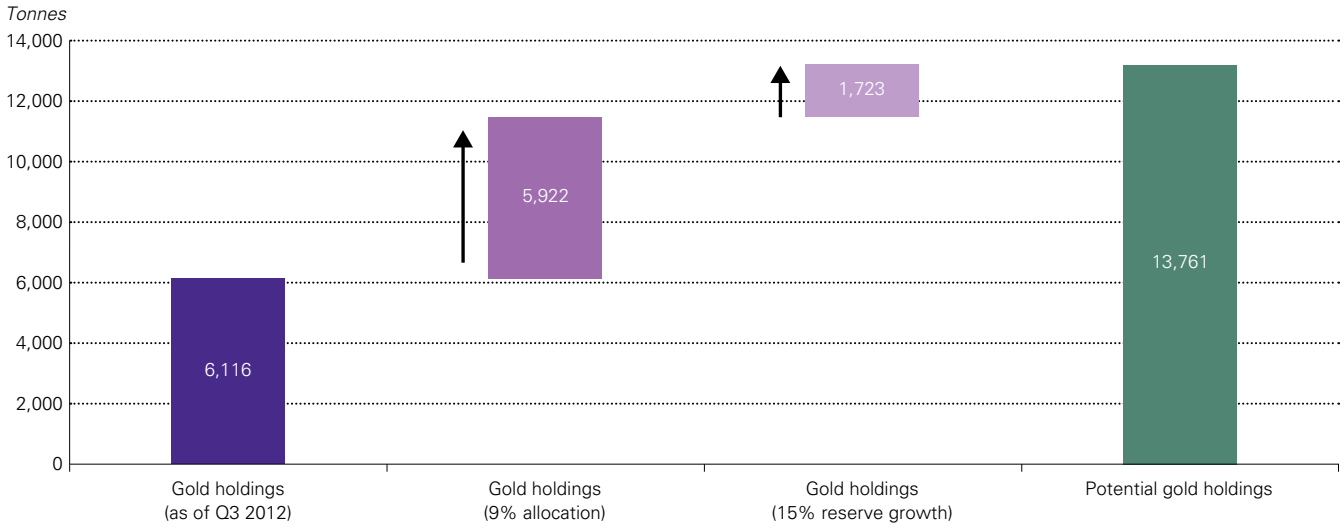
13 A detailed analysis of emerging-market central-bank reserves can be found in the Appendix.

Chart 4: Range of impact on volatility from translating assets into emerging-market currencies



Source: Barclays, Bloomberg, J.P. Morgan, World Gold Council

Chart 5: Emerging-market central-bank potential demand*



*9% allocation is in the range of optimal gold allocation in non-US$ numeraires. 15% reserve growth is approximately equal to the current growth rate of FX reserves.

Source: IMF IFS Statistics, World Gold Council

Conclusion

Gold should form an integral part of a central bank's foreign-reserve portfolio, especially in emerging markets. The optimal allocation to gold is consistently higher when considered from a domestic-currency perspective, with a resulting mid-risk optimal allocation to gold of between 8.4% and 10% (compared with 4.6% to 7% in dollar terms). Additionally, including gold in the investment universe improved risk-adjusted returns for all nine emerging-market currency optimisations. Our analysis points to gold's consistent volatility across currencies, especially relative to that of other reserve assets, like sovereign debt. When comparing gold to these other reserve assets, reserve managers will already be aware of gold's liquidity and lack of credit risk, but may also benefit from conducting an analysis to complement their US-dollar-based strategies. We have shown that analysing a reserve portfolio from the perspective of emerging-market currencies can provide useful information to portfolio managers on the optimal composition of foreign reserves. In particular, we found that gold's optimal allocation, when seen from a domestic-currency perspective, is higher than suggested by a US-dollar analysis. As central banks re-allocate to reflect these optimal allocations in an environment of rising reserves, their gold purchases need to increase to keep pace.

Appendix

Table 2 : EM central-bank gold purchases (sales) in tonnes as a function of FX-reserve growth and average gold allocation*

Reserve growth	Average gold allocations							
	4%	4.6%	5%	6%	7%	8%	9%	10%
-15%	(1,532)	(875)	(385)	761	1,907	3,053	4,199	5,345
-12%	(1,378)	(700)	(194)	990	2,175	3,359	4,544	5,728
-9%	(1,225)	(525)	(3)	1,220	2,443	3,665	4,888	6,111
-6%	(1,072)	(350)	189	1,450	2,711	3,972	5,233	6,494
-3%	(919)	(175)	380	1,680	2,979	4,278	5,577	6,877
0%	(766)	-	572	1,909	3,247	4,584	5,922	7,260
3%	(613)	175	763	2,139	3,515	4,891	6,267	7,642
6%	(459)	350	955	2,369	3,783	5,197	6,611	8,025
9%	(306)	525	1,146	2,599	4,051	5,503	6,956	8,408
12%	(153)	700	1,338	2,828	4,319	5,810	7,300	8,791
15%	0	875	1,529	3,058	4,587	6,116	7,645	9,174

*Reserve growth is a total figure and does not represent growth per annum. This analysis assumes a steady gold price of US$1776/oz – which represents the London PM fix of 28 September 2012. FX and gold reserve data is as of Q3 2012.

Source: IMF, World Gold Council

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