

Gold: alternative investment, foundation asset



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 in government affairs, 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 the 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 include the world's leading and most forward thinking gold mining companies.

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Executive summary

Diversified portfolios which contain non-traditional (or “alternative”) assets such as private equity, hedge funds, real estate and commodities can be enhanced by adding a discrete allocation to gold as a foundation.

In the current economic environment, low real yields around the globe incentivise investors to look for additional sources of return, while higher uncertainty and market volatility have increased the importance of risk management. Coupled with the corrosive effects of extreme (tail-risk) events, this has further advanced alternative investments for a wider group of investors.

Whereas many alternative asset classes have gained in acceptance among professional investors looking to increase their risk-adjusted returns and add diversification, allocations to gold remain small. However, gold produces benefits that separate it from other alternative investments. It is not only an ideal source of diversification for an investor’s portfolio, but also provides a foundation which investors rely on to manage risk and preserve capital more effectively, especially in times of financial turmoil when stability is needed the most. Moreover, an allocation to gold provides investors with the confidence to invest in a wider range of strategies including alternative assets.

In previous studies, analysis by the World Gold Council has shown that adding gold to portfolios holding traditional asset classes and commodities tends to increase risk-adjusted returns and reduce Value at Risk.¹ To test the case for gold further, we set out to analyse its effect within a portfolio which includes mainstream as well as non-traditional assets. We find that by adding an allocation to gold of between 3.3% and 7.5%, an investor can obtain a desired expected return while incurring less risk than on an equivalent portfolio without gold.² In other words, gold enhances portfolio performance.

We find that gold’s optimal allocation is statistically significant (greater than zero) not only for portfolios with standard allocations to equities, fixed income and alternatives,³ but for a whole range of combinations of traditional and non-traditional assets. Put simply, even if investors hold alternative asset classes, gold can improve portfolio risk-adjusted returns and reduce extreme losses. The analysis holds true for investors with various levels of risk tolerance and diverse allocations denominated in US dollars, euro and pounds sterling.

Our analysis establishes a sound case for adding gold to a diversified portfolio which includes alternative assets. Indeed, we show that potential losses tend to diminish without sacrificing long term returns. Given the current financial environment, we also examined past performances of diversified portfolios during recent periods of financial stress. Our analysis shows that, in general, portfolios which include gold tend to perform better (by increasing gains or reducing losses) than those that do not hold gold, during periods of financial uncertainty. In other words, gold acts as a cost-effective form of protection that does not affect and sometimes benefits long-term expected returns, while reducing risk when it is needed most.

1 World Gold Council, *Gold as a tactical hedge and long-term strategic asset*, August 2009 and *Gold: hedging against tail risk*, October 2010.

2 This result is consistent with previous findings in other research notes by the World Gold Council, New Frontier Advisors and Oxford Economics that indicate that long-term optimal allocations to gold range between 2% and 10% for more traditional portfolios that include only stocks, bonds and/or commodities.

3 For the purpose of this paper, a standard portfolio refers to one with 55% allocation to equities, 25% to fixed income, at most 5% to cash, with the remaining 15%-20% distributed optimally among alternative assets. A conservative portfolio is defined as one with 30% equities, 50% fixed income, at most 10% cash and the remaining 10%-20% distributed optimally among alternative assets.

Alternative assets: a portfolio in context

One of the tenets of portfolio theory is that, over the long run, a well balanced asset allocation increases a portfolio's risk adjusted returns. In other words, even if a particular asset or asset class may outperform another, a portfolio containing both assets can deliver higher risk-adjusted returns than the individual components as a by-product of their correlation structure.

Historically, many investors relied on a simple combination of equities, cash and bonds to diversify their portfolios. However, such a simple allocation does not always lead to optimal diversity, especially in periods of turmoil. The effects of the financial crisis have served to remind today's investor of the importance of asset allocation in generating and protecting investment return. An increasing number of professional investors, financial advisors and individual investors use additional investment strategies that can increase their returns without being directly tied to equity or bond market performance. These types of investments are typically grouped under the umbrella of alternative investments. In broad terms, an alternative asset is any asset with potential economic value that is not a stock, bond or money market instrument.⁴ A brief background to each of the alternative assets under consideration can be found in Appendix 1.

Overall, the importance of alternative assets to portfolio construction centres on the understanding that they tend to have low correlations with traditional assets and offer economic value⁵ In turn, alternative assets are expected to increase risk-adjusted returns in a portfolio.

Over the past decade, alternative assets such as private equity, hedge funds, real estate and the general commodities complex have gained acceptance among professional investors looking to increase risk-adjusted returns. For example, assets under management (AUM) of global private equity funds have grown from less than US\$400 billion in 2001 to over US\$2.4 trillion by 2010⁶ Similarly, the largest hedge funds collectively hold US\$1.9 trillion in AUM, having more than tripled in size since 2001.⁷

The attraction of investing in more active strategies such as hedge funds lies in access to proprietary information and expertise that may allow an asset manager to outperform a given benchmark without increasing risk. With private equity, an investor can access businesses and long-term development projects (not typically accessible through open markets) that would otherwise be unpractical or unfeasible to manage directly while adding diversification to a portfolio. Commodities and real estate can offer exposure to underlying economic growth and increased demand for scarce assets.

4 Not long ago, most of these traditional assets were primarily concentrated in local markets. For example, a US investor would hold US stocks and bonds, and not have much exposure to international let alone emerging markets. Similarly, the holdings of UK or European investors would be "home-biased". As financial markets have evolved and the global economy become more intertwined, investors have incorporated international holdings as an integral part of their portfolio.

5 In financial terms, these characteristics relate to the "beta" and "alpha" of a portfolio.

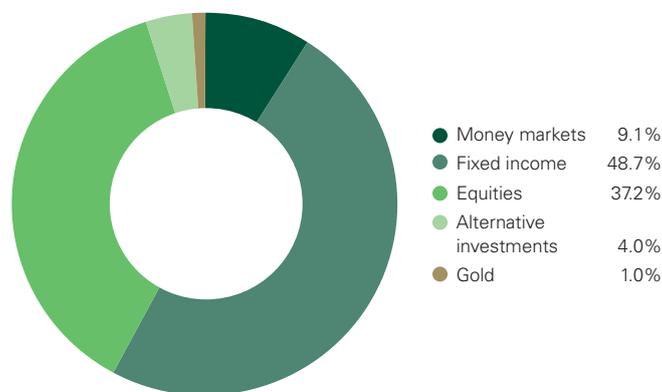
6 Based on data by Preqin.

7 Based on data by Hedge Fund Research (HFR). Funds included have at least US\$50 million under management or have been actively trading for at least twelve months.

The complexity, volatility and uncertainty present in today's financial landscape have only further underlined the importance of investment expertise and conviction in selecting and executing such strategies. Stripping out returns, hedge funds and private equity AUM have grown by 86% and 145% respectively, much greater than the 24% increase in gold holdings by investors over the last 10 years. Contrary to popular belief, gold is still an under-owned asset: it is estimated that gold bullion holdings by the end of 2010 accounted for approximately 1% of global assets under management (Chart 1).

Under-allocation to gold is even more pronounced among institutional investors, many of which only have gold exposure as a small component within a broader commodity index. Furthermore, investors who choose to access gold through a commodities index are not only under-allocated but they do not benefit from the risk management advantages gold can offer.⁹ By way of example, for an investor with an overall 5% allocation to a benchmark commodity index such as the S&P Goldman Sachs Commodity Index or the Dow Jones-UBS Commodity Index, the effective exposure to gold can be as low as 0.1% and only as high as 0.4%.

Chart 1: Distribution of investor global holdings by asset class as percentage of total (est:US\$146 trillion; Dec 2010)*



*Figures are estimated using: global market capitalisation of all publicly traded stocks and REITs; total value of outstanding bonds & money market instruments; total open interest of commodity futures plus above ground stocks of metals in private hands; assets under management of private equity and hedge funds; and private holdings of gold bullion. Central bank holdings of gold and bonds were excluded.

Source: BIS, Hedge Fund Research, J.P. Morgan, Preqin, World Federation of Exchanges, World Gold Council

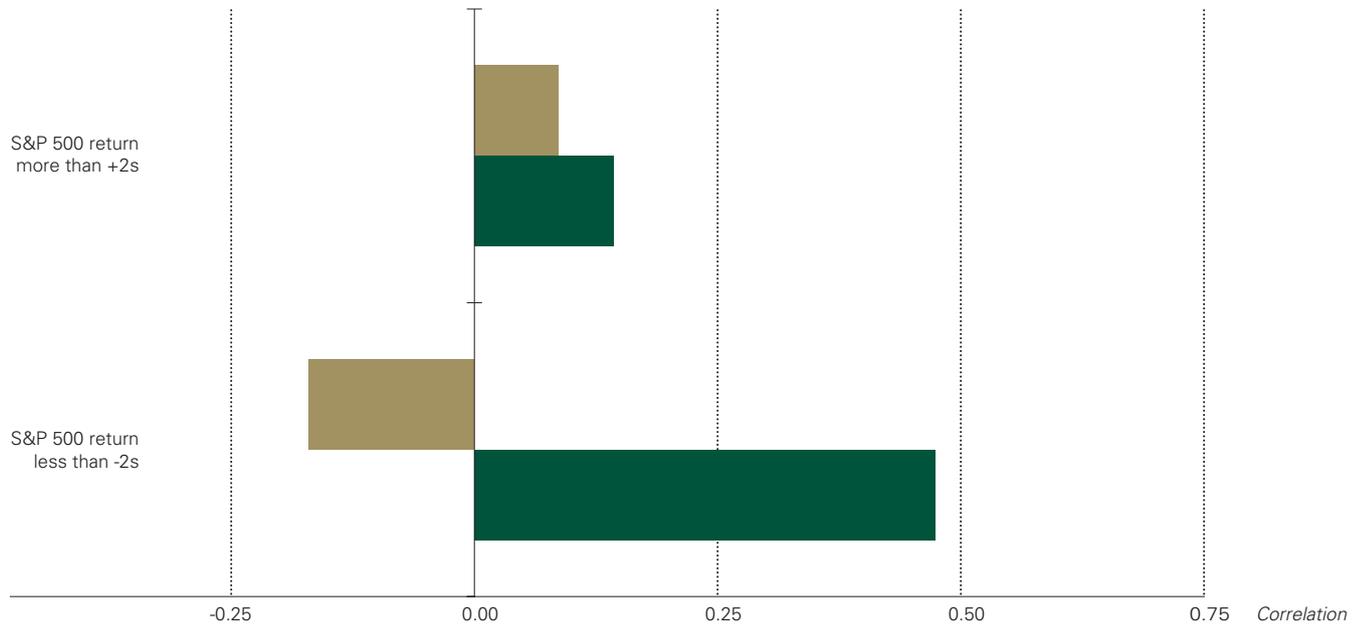
8 Assets under management go up or down depending on 1) performance of the underlying assets and 2) capital flows. Here we refer to the growth only due to new money coming into the asset class. Computations based on changes in assets under management net of index performance. Data sourced from Preqin and Hedge Fund Research.

9 World Gold Council, *Gold: a commodity like no other*, April 2011.

In healthy economic environments with robust growth and low inflation, many alternative assets add diversification and increase value to an investor's portfolio. However, this does not hold true under every economic scenario. Performance of private equity, hedge funds, natural resources, real estate and most commodities tends to be linked to the business cycle. Private equity is influenced by the availability of discretionary income and credit. Similarly, hedge funds are influenced by risk tolerance, access to capital and positive economic growth. Commodities are inputs into industry and manufacturing and thus subject to economic cycles. Real estate has two components: the underlying valuation on the property and income generated; while the latter may be less susceptible to cycles, the former ebbs and flows with private and corporate wealth. Therefore, during an economic downturn price performance of these alternative investments follows suit and their correlation to assets, such as equities, increases (Chart 2).

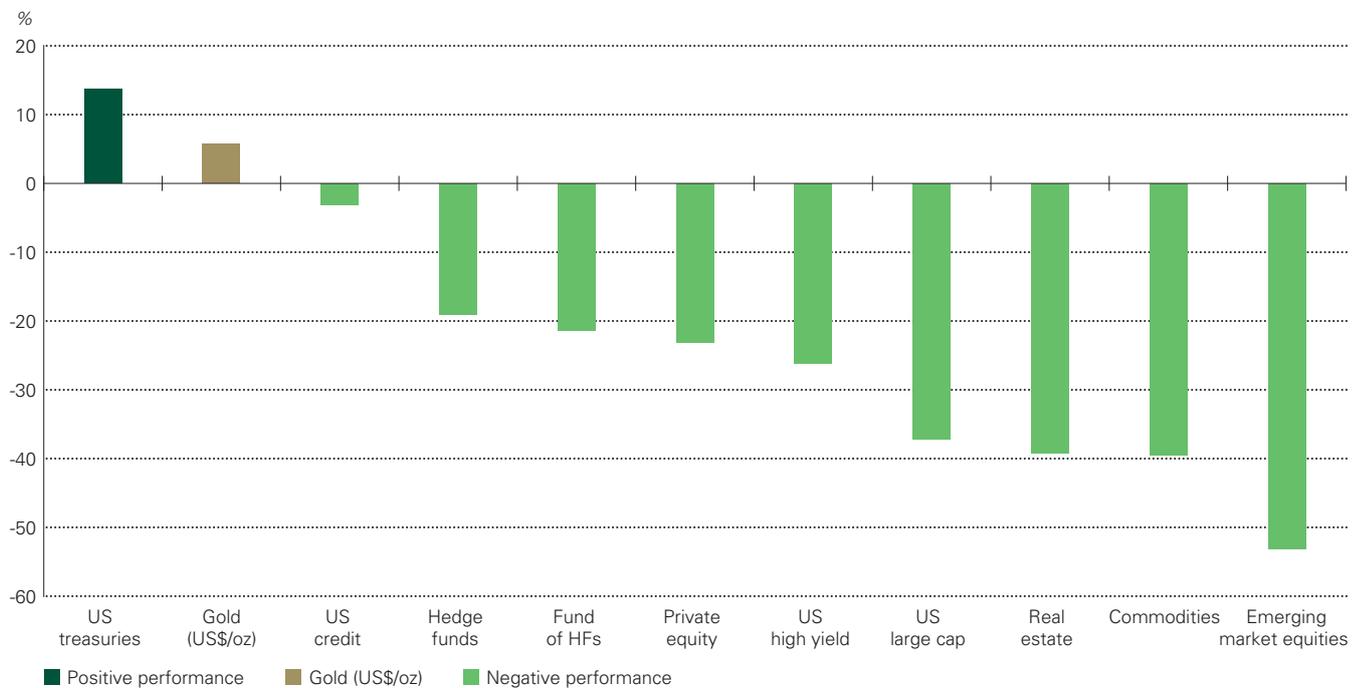
Conversely, gold's distinct characteristics stand out. There is a growing body of evidence that confirms the unique characteristics that make gold an effective foundation asset which enhances portfolio performance, while reducing losses in times of economic turmoil (Chart 3). It is a truly global asset that is influenced by economic growth of emerging economies, the activities of central banks as they manage foreign reserves, applications in new technologies, and the stability of financial markets.

Chart 2: Weekly-return correlation between equities, gold and commodities when equities move by more than 2σ; January 1987 to June 2011



Source: LBMA, Bloomberg, World Gold Council

Chart 3: 2008 performance of various assets in US dollars



Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Gold: enhancing portfolio performance

Asset and period selection methodology

To understand how gold enhances portfolio performances in the presence of alternative investments we look at performance, liquidity, risk profiles and correlation structure.

Given the broad definition of alternative assets, for the purpose of this study we have concentrated on the most popular alternatives investments. These include private equity (including venture capital and infrastructure), hedge funds, funds of hedge funds, real estate investment trusts (REITs), commodities and gold.¹⁰ The rationale behind choosing this particular subset is threefold: data availability, practical applications, and accessibility/liquidity. Furthermore, investments in private equity or REITs can, in theory, offer exposure to less liquid investments such as farmland, timber, etc.

The underlying data for this study is a collection of indices which represent assets typically held by investors over a long period of time. Ideally, data going back as far as 1972 would be used, as this marked the first year after the closure of the gold window thus allowing the gold price to float freely. However, the modern investor typically holds many more assets in a portfolio than were readily available in the 1970s and early 1980s and for which reliable data is obtainable. Examples include high yield bonds, and emerging markets bonds and equity markets.

Furthermore, many alternative asset strategies such as hedge funds did not emerge until much later. Thus, the period under consideration for this analysis spans from January 1987 to June 2011 for which most data series are available. Moreover, this period of almost 25 years includes at least three business cycles and multiple market crashes.

The information available differs by asset class. Most traditional assets along with gold, commodities and REITs are well documented and easily accessible. However, robust hedge fund and private equity data is not easily accessible as they form limited partnerships. For traditional assets, we use a selection of well known indices as proxies for cash, foreign currency, domestic and international bonds, small, mid and large cap domestic equities as well as international and emerging market equities. For hedge funds and private equity, we use data provided by Hedge Fund Research and Thomson Reuters respectively. REITs are represented by commonly used benchmarks from the US, UK and Europe. Similarly, for commodities we concentrate on a diversified basket computed by S&P and Goldman Sachs. Finally, for gold we use the spot price of bullion as the most relevant proxy for performance. A detailed list of the indices used in each category can be found in Appendix 2.

Gold's relative performance to other assets

Table 1 shows individual asset performances from the perspective of a local US investor. Seen in isolation, gold's risk-adjusted returns are not the highest. However, gold's volatility and Value at Risk (VaR)¹¹ is lower than that of equity indices. It is important to note that, while hedge fund and fund of hedge funds (FoHF) composites exhibit lower volatility and VaR than gold, these indices represent an idealised hedge fund performance which in practice is rarely attainable by the majority of investors as they typically access only a few hedge funds rather than a diversified pool of strategies and managers. In turn, the risk of investing in particular hedge funds may be higher and performance lower.

Gold's positive attributes in a portfolio from a risk management perspective stem from its interactions with other assets. In addition, gold returns tend to outperform other assets in periods of economic and financial turmoil (Chart 4) allowing investors to reduce risk when it is most needed. Gold's appeal is not restricted to US dollar-based investors.

Global investors can also benefit. For example, Table 10 and Table 11 in Appendix 2 show that investors whose portfolios are denominated in euro or pounds sterling benefit from holding gold in their portfolio. It offers a distinct performance with lower volatility and expected losses than many of the assets held in a typical portfolio.

¹⁰ We exclude the more esoteric alternatives including art & antiques, wines, stamps, coins and other collectibles as well as direct holdings of real estate or natural resources such as farmland.

¹¹ VaR is a measure of the maximum amount an investor could expect to lose in a given period of time, with a certain degree of confidence, in the event of an unlikely yet possible event occurring. More formally, the VaR of a portfolio at given confidence level $(1-\alpha)$ is the maximum expected loss such that the probability that any other loss exceeds that value is no greater than for a defined period of time.

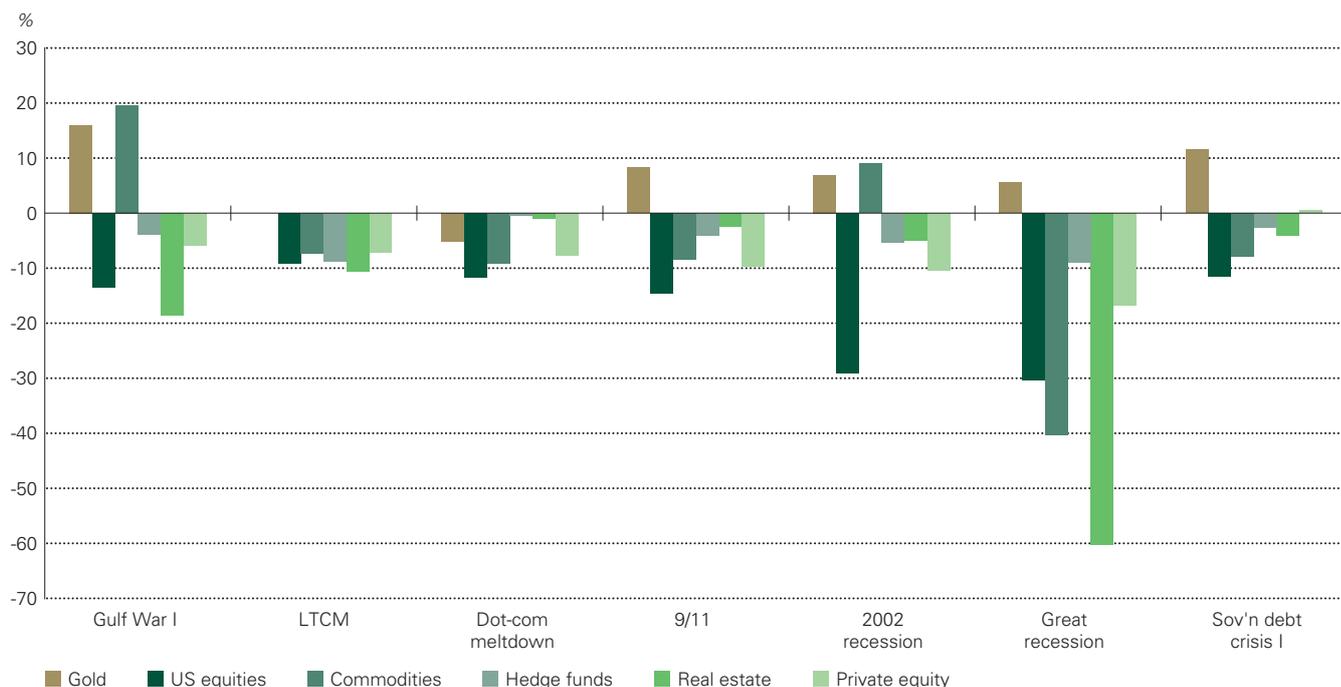
Table 1: Performance of selected assets in a model portfolio from a US dollar perspective¹

Asset name	CAGR ²		Real annual volatility (%) ³	Information ratio ⁴	Monthly VaR \$'000s Confidence level (%) ⁵	
	Real	Nominal			97.50%	99%
US cash	1.9%	4.9%	1.1%	1.72	n.a.	n.a.
Global cash	3.4%	6.4%	9.0%	0.37	452	548
US treasuries	3.8%	6.8%	4.9%	0.76	235	263
US credit	4.5%	7.6%	5.5%	0.83	238	336
Global bonds	4.6%	7.6%	9.3%	0.50	446	560
US high yield	5.5%	8.6%	9.0%	0.61	543	741
US large cap	6.6%	9.7%	15.7%	0.42	878	1,147
US small cap	6.2%	9.3%	20.0%	0.31	1,160	1,541
US mid cap	8.4%	11.5%	17.3%	0.49	989	1,252
Developed world equities	3.6%	6.6%	17.7%	0.20	1,034	1,391
Emerging market equities	10.6%	13.7%	23.9%	0.44	1,277	1,661
Gold (US\$/oz)	2.7%	5.6%	14.6%	0.18	699	909
Commodities	4.4%	7.8%	20.5%	0.22	1,177	1,340
Hedge funds	8.8%	11.8%	7.0%	1.27	286	462
Fund of HFs	5.0%	7.9%	5.7%	0.87	265	459
Real estate	6.0%	9.1%	19.4%	0.31	961	1,835
Private equity	10.8%	14.1%	13.5%	0.80	620	924

1. The data used for this chart ranges from January 1987 to June 2011.
 2. CAGR: compounded annual growth rate (geometric average return).
 3. Volatility based on historical real returns.
 4. Information ratio is computed as real return divided by volatility.
 5. Expected maximum loss during a month at a given confidence level (1- α) from a US\$10mn portfolio.
- 'n.a.' = not applicable

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Chart 4: Return on alternatives during periods of turmoil in US dollars



Notes: Persian Gulf War I: Q3 1990, LTCM: Q3 1998, Dot-com meltdown: Q1 2001, 9/11: Q3 2001, 2002 recession: Q2/Q3 2002, US Credit Crisis: Q4 2008/Q1 2009, European sovereign debt crisis: Q2 2010.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Risk management and diversification

Gold is a highly effective vehicle for diversification and risk management because of its independence from other asset classes. Gold's volatility is not only typically lower than commodity and real estate indices but also lower than equity indices, including the developed market equity indices (such as the S&P 500, FTSE or DAX) and especially emerging markets equity indices. For example, gold had 14.6% annualised volatility between January 1987 and June 2011 compared to 15.7% for large cap, 17.3% for mid cap and 20.0% for small cap US equity indices (Chart 5). Note that for this particular example we are comparing gold, a single asset, to indices that comprise many, even hundreds of holdings. These indices benefit from diversity and offsetting effects by holding multiple assets. When compared to the individual index components, gold's volatility is relatively lower.

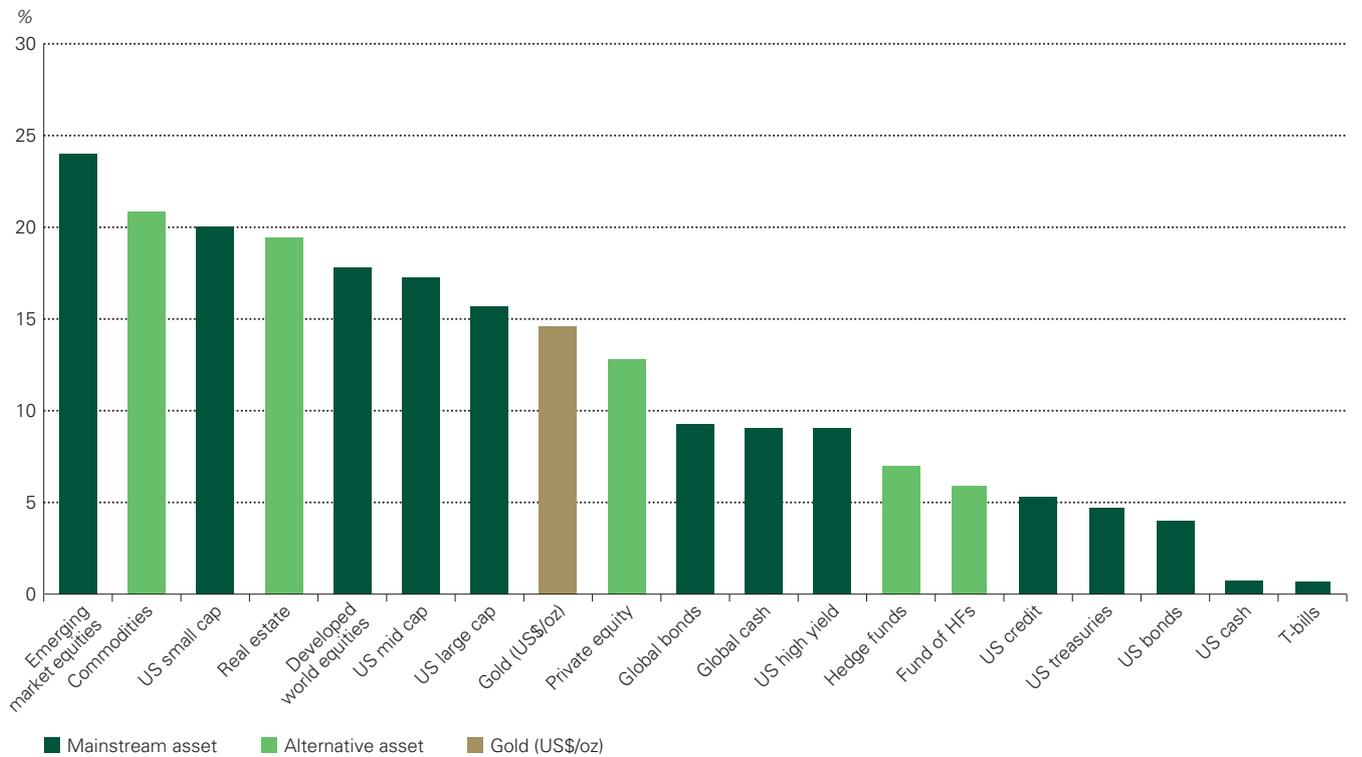
Furthermore, during periods of financial turmoil in which equity indices tend to fall sharply and volatility increases, gold's volatility remains much lower than that of equities. In addition, gold's return distribution is positively skewed, contrary to the behaviour of most assets, including equities and commodities. In other words, gold's volatility is lower when prices are falling than when they are rising.

In the context of portfolio risk management, the correlation structure of all assets combined with individual asset volatilities defines the overall level of risk of a portfolio. One of the reasons investors choose to add some alternative assets to the portfolio mix is because these non-traditional assets tend to exhibit lower correlations to mainstream assets like equities and fixed income while maintaining similar or potentially higher expected returns. Lower correlations between assets help investors achieve superior risk-adjusted returns.

In general, gold consistently exhibits low to negative correlations to mainstream assets as well as alternative asset classes (Chart 6). Moreover, as shown in previous studies, gold gives investors much needed diversification not only during normal economic periods but especially in periods of economic and financial turmoil.¹² For investors, this translates into enhanced portfolio performance and is central to the case for gold as a foundation asset.

¹² World Gold Council, *Gold: hedging against tail risk*, October 2010.

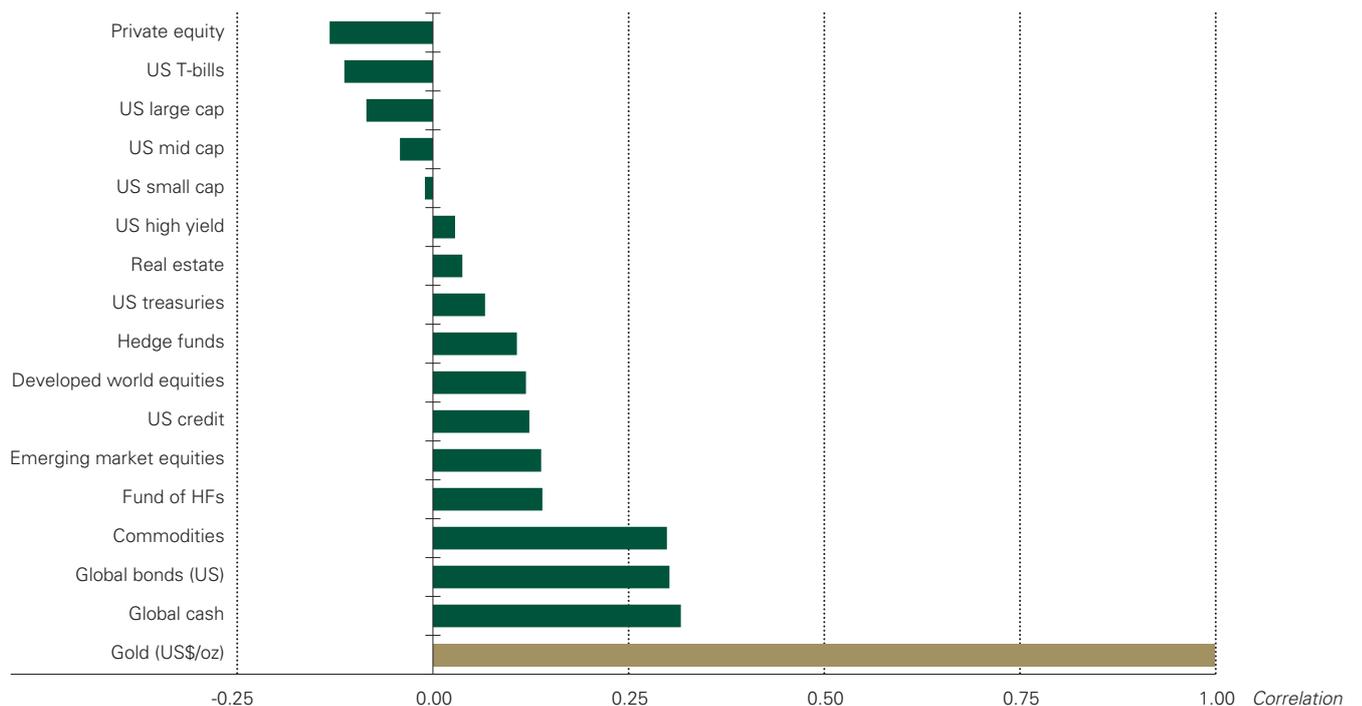
Chart 5: Annualised volatility of various asset classes in US dollars*



*Annualised volatility based on monthly returns on available data from January 1987 to June 2011.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Chart 6: Gold's correlation to other asset classes in US dollars*



*Based on monthly returns in US dollars.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Many alternative assets by design and structure may provide diversification. Commodity indices and even REITs, for example, tend to have a lower correlation to equities than other mainstream assets. However, the correlations of most alternative assets to equities are not as low as gold's. Gold even shows negative correlation to local equity indices denominated in US dollar, euro or pound sterling (Chart 7). In contrast, hedge fund and to a lesser extent private equity indices have much higher correlations to equities. Thus, while these types of investments can bring additional sources of return, they are still heavily exposed to swings in equity markets. In this sense, gold allows investors to achieve "true" diversification of risk and achieve better risk-adjusted returns. Gold possesses many attributes that allow it to complement and enhance existing portfolio allocations.

Gold's unique demand and supply dynamics ensure its role as a true diversifier for investors. Gold demand is broadly distributed between jewellery, technology and investment, and while jewellery is the largest component of demand (approximately 50%); private investment and more recently central bank net purchases, account for an additional 39% of demand; and applications to technology and other types of fabrication make up the remaining 11%. In general, economic growth spurs demand for gold in the form of jewellery, whereas recessions promote buying gold as a store of value. In turn, this creates a balance that drives gold's lack of correlation to other assets.

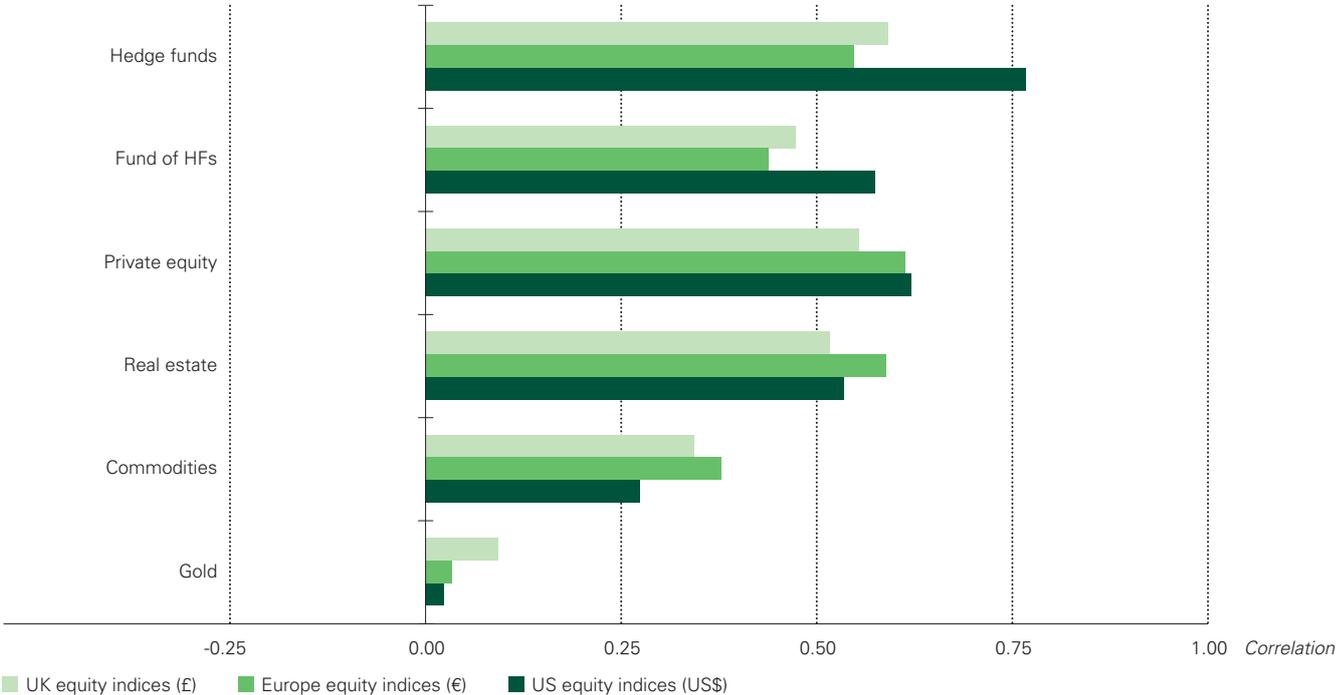
A second key factor related to gold demand is its broad geographical distribution (Chart 8). In fact, the Asian axis of India and China, gold's cultural heartland, plays an increasingly important role within the gold market. They collectively account for over 45% of all demand,¹³ reducing the traditional dominance of developed countries. In turn, this creates a balance between East and West that enables different sectors of gold demand to flourish even in periods which may not be favourable for other sectors or regions.

Another element of gold's unique attributes is the two remaining sources of supply. Mine production accounts for approximately 60% of global gold supply, leaving another 40% to recycling activity. Given that gold mine production is also spread around the globe, gold's price performance tends to be less subject to geopolitical and other idiosyncratic risks than many commodities.¹⁴ Recycled gold constantly re-enters the market thereby providing a balancing factor which can further absorb shocks to the supply chain. Central banks used to provide the market with a third source of supply, however, as European central banks have slowed down their net sales of gold reserves and emerging market central banks have increased their purchases, the official sector has now become a net source of demand.

¹³ Based on 2010 demand figures. Includes demand for jewelry, bars, coins, ETFs and technology.

¹⁴ World Gold Council, *Gold: a commodity like no other*, April 2011.

Chart 7: Average correlation to equity indices in various currencies*



*US equity indices include: MSCI US, Russell small cap, Russell mid cap, MSCI EAFE and MSCI emerging markets. European indices include: MSCI Europe, MSCI Europe small cap, MSCI US and MSCI emerging markets. UK indices include: MSCI UK local, FTSE UK small cap, MSCI World ex UK and MSCI emerging markets.

Source: Bloomberg, Hedge Fund Research, Thomson Reuters, World Gold Council

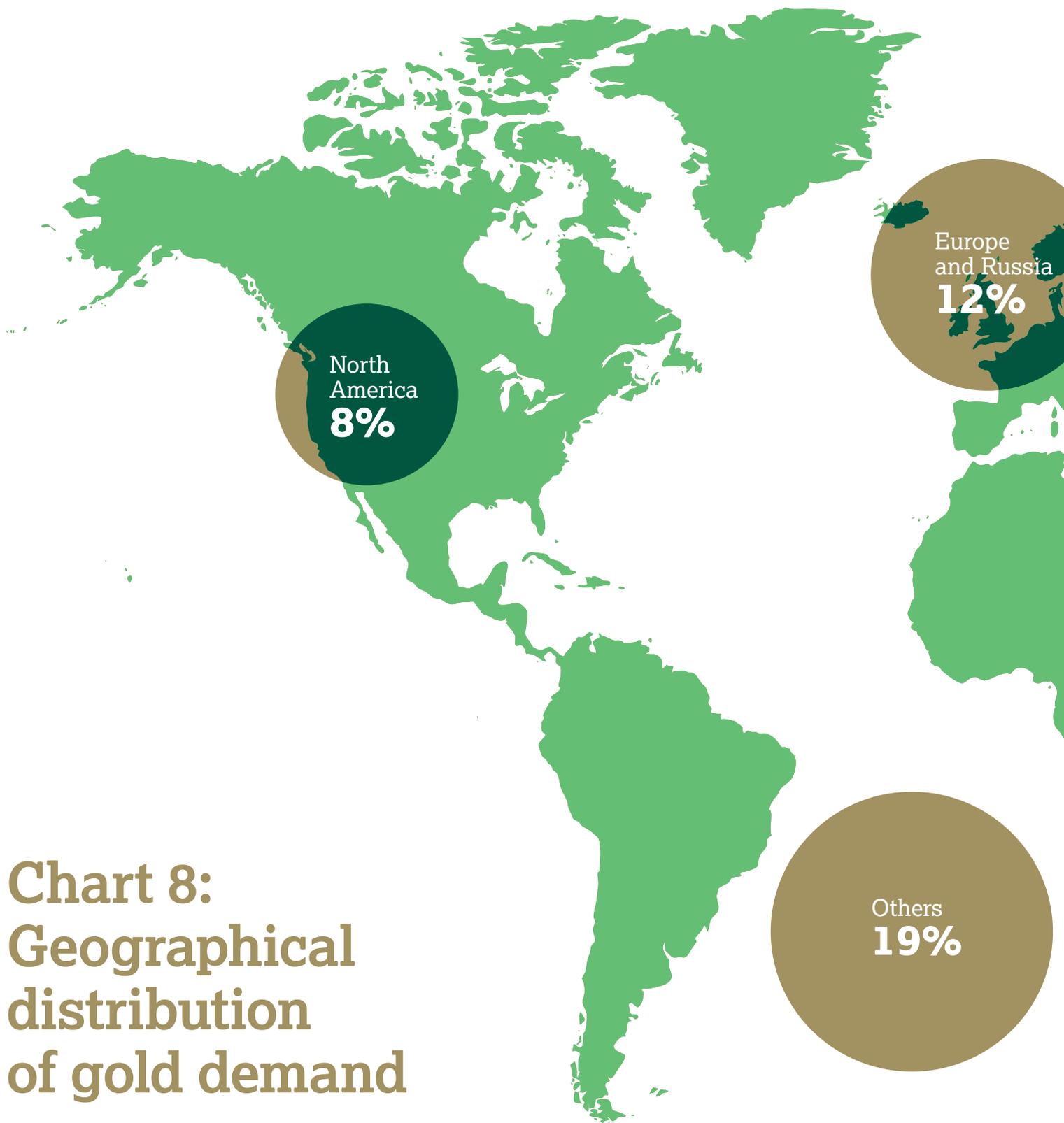
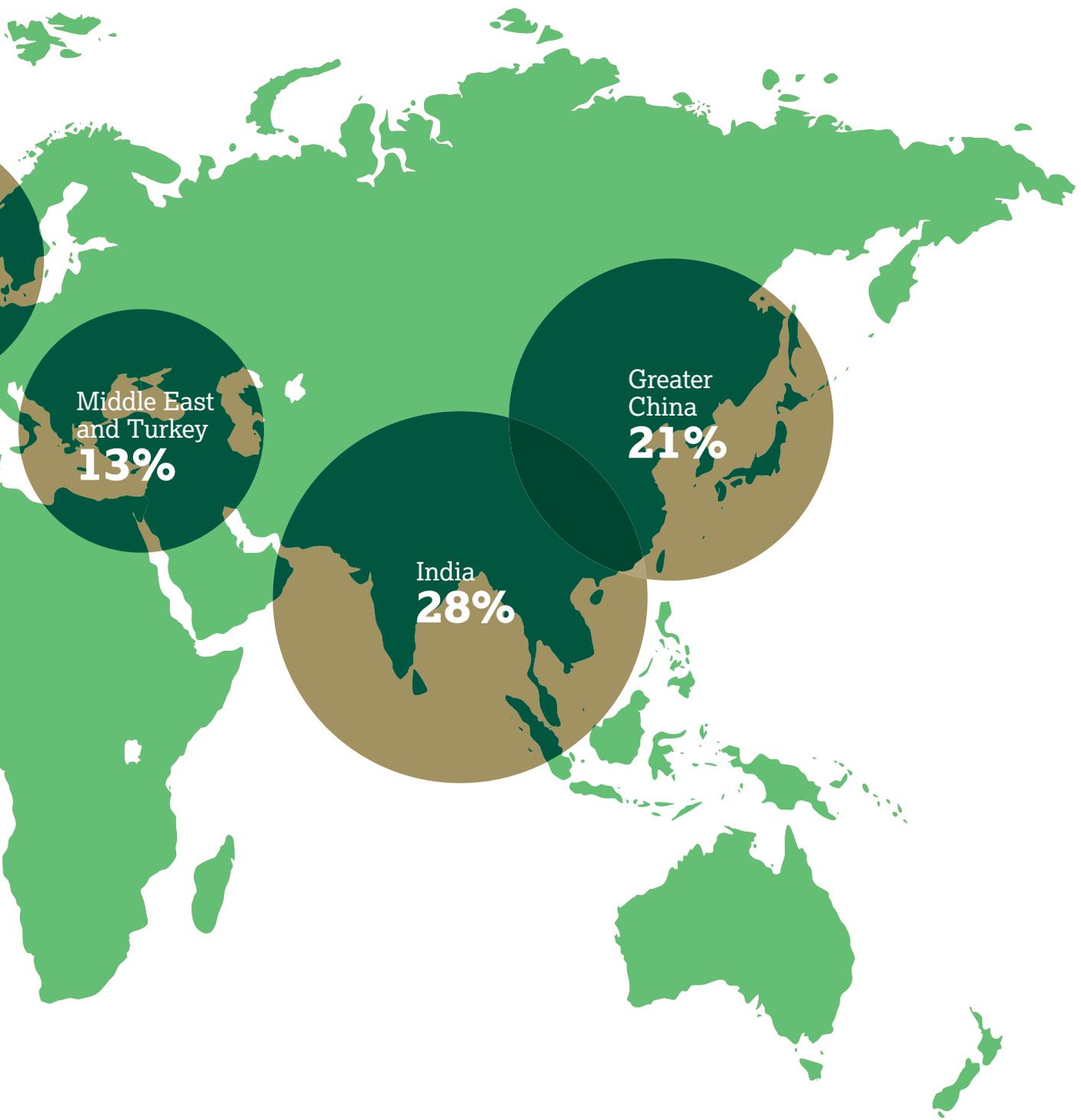


Chart 8: Geographical distribution of gold demand

Based on 2010 tonnage, demand includes jewellery, bar and coin, and technology. Excludes ETFs and OTC investment. Totals may not equal 100% due to rounding.

Source: Thomson Reuters GFMS



Adding liquidity, reducing credit risk

The gold market is deep and easily accessible, allowing investors to add a liquid asset to their portfolio at low cost. Additionally, because gold is not a liability, it is not subject to company risk or counterparty risk.¹⁵

There is considerable misinformation around the size, makeup and liquidity of the global gold market. Many underestimate the size of the bullion gold market when, in fact, the total amount of gold in the hands of private investors in the form of bars and coins (including gold-backed ETFs and similar physical holdings) were estimated to be approximately US\$1.4 trillion dollars by December 2010. Central banks hold an additional US\$1.3 trillion. Together with other forms of physical gold holdings such as jewellery, which in many parts of the world is seen as an adornment and as a savings vehicle, the available size of the gold market is large enough to guarantee access to many investors.

In comparison, estimates suggest that by the end of 2010, the private equity market had at least US\$2.4 trillion in assets under management and, collectively, hedge funds managed in excess of US\$1.9 trillion in assets (Chart 9).¹⁶ Excluding gold, the open interest¹⁷ in commodity futures contracts in exchanges around the world plus available above-ground stocks of metals in the hands of private investors stood close to US\$800 billion, while the market capitalisation of global REITs was close to US\$700 billion.

In terms of liquidity, portfolio managers typically use either exchange traded funds (ETFs), gold accounts at bullion banks or futures contracts to gain exposure to gold. Many ETFs have high trading volumes and can be a cost-effective vehicle for many investors. Investors can open gold accounts, whether in allocated or unallocated form. However, over-the-counter (OTC) transactions remain one of the most liquid channels to access the gold market. A recent survey by the London Bullion Market Association (LBMA) shows that turnover in gold averages US\$240 billion a day making gold a highly liquid asset class (Chart 10).

In contrast, private equity, hedge funds and other private investment vehicles carry liquidity constraints. Lock-up periods, which for these funds can range from three months to three years, limit investors' ability to withdraw funds. This, along with "redemption notice" and gating clauses, can restrict investors' access to funds during times of crisis.¹⁹

Some alternative assets like commodities or real estate tend not to be subject to credit risk in the same way that bonds are, but they may still be subject to counterparty risk (the risk that a party in a transaction fails to meet the terms of the financial contract) especially when accessed via derivatives markets. Given that gold is heavily traded in physical form, investors can remove credit risk and minimise counterparty risk; for example, investors can take delivery of gold, keep it in allocated accounts, or get exposure by holding physically gold-backed ETFs.

¹⁵ World Gold Council, *Liquidity in the global gold market*, April 2011.

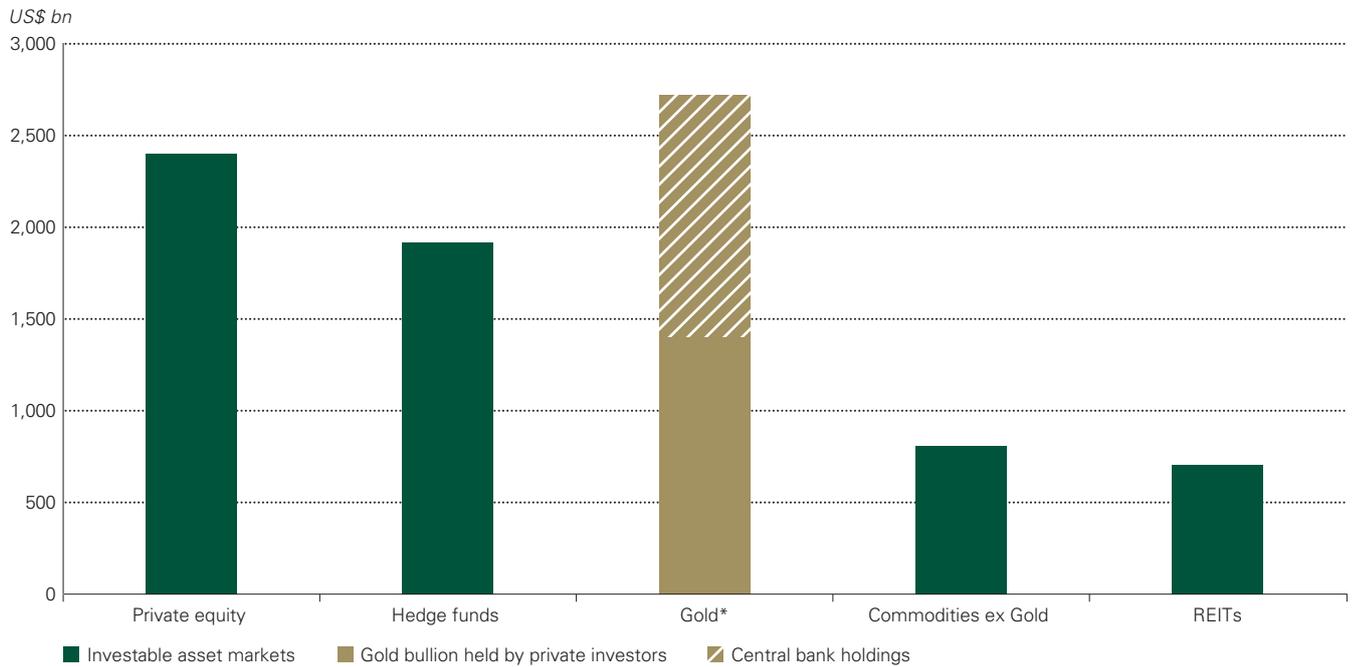
¹⁶ The exact market size of many alternative assets is difficult to estimate as data on private equity or hedge funds is often not available or disclosed.

¹⁷ Open interest measures total number of futures contracts that are not closed or delivered on a given day. If all investors with a long position (buyers) were to require physical delivery, this would be the total amount of a particular commodity that investors with short positions (sellers) would be required to supply from the available global stocks of that commodity. It relates to the size of the market.

¹⁸ London Bullion Market Association, *LBMA gold turnover survey for Q1 2011*, The Alchemist, August 2011.

¹⁹ Lock-up periods refer to the initial period in which investors are not allowed to withdraw funds when they first invest on a hedge fund (can be as long as 2 years). "Redemption notice" clauses stipulate that investors need to let hedge fund managers know they are planning to redeem funds in advance (typically 3 months). Finally, gating clauses give managers discretion to restrict withdrawals on otherwise permissible periods.

Chart 9: Size of investable alternative asset markets at the end of 2010¹

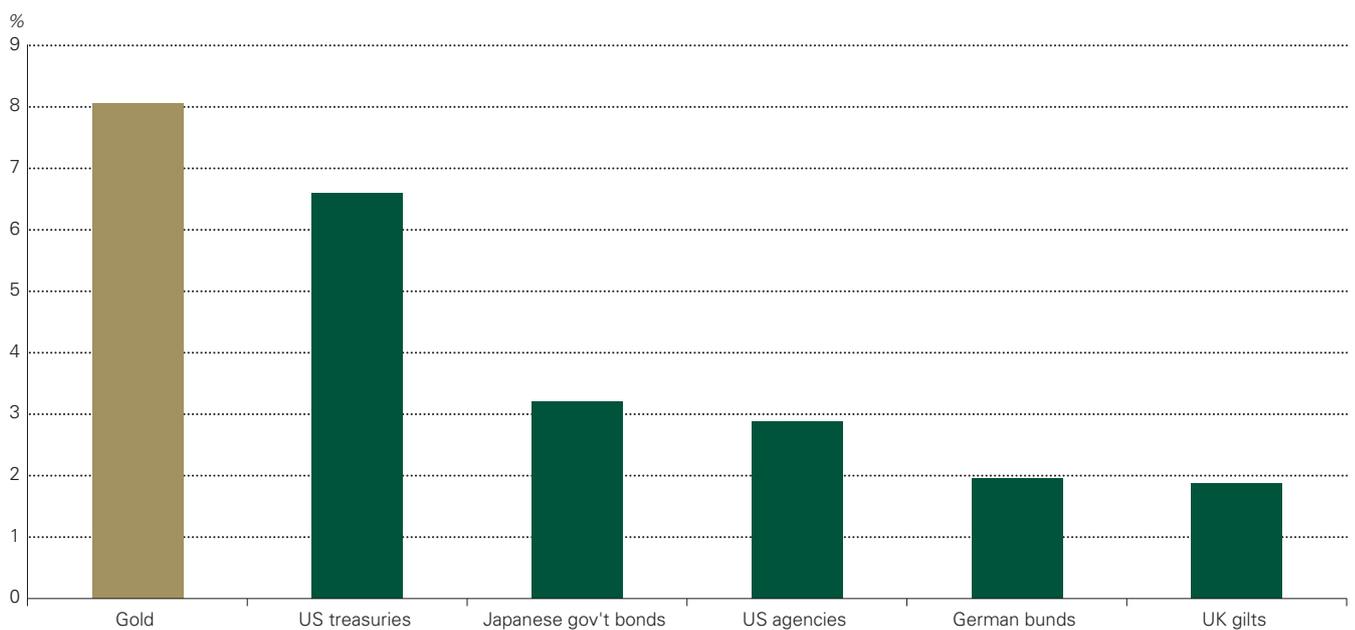


1 Private equity and hedge fund sizes were approximated using AUM; for commodities open interest on futures market plus private physical holdings of metals were used; REITs' size represents global market capitalisation; and gold corresponds to private and public holdings of physical bullion.

2 The gold price used is the end of 2010 price of US\$1405.5/oz.

Source: Bloomberg, Hedge Fund Research, Preqin, Thomson Reuters GFMS, World Gold Council

Chart 10: Average daily turnover as % of total outstanding*



*Daily turnover is calculated as daily average volume divided by total outstanding value. In the case for gold, total outstanding is calculated using private and public bullion holdings.

Source: German Finance Agency, Japanese MOF, SIFMA, Thomson Reuters GFMS, UK DMO, World Gold Council

Optimising portfolio allocations

Having established some of the advantages that gold can bring to a portfolio, we seek to measure the impact it has on portfolio performance and risk management in the presence of alternative investments.

Research by the World Gold Council has previously shown that adding gold to portfolios comprising traditional asset classes and commodities tends to increase risk-adjusted returns as well as reducing VaR.²⁰ We now find that portfolios which contain alternative investments such as private equity, hedge funds, and real estate can also be enhanced by adding gold to the mix.

To find the optimal weights employed to construct different sample portfolios, we use Resampled Efficiency (RE) optimisation developed by Michaud and Michaud.²² We concentrate on two scenarios. For each scenario, we apply “projected” long-term real returns, consistent with previous World Gold Council studies, to remove a potential period bias. We then use the volatility and correlation estimates based on monthly returns from January 1987 to June 2011.²³ A summary of the projected returns and volatilities used during portfolio optimisation can be found in Appendix 2.

In the first scenario, we use a portfolio with a similar composition to a typical standard allocation (55% equities, 25% fixed income and at most 5% cash, with the remaining 15%-20% distributed optimally among alternative assets). This portfolio resembles the typical allocation by professional investors around the world.²⁴

Under the second scenario we select a more conservative portfolio (30% equities, 50% fixed income and at most 10% cash, with the remaining 10%-20% distributed optimally among alternative assets). This portfolio reflects an allocation for an investor with lower risk tolerance.

For each scenario, we add either hedge funds or funds of hedge funds to gain exposure to the asset class and subsequently find optimal asset allocations with and without gold. The hedge fund composite has better risk-adjusted return characteristics, but it may not be attainable in practice as investors who want to access a broad range of hedge funds or hedge fund strategies typically need to access it through a fund of hedge funds vehicle. We consider that in reality, the optimal allocation to a portfolio will be somewhere between those two results.

Table 2 shows the risk-adjusted returns (information ratio), VaR and asset allocations for each portfolio between January 1987 and June 2011 for investors using US dollar denominated assets. In general, for US dollar investors who have exposure to hedge funds, private equity, REITs and commodities, optimal allocations to gold can range between 3.6% and 4.4%. Consistent with previous findings, gold shows positive (and statistically significant) allocations not only in the selected portfolios for this analysis but along the whole efficient frontier. Portfolios which include gold generally show higher risk-adjusted returns while consistently lowering the VaR in the portfolio. In other words, gold can preserve capital and reduce risk without sacrificing long-term returns.

It is important to note that optimal allocations to gold for investors who only hold some alternative assets will likely be higher. We have previously shown this is the case for investors who only hold commodities as an alternative investment. Long-term strategic allocations to gold can be as high as 10% for investors who hold mainstream assets as well as commodities. Moreover, research by Oxford Economics shows that, in addition to the advantage of holding strategic gold allocations over the long run, investors can benefit from tactically increasing their gold holdings if they expect extreme economic scenarios such as periods of high inflation or deflation. Similarly, optimal allocations for investors with lower risk tolerance tend to be higher.²⁵

European investors can also benefit by adding a separate allocation to gold. Whether based in euro or pound sterling, portfolios that contain gold tend to have higher risk-adjusted returns and consistently lower VaR compared to those which do not (Table 3 and Table 4). For euro-based investors, optimal allocations to gold can range between 4.5% and 7.5% depending on the composition of the portfolio and the risk tolerance of the investor. Pound sterling-based investors with portfolio compositions similar to the ones selected for this analysis benefit from allocations between 3.3% and 4.6%. More generally, investors with allocations to gold between 2% and 10%, depending on the asset mix of the portfolio and their risk tolerance, will likely enhance portfolio performance and reduce risk without diminishing their long-term expected returns.

20 World Gold Council, *Gold as a tactical hedge and long-term strategic asset*, August 2009 and *Gold: hedging against tail risk*, October 2010.

21 Michaud, R. and R. Michaud (2008) *Efficiency Asset Management: a practical guide to stock and portfolio optimisation and asset allocation*, 2nd edition, Oxford Press, New York.

22 During the optimisation, we do not penalise hedge funds and private equity vehicles for their potential illiquidity. However, it is worth noting that the liquidity premium for such assets can range from 0.5% to 3% depending upon the time period for which investors need to remain vested.

23 If data is not available since January 1987, we use the longest time series available. Private equity data is only available on a quarterly basis; consequently, private equity estimates for volatility and correlations to other assets are calculated using quarterly returns.

24 Tower Watson, *2010 Global Pension Asset Study*, January 2010.

25 Oxford Economics, *The impact of inflation and deflation in the case for gold, June 2011*. World Gold Council, *Gold: hedging against tail risk*, October 2010.

Table 2: Summary statistics and asset weight allocation from a US dollar perspective

	Standard Portfolio ¹				Conservative Portfolio ²			
	Hedge Funds ³		FoHFs ⁴		Hedge Funds ³		FoHFs ⁴	
	with gold	w/o gold	with gold	w/o gold	with gold	w/o gold	with gold	w/o gold
Information ratio ⁶	0.991	0.967	0.994	0.993	1.450	1.441	1.451	1.440
97.5% VaR (000s) ⁵	554	552	568	581	274	274	270	289
Portfolio weights ⁷								
US cash	0.8%	1.7%	0.9%	1.1%	2.4%	3.0%	4.5%	4.2%
Global cash	0.8%	1.0%	1.0%	1.3%	0.7%	1.1%	0.9%	1.5%
US bonds	14.1%	16.6%	14.2%	14.6%	39.2%	39.3%	42.2%	40.8%
Global bonds	10.9%	8.4%	10.8%	10.4%	10.8%	10.7%	7.8%	9.2%
US small cap	6.5%	5.1%	7.8%	6.8%	4.0%	3.8%	4.0%	3.8%
US mid cap	9.5%	9.1%	8.8%	9.6%	5.2%	4.7%	4.8%	4.6%
US large cap	18.7%	21.7%	17.9%	17.7%	11.2%	11.0%	12.7%	11.7%
Developed world equities	11.9%	12.6%	12.6%	13.0%	5.6%	7.0%	5.8%	6.7%
Emerging market equities	8.4%	6.5%	8.0%	8.0%	4.1%	3.5%	2.8%	3.3%
Hedge funds	6.5%	11.3%			6.9%	9.6%		
Fund of HFs			4.0%	7.0%			5.3%	7.6%
Private equity	5.6%	3.2%	6.8%	7.2%	4.5%	4.4%	3.7%	4.5%
Real estate	1.3%	0.6%	1.7%	1.4%	0.8%	0.6%	0.6%	0.7%
Commodities	1.4%	2.1%	1.3%	1.9%	1.1%	1.3%	1.1%	1.5%
Gold (US\$/oz)	3.7%		4.4%		3.6%		3.9%	

1. Standard portfolio is constrained to have 55% equities, 25% fixed income and at most 5% in cash.

2. Conservative portfolio is constrained to have 30% equities, 50% fixed income and at most 10% in cash.

3. This portfolio contains hedge fund composite as a proxy for a hedge fund allocation.

4. This portfolio contains the FoF composite as a proxy for a hedge fund allocation.

5. Expected maximum loss during a month at a given confidence level (1- α) from a US\$10mn portfolio.

6. The information ratio is return divided by volatility using historical price data and the solved portfolio weights.

7. Portfolio weights below are solved to optimise the information ratio with the constrains outlined in 1 or 2.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 3: Summary statistics and asset weight allocation from a Euro perspective

	Standard Portfolio ¹				Conservative Portfolio ²			
	Hedge Funds ³		FoHFs ⁴		Hedge Funds ³		FoHFs ⁴	
	with gold	w/o gold	with gold	w/o gold	with gold	w/o gold	with gold	w/o gold
Information ratio ⁶	0.743	0.753	0.732	0.736	0.977	1.004	0.976	0.992
97.5% VaR (000s) ⁵	679	696	701	725	458	465	442	456
Portfolio weights ⁷								
Euro cash	2.5%	3.7%	1.5%	1.8%	9.3%	9.1%	9.8%	9.4%
Global cash	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
European bonds	15.0%	16.1%	12.0%	10.9%	46.2%	43.7%	47.0%	44.4%
US bonds	1.1%	0.7%	2.4%	3.1%	0.1%	0.2%	0.1%	0.2%
Global bonds	9.0%	8.2%	10.6%	11.0%	3.7%	6.1%	2.9%	5.3%
European large cap	16.2%	18.6%	13.2%	11.1%	15.0%	14.4%	16.4%	14.2%
US large cap	13.3%	13.1%	12.8%	12.7%	6.5%	5.8%	5.8%	6.5%
European small cap	14.3%	13.0%	14.0%	15.4%	5.1%	6.1%	5.5%	5.9%
Emerging market equities	11.1%	10.2%	15.0%	15.8%	3.4%	3.7%	2.3%	3.5%
Hedge funds	4.8%	7.8%			1.6%	4.9%		
FoHFs			1.8%	3.0%			0.9%	3.9%
Private equity	2.8%	2.5%	6.2%	7.8%	0.6%	1.4%	0.4%	1.9%
Real Estate	2.6%	2.7%	4.4%	4.6%	0.6%	1.4%	0.4%	1.4%
Commodities	1.7%	3.3%	1.6%	2.8%	1.1%	3.2%	1.1%	3.3%
Gold	5.5%		4.5%		6.8%		7.5%	

1. Standard portfolio is constrained to have 55% equities, 25% fixed income and at most 5% in cash.

2. Conservative portfolio is constrained to have 30% equities, 50% fixed income and at most 10% in cash.

3. This portfolio contains hedge fund composite as a proxy for a hedge fund allocation.

4. This portfolio contains the FoF composite as a proxy for a hedge fund allocation.

5. Expected maximum loss during a month at a given confidence level (1- α) from a US\$10mn portfolio.

6. The information ratio is return divided by volatility using historical price data and the solved portfolio weights.

7. Portfolio weights below are solved to optimise the information ratio with the constrains outlined in 1 or 2.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 4: Summary statistics and asset weight allocation from a sterling perspective

	Standard Portfolio ¹				Conservative Portfolio ²			
	Hedge Funds ³		FoHFs ⁴		Hedge Funds ³		FoHFs ⁴	
	with gold	w/o gold	with gold	w/o gold	with gold	w/o gold	with gold	w/o gold
Information ratio ⁶	0.799	0.804	0.789	0.776	1.216	1.189	1.202	1.189
97.5% VaR (000s) ⁵	649	629	648	640	329	335	331	328
Portfolio weights ⁷								
Euro cash	2.0%	2.9%	1.8%	2.0%	7.9%	7.6%	7.4%	7.7%
Global cash	0.0%	0.0%	0.6%	0.8%	0.0%	0.0%	0.2%	0.4%
European bonds	5.7%	6.9%	5.4%	6.0%	23.6%	21.4%	23.5%	22.6%
US bonds	4.9%	3.7%	4.6%	4.7%	3.5%	3.7%	2.9%	3.9%
Global bonds	4.4%	3.9%	4.8%	4.7%	8.7%	8.5%	9.0%	8.4%
European large cap	10.1%	10.5%	10.2%	9.6%	14.2%	16.4%	14.6%	15.2%
US large cap	15.8%	15.7%	14.9%	13.9%	7.7%	7.4%	7.0%	7.3%
European small cap	13.6%	11.7%	13.5%	14.4%	10.8%	9.5%	11.1%	9.0%
Emerging market equities	18.7%	21.1%	19.0%	19.2%	9.4%	10.5%	9.8%	11.2%
Hedge funds	3.6%	5.7%			1.3%	2.6%		
FoHFs			1.8%	2.9%			0.7%	1.8%
Private equity	2.4%	2.5%	2.5%	3.0%	0.8%	1.4%	0.9%	1.3%
Real Estate	4.9%	4.4%	6.0%	7.2%	2.2%	3.1%	2.6%	3.3%
Commodities	3.1%	4.4%	2.7%	4.2%	4.5%	5.4%	4.8%	5.5%
Gold	4.0%		4.6%		3.4%		3.3%	

1. Standard portfolio is constrained to have 55% equities, 25% fixed income and at most 5% in cash.

2. Conservative portfolio is constrained to have 30% equities, 50% fixed income and at most 10% in cash.

3. This portfolio contains hedge fund composite as a proxy for a hedge fund allocation.

4. This portfolio contains the FoF composite as a proxy for a hedge fund allocation.

5. Expected maximum loss during a month at a given confidence level (1- α) from a US\$10mn portfolio.

6. The information ratio is return divided by volatility using historical price data and the solved portfolio weights.

7. Portfolio weights below are solved to optimise the information ratio with the constrains outlined in 1 or 2.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Reducing losses and managing risk in periods of financial turmoil

There is robust evidence for adding gold as a foundation to a portfolio: over the long run, risk-adjusted returns tend to increase, losses to diminish, and capital is preserved. In this section we show that in most periods of financial stress, portfolios that include gold tend to perform better (by either posting gains or reducing losses) than those without. To achieve this, we look back to periods, starting in January 1987, in which financial markets experienced an unexpected and negative shock that affected more than one asset class.²⁶

We concentrate on seven periods typically considered to be “tail-risk” events:

- the market crash around October 1987, also known as “Black Monday”, looking at the performance between August and December of that year;
- the Long-term Capital Management (LTCM) crisis, between July and August 1998;
- the bursting of the dot-com bubble, in the period between March 2000 and April 2001;
- the 9/11 terrorist attacks, in the period between August and September, 2001;
- 2002 market downturn, as stocks fell sharply between March and July 2002;
- the financial crisis of 2007-2009, also known as the “Great Recession”, between October 12, 2007 and March 6, 2009; and
- the first phase of the European sovereign debt crisis between January and May 2010.

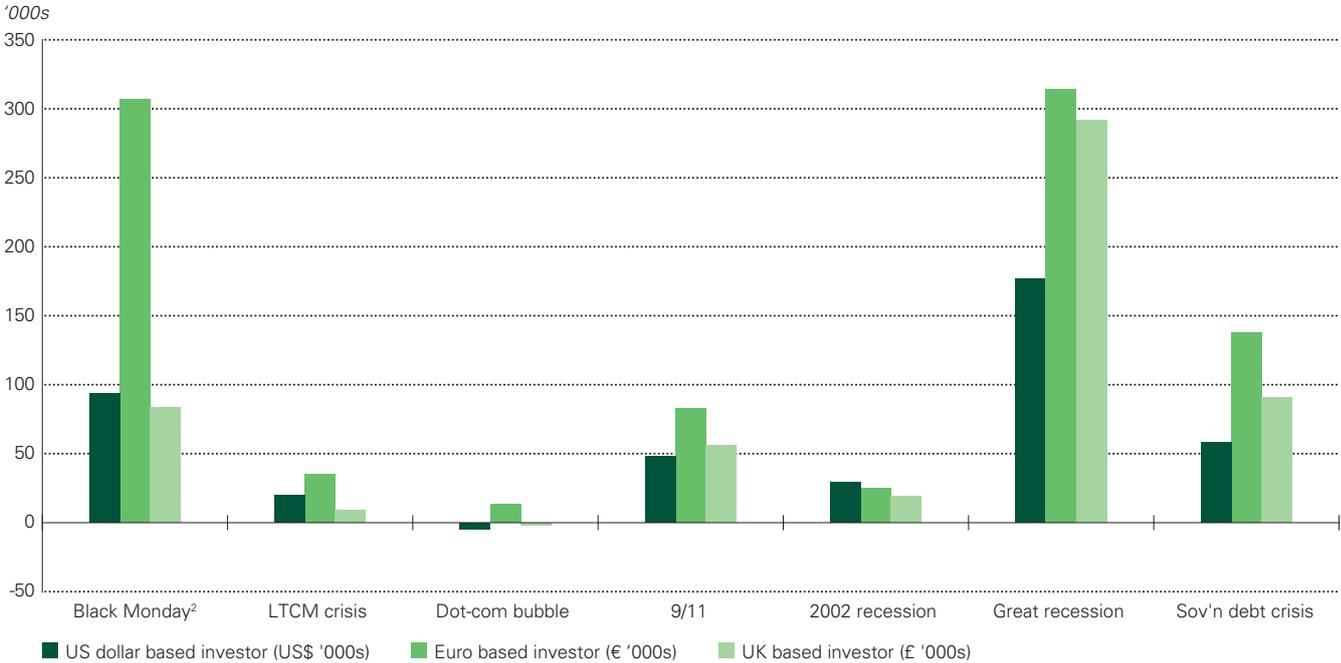
Chart 11 summarises the outperformance (loss reduction or, in some cases, excess gain) experienced by an investor with a discrete allocation to gold and whose portfolio composition included 55% in equities, 25% in fixed income, no more than 5% in cash and the remaining 15%-20% optimally allocated to hedge funds, private equity, real estate, commodities and gold. Portfolios which included gold fared much better, increasing returns in all tail-risk periods with the exception of the dot-com bubble.²⁷ For example, during the Great Recession, a US dollar-based investor would have reduced its loss by US\$177,000 on a US\$10 million portfolio by having a 3.7% allocation to gold. Similarly, a euro-based investor would have saved €314,000 on a €10 million portfolio by having a 5.5% allocation to gold, while a pound sterling based investor, would have saved a £292,000 with a corresponding 4.0% gold position. In percentage terms, this is equivalent to savings of 5%, 9%, and 13% respectively. Over the seven periods represented in Chart 11, investors with standard portfolio compositions and allocations to gold would have saved a corresponding US\$60,000, €131,000 or £79,000 depending on the currency perspective of their holdings.

Table 12 to Table 14 in Appendix 2 show a summary of gains and losses for portfolios with and without gold for different asset compositions. In some instances, adding gold to the mix produced higher positive returns, while in others, it reduced the losses. Moreover, long-run average returns for the portfolios with and without gold were similar. 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.

²⁶ For further reference to this topic see *Gold: hedging against tail risk*.

²⁷ A possible explanation is that the Dot-com bubble was heavily concentrated towards one particular sector of the economy; hence, the added benefits of gold as a diversifier to the selected portfolios may have been lessened.

Chart 11: Outperformance of a portfolio containing gold during crises¹



1 Outperformance refers to an additional gain or a loss reduction by holding gold in a portfolio containing 55% equities, 25% bonds, at most 5% cash and the remaining allocation optimally distributed among hedge funds, private equity, real estate, commodities and gold. The solved allocation to gold for this scenario was 3.7% for US, 5.5% for Europe and 4.0% for UK.
 2 Due to the unavailability of certain indices during this period, assets allocations were proportionally re-weighted.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Conclusion

Optimal asset allocations are major determinants of portfolio returns over the long run and research shows gold has proven a consistent diversifier, risk management vehicle and store of wealth.

This research note provides further support to this thesis. While alternative investments can be powerful tools in the quest for better risk-adjusted returns in a portfolio, gold stands out as a foundation to a well diversified portfolio.

Alternative investments have, over the past decade, gained popularity among investors as additional sources of return and diversification. However, many investors consider that having exposure to investments such as private equity, hedge funds, real estate, and commodities is enough. Our analysis demonstrates that gold allocations incorporate additional benefits that are not replicated by solely investing in some of these other alternatives.

Gold can enhance portfolio performance and complement alternative asset allocations by providing “true” diversification when it is most needed. We find that gold helps to manage risk effectively in a portfolio, not only by means of increasing risk-adjusted returns, but also by reducing expected losses incurred under extreme market conditions. These so-called tail-risk events can severely impact investor capital. By including gold in their portfolios, long-term holders can manage risk without necessarily sacrificing returns.

Our analysis suggests that consistent strategic allocations to gold, ranging from 3.3% to 7.5%, can positively impact the profile of a portfolio, even when there is an existing allocation to alternative assets. These results are robust across market cycles and positive strategic allocations are still optimal even in economic environments when gold may underperform other assets. We find that, over the long run, such a portfolio allocation maintains a similar risk-return profile to an equivalent portfolio without gold while reducing Value at Risk.

More tactical investors can also take advantage of gold’s unique correlation to other assets to preserve capital, add liquidity and reduce risk during times of turmoil. Gold’s correlation to other assets benefits investors who hold it within their portfolios as it is low in normal times and can even turn negative during extreme economic conditions. Furthermore, investors who hold gold only in the form of a commodity index are likely to be under-allocated and forego the benefits gold can offer.

There is a strong case for gold to be considered an asset class on its own merits and a foundation for an investment portfolio. Gold is employed in technology, bought as jewellery and used as a financial and monetary asset by public and private investors alike. As such, its price movements do not follow those of either traditional or alternative assets.

In addition to the benefits of true diversification, risk management and capital preservation, the size of the gold market and vast number of investment vehicles ensures gold remains liquid even during periods of financial distress.

Appendix 1: overview of alternative investments

Hedge funds

Hedge funds are private investment partnerships that are open to a limited number of qualified or accredited investors as defined by a country's financial regulatory body. Many investors associate hedge funds with sophisticated and complex strategies because they employ leverage, take short and long positions and they use derivatives in order to precisely express their markets views. They offer investors the potential for absolute returns with the expectation that their strategies are superior to long-only holdings of traditional assets in a portfolio.

There are many categories of hedge funds, but the universe can be broken down into four main categories: equity funds, event-driven funds, macro funds and relative-value funds.²⁸

Equity hedge funds include market neutral, long/short, long only, short-bias and quantitative equity-related strategies. Equity hedge fund managers attempt to add value by identifying mispriced securities using one or several fundamental, quantitative and technical decision-making approaches.

Event-driven strategies include active investing, distressed investing, risk arbitrage and special situations. Event-driven managers attempt to capture additional return (alpha) by taking advantage of mispriced securities resulting from systemic or idiosyncratic events that cause dislocations in the pricing of securities.

Macro fund managers generate value for investors by identifying macro trends across many assets classes. These strategies have the broadest remit and often trade across multiple markets including commodities, fixed income, equity indices, currencies and interest rates.

Finally, relative value indices encompass various strategies including convertible arbitrage, fixed income arbitrage, relative-value credit investments, long credit funds and other yield enhancing strategies including asset-backed securities and mortgages. Typically, these strategies aim to take advantage of relative mispricing in fixed-income securities.

The Hedge Fund Research (HFR) Fund-Weighted Composite Index is a global, equal-weighted index of over 2,000 single-manager funds that report to Hedge Fund Research database. Constituent funds report monthly net of all fees performance in US\$ and have a minimum of US\$50 million under management or a 12 month track record of active performance. The HFRI Fund Weighted Composite Index does not include Funds of Hedge Funds. The average AUM of an index constituent is approximately \$274 million and there are 2100 members. As a result, there is \$700 billion in aggregate assets within the index, which is a bit higher than a third of the \$1.9 trillion hedge fund industry.

Fund of hedge funds

A Fund of hedge funds (FoHFs) is an alternative way to access hedge funds. A FoHF is an investment vehicle whose portfolio consists of holdings in a number of different hedge funds. Most investors opt for fund of funds because they fail to reach the investment minimums of hedge funds or they would like to get diversified exposure to the entire asset class rather than committing their funds to one or a few managers. There are also numerous classifications of fund of funds including diversified, conservative, strategic, and market defensive.

FoHFs invest with multiple managers through funds or managed accounts. The strategy designs a diversified portfolio of managers with the objective of significantly lowering the risk of investing with an individual manager. The fund-of-funds manager has discretion in choosing which strategies to invest in for the portfolio. A manager may allocate funds to numerous managers within a single strategy, or with numerous managers in multiple strategies. The minimum investment in a FoHFs may be lower than an investment in an individual hedge fund or managed account. The investor has the advantage of diversification among managers and styles with significantly less capital than investing with separate managers.

There are 621 constituents in the HFRI Fund of Funds Composite Index with an average AUM of US\$273 million. The data contributors to this index have aggregate assets under management of US\$170 billion which is approximately a quarter of the US\$646 billion dollar fund of hedge fund industry.³⁰

²⁸ Categorisation used by Hedge Fund Research.

²⁹ While one can investigate the performance of different hedge fund strategies, we consider that the composite index can be used as a benchmark relative to individual strategies. In any case, it reflects an ideal scenario as investors do not generally have access to such a diversified pool of strategies and are subject to the idiosyncratic risks of the manager or managers they chose.

Table 5: Performance of hedge funds and private equity in a model portfolio from a US dollar perspective¹

Asset name	CAGR ²		Real annual volatility (%) ³	Information ratio ⁴	Monthly VaR \$'000s Confidence level (%) ⁵	
	Real	Nominal			97.50%	99%
Fund-weighted composite	8.9%	11.8%	7.0%	1.27	286	462
Equity Hedge Index	10.7%	13.7%	9.1%	1.18	400	584
Event-Driven Index	9.3%	12.3%	6.8%	1.37	375	583
Relative Value Index	7.7%	10.6%	4.3%	1.79	125	409
Macro Index	10.2%	13.1%	7.7%	1.31	296	373
FoF Composite Index	5.0%	7.8%	5.7%	0.88	265	459
FoF Diversified	4.5%	7.3%	6.0%	0.76	272	486
FoF Conservative	3.9%	6.7%	3.8%	1.04	184	343
FoF Strategic	7.4%	10.3%	8.6%	0.85	375	635
FoF Market Defensive	5.7%	8.5%	5.9%	0.96	252	301

1. The data used for this chart ranges from January 1989 to June 2011.

2. CAGR: compounded annual growth rate (geometric average return).

3. Volatility based on historical real returns.

4. Information ratio is computed as real return divided by volatility using historical data.

5. Expected maximum loss during a month at a given confidence level (1- α) from a US\$10mn portfolio.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Private equity

Private equity is a broad term that describes capital that is invested into private companies that are not listed on public exchanges. Private equity funds are vehicles that allow investors to participate in the growth of non exchange-traded companies. Investors access private equity through a similar legal structure as hedge funds whereby limited partners combine funds while general partners deploy the pool of capital. Investors seeking to gain the benefits of high and uncorrelated returns with private equity investments have to sacrifice liquidity, transparency and be content with large holdings of illiquid securities in a highly leveraged vehicle. For example, many private equity funds (as well as hedge funds) have lock-up periods of anywhere between one to seven years forcing investors to sell their limited partnership interests into an illiquid market if there's an urgent need for cash.

There are many sub-strategies within private equity including but not limited to growth equity, distressed/special situation strategies, mezzanine capital, leveraged buyouts, venture capital, secondary funds and 'hard assets'.

Growth capital funds typically deploy funds to profitable private companies that require capital to finance their expansion or restructure their operations.

Distressed and special situation strategies aim to invest in the debt and equity securities of financially stressed companies. Distressed funds invest in debt and equity of companies that are trading at distressed valuations, betting on a company turn-around.

Mezzanine capital refers to subordinate securities that are senior to the company's common stock. This strategy involves investing in the junior debt of companies that is senior to the company's equity. This type of investment is made strategically in order to reduce the amount of equity required to restructure, grow or purchase the company. Small companies unable to access the high yield market, tend to accept this type of capital after they have exhausted their bank loan facilities.

Leveraged buyouts is when a private equity fund purchases a private or public company with borrowed funds in order to restructure the balance sheet and improve cash flow efficiency and consequently sell the company at a higher valuation at a later point in time. LBO funds target mature, cash-flow producing companies where they could use the free cash flow to pay back the interest and principal payments on the loans.

Venture capital funds are companies that invest in start-up companies looking for funds in order to launch their operation. Venture capital funds target companies with unparalleled growth potential in order to compensate for the risk of investing in an unproven company. Target companies are commonly in the technology space offering the investor the potential of participating in the growth of a disruptive technology. Secondary funds are private equity funds that buy portfolios of mature companies or limited partnership interests in existing private equity funds in order to achieve high cash flow yields and stable company valuations for their investors. Secondary funds provide liquidity to existing private equity investors.

Finally, 'hard assets' refer to real estate, natural resources and infrastructure investments. Investors could hold these assets as part of a wide array of strategies. Many investors look to hard assets in order to achieve diversification while benefiting from economic growth.

Private equity data was sourced from Thomson Reuters which combines all private equity strategies except real estate. The index is an aggregate of data provided voluntarily by private equity managers with respect to their distributions and net asset values. The aggregate assets under management of the index constituents are \$635.5, one quarter of the \$2.4 trillion managed by all private equity funds.

30 These types of investments were excluded from the private equity data that is used in the study as REITs are used for real estate investments while natural resource and infrastructure markets don't carry the depth and history necessary for an analytical discourse.

31 Kaplan and Schoar in their paper entitled *Private equity performance: returns, persistence and capital flows* suggest that private equity performance data has been found to suffer from a survival bias in which reporting is voluntary leading to exaggerated returns that are not representative of industry averages. Additionally, successful funds tend to continue outperforming with under-performers continuing to lag.

REITs

Real estate investment trusts are exchange-traded securities that directly invest in real estate through property, mortgages or agency debt. Some individual investors may have some of their assets directly vested in a real estate property, but direct property investment can be highly illiquid and be subject high levels of idiosyncratic risk. Thus, most professional investors access the market through REITs which provide multiple types of properties or property-related securities, whether residential or commercial. Moreover, REITs are entitled to a special tax designation whereby the trust receives a corporate income tax break and in return is obligated to distribute 90% of taxable income back to investors.

REITs tend to focus on specific markets and investors can use them to access real estate performance of particular regions. Typically, however, investors tend to access REITs as a financial security alternative to physical holdings to avoid the complications of accessing the real estate market directly.

The Dow Jones US Select REIT index has 80 components with a median market capitalisation of \$2.2 billion. The total market capitalisation of the index as of August 31, 2011 is \$339.4 billion dollars which is approximately 76% of the market capitalisation of all major U.S. REITS. is weighted by float-adjusted market capitalisation and is typically reviewed every quarter for float factors and corporate actions. Components of the index were selected through the following criteria: company must be an equity owner and operator of commercial and/or residential real estate, 75% of total revenues must be derived from the ownership and operation of property and the company must have a minimum market capitalisation of \$200 million.

Commodities

Commodities are economic goods, which are valued and useful and have little or no difference in composition or quality regardless of the place or method of production, thus facilitating their exchange. Commodities are typically inputs in the production of other goods and services. They can be generally grouped into four categories: 1) energy, such as oil, natural gas, and coal; 2) metals, which include precious and base metals; 3) agriculture, such as grains; and 4) livestock, including cattle and hogs.

Many investors access commodities via derivatives as they offer a practical alternative when physical transactions of these assets are not a viable or cost-effective. Some investors prefer active strategies in commodities, taking advantage of the shape of the futures curve and other factors, as they are considered to outperform passive strategies in terms of risk and return. However, the majority use commodity indices based on futures contracts as benchmarks for their commodity allocations. Examples include the widely referenced S&P Goldman Sachs Commodity Index™ as well as the less energy-heavy Dow Jones-UBS Commodity Index™.

Highly traded commodities are important inputs to the global economy and are an attractive source of diversification for investors as well as a vehicle for exposure to economic growth and inflation hedging.

However, many commodities including energy, industrial and some precious metals tend to be heavily exposed to the business cycle and are subject to idiosyncratic risks such as geopolitical events or weather patterns that may affect their production. While this can help with lack of correlation to other assets it can also be accompanied by higher volatility.³²

The S&P Goldman Sachs Commodity Index is a production-weighted index which includes futures contracts to approximately 20 physical commodities and which is rebalanced at the end of each month. Rebalancing is done to accommodate changes in production weights (which are based on five year averages of each commodity's world production) and the selection of the active futures contract on the corresponding commodity. Because the index is production-based, it tends to be heavily concentrated on the energy sector, which accounts for almost two-thirds of the index. Gold's weight in the index is usually around 3% as gold's mine production is relatively small, especially when compared with the production value of energy-related commodities. This tends to artificially produce an under-allocation to gold, as recycled gold provides an alternate source of supply.

As a less energy-heavy alternative, investors use the S&P Goldman Sachs Light Energy Commodity Index, which includes the same futures contracts as the S&P GSCI, but which has a much smaller exposure to oil and other energy-related commodities. In particular, the original energy weights are divided by a factor of four, while other commodity weights are proportionally increased to total one. In this case, gold has an approximate weighting of 7%.

Gold

Gold stands apart from commodities. In a recent study entitled "Gold: a commodity like no other", research by the World Gold Council showed that while gold is sometimes viewed in the context of commodities, there are a number of qualities that separate it from the broader commodity complex and that investors who hold gold only through a commodity index tend to be under-allocated. Gold is, in many ways, synonymous with luxury and wealth. Half of all gold in above-ground stocks still exists in the form of jewellery, yet it is also an important financial asset and is considered by many as a currency in its own right. It has been proven as a store of wealth and an efficient diversifier of risk and it plays an important role in central banks' reserve asset management.

Globally, gold's religious and cultural significance around the world makes it attractive for reasons beyond its economic value. It also acts as a reliable and essential component used in a range of electronics, medical and dental applications and is continually proving its wider relevance as an innovative enabler to new technologies. Moreover, the size, depth and liquidity of the gold market ranks much higher than sovereign debt and individual stocks. These factors coupled with gold's ability to reduce portfolio credit risks, add liquidity, increase diversification and preserve wealth during times of economic duress makes it attractive for investors.

32 World Gold Council, *Gold: a commodity like no other*, April 2011.

Appendix 2: charts and tables

Indices used as proxies for each of the relevant asset classes in three different currencies

Table 6: Name keys for assets used for research analytics¹

Short name	Index name	Date range
US cash	J.P. Morgan US cash	December 1986 to June 2011
European cash	J.P. Morgan European cash	December 1986 to June 2011
UK cash	J.P. Morgan UK cash	December 1986 to June 2011
Global cash ³	J.P. Morgan global cash	December 1986 to June 2011
US bonds	Barclays Capital US Aggregate	December 1986 to June 2011
US gov't	Barclays Capital US Treasury Aggregate	December 1986 to June 2011
European bonds (EU)	Barclays Capital Euro-Aggregate	June 1998 to June 2011
European bonds (UK)	J.P. Morgan GBI Euro ex UK	December 1986 to June 2011
Global bonds (US)	Barclays Capital global tsy agg ex US	December 1986 to June 2011
Global bonds (EU)	Barclays Capital global tsy agg ex US/EU	December 1986 to June 2011
UK Gilts	J.P. Morgan GBI UK	December 1986 to June 2011
UK corporates	Barclays Capital sterling corporates	January 1999 to June 2011
US large cap	MSCI US	December 1986 to June 2011
US small cap	Russell 2000	December 1986 to June 2011
US mid cap	Russell mid cap	December 1986 to June 2011
European large cap	MSCI Europe	December 1986 to June 2011
European small cap	MSCI Europe Small Cap	January 1995 to June 2011
UK large cap	MSCI UK Local	December 1986 to June 2011
UK small cap	FTSE UK Series Small Cap	December 1986 to June 2011
Global equities (UK)	MSCI World ex UK	December 1986 to June 2011
Developed world equities	MSCI EAFE	December 1986 to June 2011
Emerging market equities	MSCI Emerging Markets	December 1986 to June 2011
Hedge funds	HFRI Fund-Weighted Composite	December 1989 to June 2011
Fund of HFs	HFRI Fund of Funds Composite	December 1989 to June 2011
Private equity	Thomson Reuters private equity	December 1986 to June 2011
Real estate (US)	Dow Jones US Select REIT	December 1986 to June 2011
Real estate (EU)	FTSE EPRA/NAREIT Developed Europe	December 1986 to June 2011
Real estate (UK)	FTSE EPRA/NAREIT UK	December 1986 to June 2011
Commodities	S&P GSCI Light Energy	December 1986 to June 2011
Gold (US\$/oz)	Gold spot price at 5PM NY time	December 1986 to June 2011

1. These indices and data sets were selected on the basis of their inception date and appropriateness.

2. Perspective refers to the region under consideration. Index will change depending upon geographical perspective.

3. Equal-weighted average of a combination of cash indices from major currencies: US dollar, euro, pound sterling, Swiss franc and Japanese yen.

For each of the perspectives under consideration (US dollar, euro and pound sterling), the global cash average excludes the corresponding currency index and all other indices are expressed from that currency's perspective. For example, for a euro-based investor, global cash does not include euro cash and all other components are expressed in euro.

Source: Barclays, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Return and volatility assumptions

Table 7: Optimisation assumptions for assets in US dollars

Asset name	Asset class	Return	Volatility
US cash	Fixed Income	1.0%	1.1%
Global cash	Fixed Income	2.0%	9.0%
US bonds	Fixed Income	4.0%	4.2%
Global bonds	Fixed Income	5.0%	9.3%
US small cap	Equity	7.0%	20.0%
US mid cap	Equity	7.0%	17.3%
US large cap	Equity	6.0%	15.7%
Developed world equities	Equity	6.0%	17.8%
Emerging market equities	Equity	8.0%	24.4%
Hedge funds	Alternatives	8.0%	7.0%
Fund of HFs	Alternatives	5.0%	5.8%
Private equity	Alternatives	10.0%	13.5%
Real estate	Alternatives	6.0%	19.4%
Commodities	Alternatives	2.0%	13.9%
Gold (US\$/oz)	Alternatives	2.0%	14.6%

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 8: Optimisation assumptions for assets in pound sterling

Asset name	Asset class	Return	Volatility
UK cash	Fixed Income	1.0%	2.0%
Global cash	Fixed Income	1.0%	8.1%
UK gilts	Fixed Income	4.0%	6.2%
US bonds	Fixed Income	5.0%	11.0%
UK corporates	Fixed Income	5.0%	7.5%
European bonds x UK	Fixed Income	4.0%	9.4%
UK large cap	Equity	6.0%	16.1%
UK small cap	Equity	7.0%	19.3%
Global equities	Equity	7.0%	16.1%
Emerging market equities	Equity	8.0%	25.0%
Hedge funds	Alternatives	8.0%	11.7%
Fund of HFs	Alternatives	5.0%	11.0%
Private equity	Alternatives	10.0%	16.5%
Real estate	Alternatives	6.0%	20.8%
Commodities	Alternatives	2.0%	15.1%
Gold (£/oz)	Alternatives	2.0%	15.8%

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 9: Optimisation assumptions for assets in euro

Asset name	Asset class	Return	Volatility
European cash	Fixed Income	1.0%	1.8%
Global cash	Fixed Income	1.0%	6.7%
European bonds	Fixed Income	4.0%	3.4%
US bonds	Fixed Income	4.0%	10.9%
Global bonds	Fixed Income	5.0%	11.9%
European large cap	Equity	6.0%	16.6%
US large cap	Equity	6.0%	18.3%
European small cap	Equity	7.0%	18.5%
Emerging market equities	Equity	8.0%	25.6%
Hedge funds	Alternatives	8.0%	12.9%
Fund of HFs	Alternatives	5.0%	12.4%
Private equity	Alternatives	10.0%	17.4%
Real estate	Alternatives	6.0%	16.1%
Commodities	Alternatives	2.0%	15.2%
Gold (€/oz)	Alternatives	2.0%	15.4%

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Asset performance in pound sterling and euro

Table 10: Performance of selected assets in a model portfolio from a Euro perspective¹

Asset name	CAGR ²		Real annual volatility (%) ³	Information ratio ⁴	Monthly VaR €'000s Confidence level (%) ⁵	
	Real	Nominal			97.50%	99%
European cash	2.5%	5.4%	1.1%	2.32	n.a.	n.a.
Global cash	2.6%	5.4%	3.7%	0.72	138	171
US bonds	3.1%	5.9%	10.9%	0.28	465	570
European bonds	1.4%	4.7%	3.6%	0.38	123	159
Global equities	0.7%	3.5%	12.3%	0.06	503	640
European large cap	5.1%	8.0%	16.6%	0.31	1,031	1,270
European small cap	4.4%	6.6%	18.4%	0.24	1,191	1,677
US large cap	5.5%	8.5%	18.3%	0.30	1,020	1,299
Emerging market equities	10.3%	13.3%	25.0%	0.41	1,411	1,617
Asia-Pacific equities	-0.5%	2.2%	20.6%	-0.03	1,162	1,446
Gold (€/oz)	1.7%	4.5%	15.4%	0.11	844	988
Commodities	3.4%	6.3%	21.0%	0.16	1,109	1,430
Hedge funds	8.1%	10.9%	12.5%	0.65	538	686
Fund of HFs	4.3%	7.0%	12.1%	0.36	532	710
Real estate	1.9%	4.8%	16.0%	0.12	888	1,191
Private equity	9.9%	12.9%	26.9%	0.37	692	857

1. The data used for this chart ranges from January 1987 to June 2011.

2. CAGR: compounded annual growth rate (geometric average return).

3. Volatility based on historical real returns.

4. Information ratio is computed as real return divided by volatility.

5. Expected maximum loss during a month at a given confidence level (1- α) from a €10mn portfolio.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 11: Performance of selected assets in a model portfolio from a sterling perspective¹

Asset name	CAGR ²		Real annual volatility (%) ³	Information ratio ⁴	Monthly VaR €'000s Confidence level (%) ⁵	
	Real	Nominal			97.50%	99%
UK cash	3.2%	6.9%	2.0%	1.62	30	65
Global cash	1.8%	5.4%	8.1%	0.23	338	387
UK gilts	4.7%	8.4%	6.2%	0.76	234	324
UK corporates	1.8%	4.8%	5.9%	0.31	310	447
US bonds	3.1%	6.7%	11.0%	0.28	498	555
European bonds	4.1%	7.8%	9.3%	0.44	351	420
UK large cap	5.1%	8.8%	16.1%	0.32	899	1,076
UK small caps	3.9%	7.6%	19.3%	0.20	1,227	1,517
Global equities x UK	2.3%	5.9%	16.1%	0.14	1,018	1,127
Emerging market equities	10.6%	14.5%	25.0%	0.42	1,267	1,731
Gold (£/oz)	1.7%	5.3%	15.8%	0.11	801	896
Commodities	3.4%	7.1%	20.9%	0.16	1,081	1,227
Hedge funds	8.3%	11.8%	11.7%	0.71	463	548
Fund of HFs	4.5%	7.9%	11.0%	0.41	435	520
Real estate	-3.1%	0.0%	20.8%	-0.15	1,119	1,458
Private equity	9.9%	13.8%	16.5%	0.60	597	899

1. The data used for this chart ranges from January 1987 to June 2011.

2. CAGR: compounded annual growth rate (geometric average return).

3. Volatility based on historical real returns.

4. Information ratio is computed as real return divided by volatility.

5. Expected maximum loss during a month at a given confidence level (1- α) from a £10mn portfolio.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Tail-risk performance tables

Table 12: Observed gain (loss) on a US\$10 million investment for selected portfolios with and without including gold during various “tail-risk” events from a US dollar perspective

		Standard portfolio							
		Hedge funds				FoHFs			
		Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %	Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %
		with gold	w/o gold			with gold	w/o gold		
Black Monday	08/1987 – 11/1987	(1,339)	(1,433)	93	7%	(1,316)	(1,423)	107	8%
LTCM crisis	07/1998 – 08/1998	(906)	(926)	20	2%	(943)	(969)	26	3%
Dot-com meltdown	02/2000 – 03/2001	(984)	(980)	(4)	0%	(1,047)	(1,044)	(2)	0%
'9/11	08/2001 – 09/2001	(563)	(611)	48	8%	(569)	(627)	58	9%
2002 recession	02/2002 – 07/2002	(545)	(574)	30	5%	(555)	(590)	36	6%
Great recession	09/2007 – 02/2009	(3,335)	(3,512)	177	5%	(3,442)	(3,655)	213	6%
Sov'n debt crisis	12/2009 – 06/2010	(248)	(306)	58	19%	(240)	(309)	69	22%
Gold weighting		3.7%				4.4%			
		Conservative portfolio							
		Hedge funds				FoHFs			
		Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %	Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %
		with gold	w/o gold			with gold	w/o gold		
Black Monday	08/1987 – 11/1987	(597)	(656)	59	9%	(629)	(692)	63	9%
LTCM crisis	07/1998 – 08/1998	(434)	(436)	2	0%	(457)	(460)	3	1%
Dot-com meltdown	02/2000 – 03/2001	(133)	(94)	(39)	-41%	(98)	(54)	(44)	-80%
'9/11	08/2001 – 09/2001	(256)	(291)	35	12%	(248)	(286)	38	13%
2002 recession	02/2002 – 07/2002	(140)	(155)	14	9%	(179)	(196)	17	9%
Great recession	09/2007 – 02/2009	(1,755)	(1,899)	145	8%	(1,793)	(1,951)	158	8%
Sov'n debt crisis	12/2009 – 06/2010	51	5	46	854%	62	13	50	388%
Gold weighting		3.6%				3.9%			

1. Standard portfolio has been constrained to have 55% equities, 25% fixed income and at most 5% in cash.

2. Conservative portfolio has been constrained to have 50% fixed income, 30% equities and at most 10% in cash.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 13: Observed gain (loss) on a €10 million investment for selected portfolios with and without including gold during various “tail-risk” events from a euro perspective

		Standard portfolio							
		Hedge funds				FoHFs			
		Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %	Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %
		with gold	w/o gold			with gold	w/o gold		
Black Monday	08/1987 – 11/1987	(2,393)	(2,699)	307	11%	(2,335)	(2,579)	245	9%
LTCM crisis	07/1998 – 08/1998	(1,090)	(1,124)	35	3%	(1,164)	(1,197)	33	3%
Dot-com meltdown	02/2000 – 03/2001	(482)	(496)	13	3%	(536)	(549)	13	2%
'9/11	08/2001 – 09/2001	(671)	(753)	83	11%	(704)	(772)	68	9%
2002 recession	02/2002 – 07/2002	(1,294)	(1,319)	25	2%	(1,328)	(1,350)	22	2%
Great recession	09/2007 – 02/2009	(2,997)	(3,312)	314	9%	(3,129)	(3,385)	256	8%
Sov'n debt crisis	12/2009 – 06/2010	855	718	137	19%	940	832	108	13%
Gold weighting		5.5%				4.5%			
		Conservative portfolio							
		Hedge funds				FoHFs			
		Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %	Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %
		with gold	w/o gold			with gold	w/o gold		
Black Monday	08/1987 – 11/1987	(1,762)	(2,085)	322	15%	(1,720)	(2,057)	337	16%
LTCM crisis	07/1998 – 08/1998	(442)	(434)	(8)	-2%	(412)	(400)	(12)	-3%
Dot-com meltdown	02/2000 – 03/2001	99	127	(28)	22%	113	145	(32)	22%
'9/11	08/2001 – 09/2001	(268)	(342)	74	22%	(255)	(337)	81	24%
2002 recession	02/2002 – 07/2002	(587)	(567)	(20)	-4%	(566)	(543)	(24)	-4%
Great recession	09/2007 – 02/2009	(1,277)	(1,620)	343	21%	(1,258)	(1,637)	380	23%
Sov'n debt crisis	12/2009 – 06/2010	567	379	188	49%	536	326	210	64%
Gold weighting		6.8%				7.5%			

1. Standard portfolio has been constrained to have 55% equities, 25% fixed income and at most 5% in cash.

2. Conservative portfolio has been constrained to have 50% fixed income, 30% equities and at most 10% in cash.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 14: Observed gain (loss) on a £10 million investment for selected portfolios with and without including gold during various “tail-risk” events from a sterling perspective

		Standard portfolio							
		Hedge funds				FoHFs			
		Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %	Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %
		with gold	w/o gold			with gold	w/o gold		
Black Monday	08/1987 – 11/1987	(1,581)	(1,664)	83	5%	(1,558)	(1,653)	95	6%
LTCM crisis	07/1998 – 08/1998	(1,012)	(1,021)	9	1%	(1,021)	(1,032)	11	1%
Dot-com meltdown	02/2000 – 03/2001	(133)	(133)	-	0%	(178)	(181)	3	1%
'9/11	08/2001 – 09/2001	(760)	(816)	56	7%	(753)	(818)	65	8%
2002 recession	02/2002 – 07/2002	(1,146)	(1,165)	19	2%	(1,148)	(1,170)	22	2%
Great recession	09/2007 – 02/2009	(1,905)	(2,197)	292	13%	(1,888)	(2,225)	337	15%
Sov'n debt crisis	12/2009 – 06/2010	33	(58)	91	157%	50	(54)	104	194%
Gold weighting		4.0%				4.6%			
		Conservative portfolio							
		Hedge funds				FoHFs			
		Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %	Gain (loss) in US\$ '000		Difference in US\$ '000	Difference in %
		with gold	w/o gold			with gold	w/o gold		
Black Monday	08/1987 – 11/1987	(607)	(621)	15	2%	(603)	(617)	14	2%
LTCM crisis	07/1998 – 08/1998	(500)	(489)	(12)	-2%	(503)	(491)	(11)	-2%
Dot-com meltdown	02/2000 – 03/2001	384	403	(19)	5%	370	388	(18)	5%
'9/11	08/2001 – 09/2001	(459)	(496)	37	7%	(467)	(503)	36	7%
2002 recession	02/2002 – 07/2002	(487)	(480)	(6)	-1%	(483)	(477)	(6)	-1%
Great recession	09/2007 – 02/2009	(529)	(762)	233	31%	(575)	(802)	227	28%
Sov'n debt crisis	12/2009 – 06/2010	176	104	72	69%	167	96	70	73%
Gold weighting		3.4%				3.3%			

1. Standard portfolio has been constrained to have 55% equities, 25% fixed income and at most 5% in cash.

2. Conservative portfolio has been constrained to have 50% fixed income, 30% equities and at most 10% in cash.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Correlation matrices among assets

Table 15: Correlation matrix for various assets from a US dollar perspective

	US cash	Global cash	US agg	US gov't	Global bonds	US small cap	US mid cap	US large cap	Developed world equities	Emerging market equities	Hedge funds	Fund of HFs	Real estate	Private equity ¹	Commodities	Gold (US\$/oz)	
US cash	1.00																
Global cash	0.01	1.00															
US agg	0.41	0.19	1.00														
US treasuries	0.43	0.19	0.96	1.00													
Global bonds	0.10	0.91	0.41	0.41	1.00												
US small cap	-0.02	-0.07	0.02	-0.10	-0.02	1.00											
US mid cap	0.00	-0.03	0.11	-0.04	0.02	0.93	1.00										
US large cap	0.05	-0.02	0.14	0.00	0.05	0.81	0.93	1.00									
Developed world equities	-0.03	0.36	0.06	-0.06	0.39	0.63	0.69	0.70	1.00								
Emerging market equities	-0.07	0.03	-0.04	-0.16	0.06	0.68	0.70	0.67	0.69	1.00							
Hedge funds	0.06	-0.05	0.07	-0.06	0.00	0.83	0.82	0.75	0.64	0.78	1.00						
Fund of HFs	0.00	-0.08	0.05	-0.06	-0.06	0.58	0.59	0.53	0.49	0.66	0.86	1.00					
Real estate	-0.12	0.05	0.12	0.00	0.09	0.64	0.64	0.53	0.45	0.42	0.43	0.28	1.00				
Private equity*	-0.05	-0.11	-0.19	-0.26	-0.12	0.62	0.66	0.70	0.60	0.52	0.73	0.67	0.35	1.00			
Commodities	-0.21	0.19	-0.06	-0.12	0.13	0.23	0.27	0.22	0.31	0.33	0.34	0.37	0.20	0.24	1.00		
Gold (US\$/oz)	-0.10	0.32	0.08	0.07	0.30	-0.01	-0.04	-0.09	0.12	0.13	0.06	0.10	0.04	-0.13	0.30	1.00	

*The private equity data used for this correlation matrix is on a quarterly frequency unlike all other assets which use monthly data.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 16: Correlation matrix for various assets from a euro perspective

	European large cap	European small cap	US large cap	Emerging market equities	Asia-Pacific equities	US bonds	European bonds	Global bonds x US/EU	European cash	Global cash	Commodities	Gold (£/oz)	Hedge funds	Fund of HFs	Real estate	Private equity ¹	
European large cap	1.00																
European small cap	0.87	1.00															
US large cap	0.80	0.68	1.00														
Emerging market equities	0.60	0.73	0.48	1.00													
Asia-Pacific equities	0.60	0.60	0.55	0.52	1.00												
US bonds	0.21	0.05	0.53	-0.07	0.23	1.00											
European bonds	-0.21	-0.18	-0.18	-0.13	-0.14	0.22	1.00										
Global bonds x US/EU	-0.12	-0.14	0.18	-0.33	0.23	0.70	0.21	1.00									
European cash	0.01	0.02	0.05	-0.06	0.07	0.26	0.32	0.30	1.00								
Global cash	0.10	-0.02	0.34	-0.17	0.33	0.76	0.06	0.85	0.39	1.00							
Commodities	0.30	0.38	0.41	0.25	0.32	0.39	-0.19	0.02	0.05	0.30	1.00						
Gold (£/oz)	0.00	-0.01	0.12	0.02	0.19	0.39	0.03	0.33	0.04	0.41	0.37	1.00					
Hedge funds	0.56	0.54	0.77	0.32	0.51	0.79	-0.13	0.46	0.23	0.65	0.54	0.40	1.00				
Fund of HFs	0.44	0.45	0.66	0.20	0.42	0.83	-0.12	0.49	0.27	0.70	0.55	0.43	0.96	1.00			
Real estate	0.66	0.72	0.50	0.48	0.49	0.10	0.02	-0.14	-0.05	0.00	0.25	0.02	0.31	0.23	1.00		
Private equity*	0.67	0.54	0.81	0.43	0.58	0.61	-0.36	0.31	0.03	0.60	0.50	0.33	0.88	0.86	0.37	1.00	

*The private equity data used for this correlation matrix is on a quarterly frequency unlike all other assets which use monthly data.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

Table 17: Correlation matrix for various assets from a sterling perspective

	UK large cap	UK small cap	Global stock x UK	Emerging market equities	UK cash	Global cash	UK gilts	UK corporates	US bonds	European bonds x UK	Commodities	Gold (£/oz)	Hedge funds	Fund of HFs	Real estate	Private equity
UK large cap	1.00															
UK small cap	0.79	1.00														
Global stock x UK	0.80	0.69	1.00													
Emerging market equities	0.61	0.63	0.75	1.00												
UK cash	0.05	0.05	0.08	0.06	1.00											
Global cash	0.09	0.00	0.32	0.19	0.24	1.00										
UK gilts	0.18	0.06	0.17	0.08	0.36	0.26	1.00									
UK corporates	0.28	0.30	0.19	0.21	0.08	0.06	0.59	1.00								
US bonds	0.17	0.11	0.40	0.29	0.26	0.73	0.33	0.12	1.00							
European bonds x UK	0.12	0.02	0.25	0.16	0.12	0.73	0.44	0.36	0.48	1.00						
Commodities	0.27	0.32	0.37	0.42	-0.01	0.30	-0.05	0.09	0.38	0.20	1.00					
Gold (£/oz)	0.00	0.01	0.14	0.22	0.06	0.45	0.11	0.02	0.42	0.28	0.38	1.00				
Hedge funds	0.49	0.48	0.71	0.68	0.24	0.54	0.21	0.07	0.76	0.29	0.51	0.39	1.00			
Fund of HFs	0.37	0.36	0.58	0.58	0.24	0.55	0.21	0.05	0.80	0.27	0.51	0.42	0.95	1.00		
Real estate	0.60	0.62	0.49	0.36	-0.06	0.11	0.22	0.30	0.12	0.22	0.24	0.01	0.25	0.17	1.00	
Private equity*	0.49	0.45	0.71	0.56	0.12	0.24	0.11	-0.06	0.45	0.02	0.33	0.24	0.83	0.79	0.15	1.00

*The private equity data used for this correlation matrix is on a quarterly frequency unlike all other assets which use monthly data.

Source: Barclays Capital, Bloomberg, Hedge Fund Research, J.P. Morgan, Thomson Reuters, World Gold Council

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