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# Should Insitutional Investors include a Gold ETF in Their Portfolio: Comparative Analysis of Gold Performance




FIN11 – Trading & Market Microstructure
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## Abstract

Investment decisions are one of the key activities for a portfolio manager. Investments are most often a result of intricate analyses combined with comprehensive market insight. Over time, gold has been generally accepted as one of the true safe havens for investors in times of rough market conditions. Initially, we will compare gold to other precious metals to investigate whether this assumption still holds, or if it has lost its explanatory power during the last 15 years. We have analyzed the impact of including gold in a balanced portfolio through holding gold ETF shares. In our analysis we have applied Jaffe's (1989) approach to construct three portfolio strategies with varying risk-appetites. Moreover, we have used a combination of performance measurements to analyze the impact of gold in each portfolio. We have specifically chosen to limit our analysis to gold's impact on risk-adjusted returns. We have chosen three different time-intervals for our observations to analyze the impact of holding gold throughout different market conditions.

We have found that over the last 15 years, holding gold in a diversified portfolio would have increased excess returns and decreased portfolio risk for every strategy. For each individual sub-period, we have found that this also applies to holding gold in times of recession (2005-2010) and in times of continuous growth (2015-2019). Although, in times of recovery (2010-2015), holding gold in a balanced portfolio would have decreased portfolio risk, but also decreased excess- and annualized returns.

We find these observations interesting as some of our results at first seems counterintuitive. While gold shows the characteristics of a zero-beta asset, it has approximately the same mean return as a Treasury Bill and bears no market risk (McCown & Zimmerman, 2006). Therefore, one could assume that substituting assets that benefited from overall market growth (S&P500, real estate and emerging markets) with a zero-beta asset would have decreased annualized returns over time. This has evidently not been the case over the last 15 years.

# Table of contents

**ABSTRACT** ..... **1**

**INTRODUCTION** ..... **3**

**THEORY** ..... **4**

The Reason to Invest in Gold ..... 4
ETF Fundamentals ..... 5
Advantages & Disadvantages ..... 5
Introducing the gold ETF ..... 6
Transaction- and management costs ..... 6
Performance measurements ..... 7
*Sharpe ratio* ..... *7*
*Treynor Ratio* ..... *7*
*Jensen's Alpha* ..... *8*

**DATA & METHODOLOGY** ..... **8**

Volatility and returns ..... 10
Systematic risk ..... 11
Characteristics of the portfolio ..... 12
Transaction cost ..... 13
Summary ..... 14

**ANALYSIS** ..... **15**

Comparing Gold with Other Precious Metals ..... 15
Aggregate Gross Portfolio Performance 2005-2019 ..... 17
Aggregate Net Portfolio Performance 2005-2019 ..... 18
2005 – 2010 - Recession ..... 19
Sub-conclusion ..... 20
2010 – 2015 – Recovery/Growth ..... 20
Sub-conclusion ..... 21
2015 – 2019 – Growth ..... 21
Sub-conclusion ..... 22
Weaknesses of the analysis ..... 22

**CONCLUSION** ..... **23**

**BIBLIOGRAPHY** ..... **25**

# Introduction

In this paper we will analyze the impact of including gold in a balanced portfolio during different market conditions. We aim to unfold whether investors should include a gold ETF in their portfolio during times of recession, recovery or growth. We find this topic compelling due to gold being generally accepted as a secure hedge against the equity and money market in times of economic- and political instability. Baur and Lucey (2010)found that gold is a certain hedge against stocks on average, and a safe haven in extreme market conditions. However, their study was based on observations between 1995 and 2005. Thus, we want to ascertain whether this premise is tangible with more recent developments in the market, or if the validity of gold as a hedging tool has lost its explanatory power. We also compare gold with other precious metals to determine if it can be considered as the superior hedging tool. We find this case both challenging and relevant to the course as it requires a combination of processing large amounts of data and syllabus-oriented theory.

*Historically, gold has always been a safe haven against inflation and a safe haven in times of political instability - John Paulsen*

The basis for the analysis is to compare three portfolio strategies before and after the addition of a gold ETF. The portfolios vary in risk appetite and our data is divided into three sub-periods. We have chosen to apply three different performance measures for risk-adjusted returns to provide a more comprehensive interpretation of our results. We will angle the analysis from the perspective of an American investor. Hence, the S&P500 has been applied as a universal benchmark in our calculations. We have divided our observations into three time-intervals: 2005-2010, 2010-2015 and 2015-2019. Our findings are further augmented by analyzing the portfolio performances with and without transaction- and management costs.

First, we will assess all the theoretical aspects necessary to interpret our analysis. Then we will explain the data and methodology used in the analysis. In the analysis we will discuss our findings

in light of our data, calculations and pre-conceived assumptions. Finally, we will discuss eventual weaknesses of our analysis and provide a conclusion based on the results.

# Theory

In this part of the paper we will provide the reader with fundamental knowledge necessary to interpret the upcoming analysis. First, we are going to discuss why investors historically has included gold in their investment strategies. Concurrently, we will review some of the criticism towards investing in gold. After, we will explain the fundamentals of exchange traded funds, along with its advantages and disadvantages. Finally, we will provide an in-depth explanation on the performance measures applied in the analysis.

## Advantages and disadvantages of gold investing – Historically

Several studies have found three main attributes of gold that can be beneficial for a portfolio manager. Firstly, research has found gold to be an efficient tool for hedging against inflation, political unrest and currency risk. In addition, Nikos (2006) found that gold is more efficient as a hedging tool than other precious metals. Secondly, several studies have found that gold can provide benefits of diversification. Sherman (1986) used simulation to assert the effect of holding different ratios of gold in a balanced portfolio. He found that almost every portfolio that did not hold a position in gold could generate benefits of diversification from doing so. Gold has also been observed to be more attractive in the wake of extreme market shocks, acting as an important safe haven for investors (Ciner et. al, 2010). This is mainly due to the physical nature of gold. If we compare it to bonds, gold is the only asset where you are guaranteed a zero chance of defaulting since it is a physical asset.

These studies have contributed to a general acceptance of gold being an efficient tool for hedging equity markets, generating diversification and providing safety when shocks arise. Nevertheless, the findings have received some criticism as well. For example, Wang (2011) found that the

efficiency of gold as a hedging tool fluctuates over time. In addition, Chua and Woodward (1982) confirmed that gold was an effective way to beat inflation, but only in the US. Additionally, Johnson and Soenen (1997) found that the benefits gained from holding gold in a portfolio in the period 1978 to 1995 were negligible, and that it did not increase risk-adjusted returns during this period. Thus, the benefits from holding gold in a portfolio is highly debatable.

## ETF Fundamentals

An increasingly popular way to invest is through exchange traded funds (ETFs). ETFs are publicly traded on a stock exchange with the sole purpose of replicating a given benchmark or index through holding a pool of assets. Some of them tracks indexes in their entirety, while other use representative sampling. ETFs are primarily divided into six categories: equity funds, fixed-income funds, commodity funds, currency funds, real estate funds and specialty funds (Petrova, 2015). Since its introduction in 1989, the ETF industry in the US has surpassed $4 trillion in assets (ETF.com, 2019).

The structure of an ETF offers a range of advantages to investors. Firstly, ETFs are traditionally designed to be managed passively, resulting in low administrative expenses. Usually, the total expense ratio for an ETF ranges from 0.15% to 0.70% and carries an average expense ratio of 0.44% a year. This is almost half the expense ratio of owning an index fund, averaging at 0.74% a year (Wall Street Journal, 2019). The expense ratio is the sum of transaction fees related to acquiring the ETF plus the management fees. ETFs are also highly tax efficient. Due to its passive structure, shareholders will only be exposed to taxable capital gains when they sell their shares. ETFs also offer high trading flexibility as they are listed on stock exchanges with prices varying throughout the day. Additionally, certain types of ETFs provide investors with the opportunity to fully diversify their portfolio through holding one financial instrument.

Nevertheless, investors are also exposed to a handful of disadvantages. Studies have found a significant tracking error between the most liquid ETFs and their affiliated benchmarks (Defuso, 2011). Thus, investors are exposed to a higher level of risk than they might think. Equally

important, due to SEC regulations, ETFs are not allowed to reinvest the dividends paid by securities that make up the underlying index, thereby losing the benefit of dollar cost averaging in downturn markets (Armstrong, 2013). Also, liquidity can be a problem for ETFs in thinner markets. This has previously increased the bid-offer spread and generated added costs to investors.

## Introducing the gold ETF

The gold ETF was first introduced in 2003, categorized as a commodity fund. The main goal of a gold ETF is to track the changes in the gold price. This ETF type is structured in a way that provides investors the opportunity to profit from changes in the gold price, without holding the physical asset. The gold ETF acts like any other individual stock and is bought and sold on an exchange. Gold ETFs can be structured in a variety of ways, usually by holding a representative sample of gold derivatives or gold options. Although, the ETF can also be backed by a stockpile of the physical asset itself.

## Transaction- and management costs

Since ETFs are traded on exchanges there are commission fees associated with trading them. The commission is often a flat fee, paid to the broker or another salesperson due to exchange of services in facilitating or completing a sale transaction (Bragg, 2018). As different brokers operate with different commission fees these can range anywhere from $0 to $25 (Vanguard, 2019). As a result of the ongoing zero-commission rivalry between brokers, most brokers have removed their commission fees related to trading ETFs (Fidelity Investments, 2019).

The bid/ask spread is also a part of the transaction cost of trading ETFs. The ask is the market price at which an ETF can be bought, and the bid is the market price at which it can be sold. There are three main factors that impacts the overall cost of the bid/ask spread: The extent of market makers competition, the liquidity of the underlaying asset(s) in the ETF and the market maker inventory management costs (Iachini, 2019). As a result, ETFs with high trading volumes provide more liquidity to the market which results in lower transaction costs related to the bid/ask spread.

Another potential transaction cost is changes in discounts and premiums to an ETF's net asset value (NAV). This is only a potential cost, as it can also be a factor to benefit from. On the one hand, an ETF is said to be traded at a premium when the underlaying asset(s) of the ETF is worth less than the market price of the ETFs NAV. On the other hand, an ETF is traded at a discount when the market price of an ETF's NAV is lower than the ETF itself. When discounts and premiums occur, the market usually corrects itself due to arbitrage traders. This results in better alignment between the ETF's market price and NAV.

## Performance measurements

The main task for an investor is to evaluate the potential performance of an investment. Explicitly, investors must be aware of the risk taken and the subsequent returns expected. To measure portfolio performance, we have chosen to apply a combination of the Sharpe ratio, the Treynor ratio and Jensen's Alpha.

### Sharpe ratio

The Sharpe ratio (Sharpe, 1966) is conceivably the most eminent and practiced tool for measuring risk-adjusted return. From an investor's point of view, the ratio describes how well the return of an investment compensates the investor for the risk taken. The Sharpe ratio is measured by using the standard deviation of a portfolio. The measure closely follows the Capital Asset Pricing Model (CAPM), and by extension uses total risk to compare portfolios to the capital market line (Mukul, Kumar & Ray, 2012).

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$$

### Treynor Ratio

The Treynor ratio measures the risk-adjusted return by comparing the performance of a single portfolio to the equity market. To do so, one must substitute the standard deviation of the portfolio in the Sharpe equation with the beta of the portfolio. The beta is defined by the slope of the security market line (SML), which measures the relative volatility of the portfolio returns with respect to

the market returns (Mukul, Kumar & Ray, 2012). The Treynor ratio is purely based on the systematic risk of a portfolio.

$$Treynor\ Ratio = \frac{R_p - R_f}{\beta_p}$$

### Jensen's Alpha

Jensen's alpha is an absolute measure of portfolio performance that measures excess return gained by deviating from a given benchmark (CAPM). Therefore, it exposes a portfolio manager's ability to deliver returns exceeding the average returns of a market. The measure can be broken down into two equations:

1. $Benchmark\ Portfolio\ Return\ (CAPM) = Risk\ Free\ Rate\ of\ Return + Beta(Return\ of\ Market - Risk\ Free\ Rate\ of\ Return)$

2. $Jensen's\ Alpha = Portfolio\ Return - Benchmark\ Portfolio\ Return$

## Data & Methodology

For the purpose of this analysis, we have collected monthly data from our chosen ETFs, S&P500 and the spot gold price from March 2005 to September 2019. We also collected spot prices of three other precious metals and one industrial metal index. These were silver, platinum, palladium and the Bloomberg Industrial Metal Index (BCOMIN). We did this to determine if gold is the optimal asset in terms of portfolio performance and risk adjusted returns. The starting point of our analysis takes place four months after the first gold ETF was listed on the NYSEArcha (Seafong, 2019). The data from the 174 months was collected from Yahoo Finance and the Bloomberg Terminal at NHH. Prices are retrieved from the first business day of each month and is adjusted for any stock splits/reverse and dividends. Our study reflects the viewpoint of an American investor and all calculations have been done in US dollars.

We seek to capture the effect of gold ETFs on investors with varying risk appetites. Therefore, our analysis is based on three different portfolio constructions with different degrees of risk exposure. The portfolios are constructed in line with Jaffe's (1989) approach. Jaffe wanted to replicate the allocations of typical institutional investors. We find this approach meaningful to implement in our analysis. Therefore, we have split the portfolios in three different categories: defensive, neutral and aggressive. *Table 1* summarizes the portfolio weights chosen to achieve these risk profiles.

| | Defensive | Neutral | Aggressive |
|---|---|---|---|
| IVV | 45% | 40% | 50% |
| EEM | 10% | 20% | 25% |
| IYR | 10% | 20% | 25% |
| TNX | 35% | 20% | 0% |

*Table 1: Portfolio categories and weight*

The portfolios are diversified across different market sectors to accurately reflect the allocation of an institutional US investor (Jaffe, 1989). To represent the US equity market, we used the iShares Core S&P 500 ETF (IVV), which tracks the S&P 500 index (Blackrock, 2019). We have also included the iShares MSCI Emerging Markets ETF (EEM) for international and emerging market exposure. The portfolios are also exposed towards real estate through the iShares U.S. Real Estate ETF (IYR), an ETF that invests directly in real estate companies and REITs (Blackrock, 2019). For our risk-free asset we chose to apply the 10-year US treasury bond, and for the risk-free rate of return we have used the US 3-month T-bill rate. We can consider the 10-year treasury bond to be risk-free as the US has a credit rating of AAA (prime). The 3-month T-bill offers the most accurate risk-free rate as the lending period is very short. Lastly, to see the effect of including gold in the three portfolios we have used the iShares Gold Trust (IAU), which seeks to track the performance of the gold spot price. This ETF only holds gold bullions and gives direct exposure to the gold price (Blackrock, 2019).

To directly analyze the impact of gold, we will compare all our portfolio's performances both with and without an exposure to the gold ETF. Where Jaffe (1989) analyzes his portfolios with different degrees of gold exposure, we will restrict our exposure to either zero or 10% of the portfolio weight in the iShares Gold Trust. When including gold, we will equally reduce the weights of the remaining assets.

## Volatility and returns

Having the data sampled, we calculated each ETF's monthly standard deviation and the individual asset's monthly average returns for the sub-periods. To compute the average returns, we used the geometric average mean. This was a natural choice because the geometric average takes the compounding of returns into account and is a more accurate measure of returns over time. Our findings are illustrated in *table 2*.

| | | IVV | EEM | IYR | TNX | IAU |
|---|---|---|---|---|---|---|
| **2005-2010** | Monthly Geometric Mean | 0.0007 | 0.0107 | 0.0006 | 0.0011 | 0.0160 |
| | Anualized Geometric Mean | 0.0079 | 0.1361 | 0.0069 | 0.0128 | 0.2100 |
| | Standard Deviation | 0.0470 | 0.0810 | 0.0910 | 0.0000 | 0.0560 |
| | Beta | 1.0600 | 0.5300 | 0.4500 | 0.0000 | 0.1000 |
| **2010-2015** | Monthly Geometric Mean | 0.0119 | 0.0011 | 0.0111 | 0.0000 | 0.0012 |
| | Anualized Geometric Mean | 0.1521 | 0.0130 | 0.1421 | 0.0004 | 0.0146 |
| | Standard Deviation | 0.0380 | 0.0580 | 0.0480 | 0.0000 | 0.0550 |
| | Beta | 0.9800 | 0.5100 | 0.5100 | 0.0000 | 0.1200 |
| **2015-2019** | Monthly Geometric Mean | 0.0085 | 0.0020 | 0.0062 | 0.0004 | 0.0039 |
| | Anualized Geometric Mean | 0.1063 | 0.0245 | 0.0768 | 0.0050 | 0.0474 |
| | Standard Deviation | 0.0360 | 0.0490 | 0.0370 | 0.0000 | 0.0390 |
| | Beta | 0.9600 | 0.5100 | 0.5900 | 0.0000 | -0.1000 |
| **2005-2019** | Monthly Geometric Mean | 0.0070 | 0.0050 | 0.0064 | 0.0002 | 0.0069 |
| | Anualized Geometric Mean | 0.0879 | 0.0613 | 0.0793 | 0.0029 | 0.0856 |
| | Standard Deviation | 0.0410 | 0.0040 | 0.0630 | 0.0000 | 0.0510 |
| | Beta | 0.9900 | 0.4900 | 0.4600 | 0.0000 | 0.0200 |

*Table 2: Average returns 2005-2019*

Further, we used the following formulas to calculate the geometric mean and standard deviation of each asset:

*Formula 1:*

$$Geometric\ mean = [(1 + R_1) * (1 + R_2) * \ldots * (1 + R_n)]^{1/n} - 1$$

$r_1 \ldots r_n = Individual\ monthly\ returns$

$n = count\ of\ return\ samples$

*Formula 2:*

$$Standard\ Deviation = \sqrt{\frac{\sum |x - X|^2}{n}}$$

$x = Monthly\ return$

$X = Mean\ return$

$n = count\ of\ return\ samles$

## Systematic risk

In addition to the standard deviation, which indicates an asset's isolated behavior, we need to measure each asset's systematic risk. The beta takes account for this type of risk and informs us about an asset's behavior in comparison to the rest of the market. Therefore, we need a benchmark index for each asset. Given the perspective of an American investor, we chose the S&P 500 as our benchmark to compute the systematic risk each asset historically has faced. S&P500 is widely recognized as a measure for the US equity market and we find it appropriate as a benchmark for our research.

We also had to compute correlation coefficients for all assets. The correlation coefficient indicates the statistical relationship between two variables. We used the formulas below to compute all correlation coefficients giving us the correlation matrixes displayed in *table 3*.

*Formula 3:*

$$Cov(x,y) = \frac{\sum(x - X) * (y - Y)}{(n-1)}$$

*Formula 4:*

$$Corr(x,y) = \frac{Cov(x,y)}{\sigma_x * \sigma_y}$$

| 2005-2010 | IAU | IYR | EEM |
|---|---|---|---|
| IVV | 0.0978 | 0.8283 | 0.8504 |
| EEM | 0.3433 | 0.6552 | |
| IYR | 0.0782 | | |

| 2010-2015 | IAU | IYR | EEM |
|---|---|---|---|
| IVV | 0.1041 | 0.6842 | 0.7919 |
| EEM | 0.2992 | 0.6462 | |
| IYR | 0.2611 | | |

| 2015-2019 | IAU | IYR | EEM |
|---|---|---|---|
| IVV | -0.1046 | 0.6469 | 0.7009 |
| EEM | 0.2420 | 0.4484 | |
| IYR | 0.0461 | | |

| 2005-2019 | IAU | IYR | EEM |
|---|---|---|---|
| IVV | 0.0421 | 0.737335 | 0.7835 |
| EEM | 0.3121 | 0.6119 | |
| IYR | 0.1125 | | |

*Table 3: Correlation matrix*

## Characteristics of the portfolio

It was necessary to compute the descriptive statistics for the portfolios in addition to the assets they are composed of. To do this we have followed basic portfolio theory to compute the individual portfolio returns, standard deviations and betas. Unlike the measures for the individual assets we now deliver annualized returns and standard deviations. Due to its nature, the beta values will not differ from the computations for the individual assets. While the annualized standard deviation is converted by multiplying the monthly deviation with the square root of 12, the returns were converted by applying the following formula:

*Formula 5:*

$$Effective\ annual\ returns\ = (1 + r)^{12} - 1$$

Both the portfolio returns, and betas are computed as the sum of the weighted average of its components. We calculated the standard deviation for the portfolio by applying the following formula:

*Formula 6:*

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{1,2}\sigma_1\sigma_2}$$

Altogether, this gives us the required input to analyze the portfolios' risk adjusted and excess returns. To do so we will utilize Jensen's alpha, Treynor's Ratio and the Sharpe Ratio. Our findings for the full period, and sub periods, will be presented in the upcoming analysis.

## Transaction cost

Investing in ETFs can potentially generate significant costs even though they generally are considered cost efficient investments (Vanguard, 2019). Transaction costs are therefore highly relevant from an investor's perspective. The expense ratio of each ETF is the direct cost affiliated with investing in an ETF. These are deducted directly from the fund's assets annually. To correct our data samples, the expense ratio is deducted from each of the ETFs aggregated returns on the first day of each year. This gives us the returns realized for the investor given a long-term holding horizon.

There are more aspects of transaction cost to consider than simply deducting the expense ratio regarding ETFs. Unlike stocks the spread does not give an appropriate indication of trading costs (Angel et.al, 2016). Since they often are traded at a discount or premium, the appropriate measure according to Angel's paper is the difference between trading price and the fund's net asset value. As these tend to exceed the ETFs spread significantly, they are of outmost importance from an investor's view. Unfortunately, it's difficult to access the ETFs historical NAV data needed to evaluate the difference between NAV and trade price accurately. Since we look at long term investments, which reduces the importance of such costs, we will not present calculations on them in this paper.

## Summary

Based on the calculations described in the section above, we have obtained a set of results presented in *table 4* below. All calculations and graphs were produced in Microsoft Excel.

| | | Agressive_NG | Agressive_G | Neutral_NG | Neutral_G | Defensive_NG | Defensive_G |
|---|---|---|---|---|---|---|---|
| 2005-2010 | Monthly Geometric Mean | 0,00314451 | 0,00434825 | 0,003095608 | 0,004326182 | 0,002437279 | 0,003667853 |
| | Annualized Geometric Mean | 0,038393607 | 0,053445141 | 0,037786327 | 0,053167421 | 0,029642607 | 0,044913092 |
| | Annualized Standard Deviation | 0,212416263 | 0,180172516 | 0,16993301 | 0,145909688 | 0,12460205 | 0,107699295 |
| | Portfolio Beta | 0,771827514 | 0,714629546 | 0,617462011 | 0,577178336 | 0,573129763 | 0,532846087 |
| | Sharpe Ratio | 0,120668571 | 0,225823245 | 0,147283498 | 0,276948175 | 0,135508268 | 0,298563636 |
| | Treynor Ratio | 0,033214167 | 0,056934593 | 0,040534199 | 0,070012021 | 0,029460358 | 0,060345931 |
| | Jensens Alpha | 0,068213398 | 0,080109612 | 0,05909056 | 0,072249409 | 0,048501256 | 0,061549496 |
| 2010-2015 | Monthly Geometric Mean | 0,008986418 | 0,008304866 | 0,007589534 | 0,007058595 | 0,007261802 | 0,006730863 |
| | Annualized Geometric Mean | 0,113329819 | 0,104338862 | 0,094973917 | 0,088070121 | 0,090707694 | 0,083828565 |
| | Annualized Standard Deviation | 0,142582168 | 0,127001836 | 0,114065735 | 0,103158051 | 0,08887273 | 0,080285412 |
| | Portfolio Beta | 0,744443907 | 0,689820097 | 0,595555126 | 0,545589743 | 0,54256641 | 0,504598959 |
| | Sharpe Ratio | 0,792028953 | 0,818399572 | 0,829112296 | 0,849855618 | 1,016139373 | 1,039142095 |
| | Treynor Ratio | 0,151696057 | 0,150674427 | 0,158798572 | 0,160687602 | 0,166443911 | 0,165335164 |
| | Jensens Alpha | 0,018015641 | 0,015988997 | 0,018642452 | 0,018109038 | 0,021131917 | 0,019093641 |
| 2015-2019 | Monthly Geometric Mean | 0,006280547 | 0,00611131 | 0,005406837 | 0,005328685 | 0,005295442 | 0,00521729 |
| | Annualized Geometric Mean | 0,078025226 | 0,07581607 | 0,066846684 | 0,065851971 | 0,065429116 | 0,064435615 |
| | Annualized Standard Deviation | 0,119605 | 0,104413227 | 0,095684 | 0,084205678 | 0,077954458 | 0,068108726 |
| | Portfolio Beta | 0,751701686 | 0,673670974 | 0,601361349 | 0,540411315 | 0,539962018 | 0,479011983 |
| | Sharpe Ratio | 0,610726123 | 0,678767256 | 0,646579949 | 0,722904257 | 0,77545005 | 0,872961367 |
| | Treynor Ratio | 0,097174051 | 0,105203107 | 0,102878836 | 0,112641319 | 0,111951926 | 0,124122755 |
| | Jensens Alpha | 0,013404357 | 0,017421854 | 0,014154112 | 0,01799531 | 0,017608103 | 0,021450502 |
| 2005-2019 | Monthly Geometric Mean | 0,006361129 | 0,006434365 | 0,005137103 | 0,005315445 | 0,004390776 | 0,004532968 |
| | Annualized Geometric Mean | 0,079061612 | 0,080004317 | 0,063417137 | 0,065683536 | 0,053980532 | 0,055772472 |
| | Annualized Standard Deviation | 0,163308337 | 0,140926149 | 0,130646669 | 0,1141119 | 0,099339808 | 0,086976151 |
| | Portfolio Beta | 0,627959 | 0,579509067 | 0,5023672 | 0,4666318 | 0,4977066 | 0,4619712 |
| | Sharpe Ratio | 0,466392454 | 0,547155235 | 0,463244114 | 0,550229343 | 0,514241934 | 0,607944071 |
| | Treynor Ratio | 0,121291001 | 0,133058281 | 0,120472237 | 0,134555123 | 0,10264018 | 0,114458727 |
| | Jensens Alpha | 0,036627989 | 0,040621216 | 0,028891071 | 0,033407455 | 0,019747908 | 0,023789834 |

*Table 4: Calculations of Monthly geometric mean, Annualized geometric mean, Annualized standard deviation, Portfolio beta, Sharpe ratio, Treynor ratio and Jensen's alpha in the time period 2005-2019*

# Analysis

We have firstly compared gold to other precious metals individually to investigate their characteristics and to see whether gold has outperformed them. We have then chosen to break down the analysis into the three subperiods. For each subperiod we will analyze each portfolio's performance by the chosen measurements. We discuss the results considering the coherent market conditions to see how well the portfolios including gold perform compared to the portfolios excluding gold. We analyze gross and net returns for the full period from 2005 to 2019 to see the effect of management fees. For the sub-periods we turn our attention towards gross returns.

## Comparing Gold with Other Precious Metals

Before analyzing the impact of gold on our portfolios, we chose to look at how gold has performed amongst other precious metals. *Table 5* presents a comparison of gold, silver, platinum, palladium and the Bloomberg's Industrial Metal Index from 2005 to 2019. We have included this comparison to confirm Jaffe's (1989) findings that gold will outperform its peers over time and lower portfolio risk in a superior manner to that of other metals.

| 2005-2019 | Annualized Geometric Mean | Annualized SD | Beta |
|---|---|---|---|
| **Gold** | **0.0856** | **0.1757** | **0.0241** |
| Silver | 0.0613 | 0.3185 | 0.0881 |
| Platinum | 0.0023 | 0.2410 | 0.1611 |
| Palladium | 0.1589 | 0.3245 | 0.1394 |
| BCOMIN | 0.0046 | 0.2234 | 0.3181 |

*Table 5 - Precious Metal Comparison*

Column one in *table 5* compares the annualized geometric mean returns and shows that gold is only beaten by palladium. The demand for palladium has surged the last decade due to its environmental advantages forcing especially car manufacturers to buy more of the precious metal (Reuters, 2019). The market for palladium is however characterized as small with challenging liquidity conditions (Reuters, 2019), which is reflected in its high standard deviation. Gold was clearly the least volatile asset amongst them and is likely to fluctuate less than other metals. Also, gold had the lowest beta, followed by silver. The beta value close to zero proposes that although gold is a volatile asset on its own, the

price movements is virtually unrelated to that of the market. This suggests that the inclusion of gold in the institutional portfolios will reduce volatility.

*Table 6* compares each assets' correlation coefficient to our chosen ETFs. The results generally show low correlation between precious metals and the other assets. BCOMIN was the most correlated to the ETFs, which is not surprising. The demand for industrial metals will always be dependent on market cycles. Gold has virtually no correlation to US equity- (IVV) and real estate (IYR) markets, nor emerging markets (EEM). In fact, gold was the least correlated to all of these markets compared to the other precious metals, which cements gold's superior characteristics and enhances our assumption of gold as a hedging tool and a diversifying asset. Our results show that over the last 15 years gold has outperformed the other precious metals individually, only beaten by palladium in terms of returns.

| 2005-2019 | IVV | EEM | IYR |
|---|---|---|---|
| **Gold** | **0.0421** | **0.3121** | **0.1125** |
| Silver | 0.2007 | 0.4245 | 0.2053 |
| Platinum | 0.2776 | 0.3494 | 0.2111 |
| Palladium | 0.3234 | 0.3978 | 0.1806 |
| BCOMIN | 0.5080 | 0.5981 | 0.3797 |

*Table 6 - Correlation Coefficients*

For the further analysis we will include gold in our constructed portfolios to investigate whether gold has enhanced risk-adjusted returns and functioned as a hedging tool for US institutional investors.

## Aggregate Gross Portfolio Performance 2005-2019

*Figure 1* presents the gross returns of a US$1000 investment in each portfolio from March 2005 to September 2019, before considering transaction- and management fees.

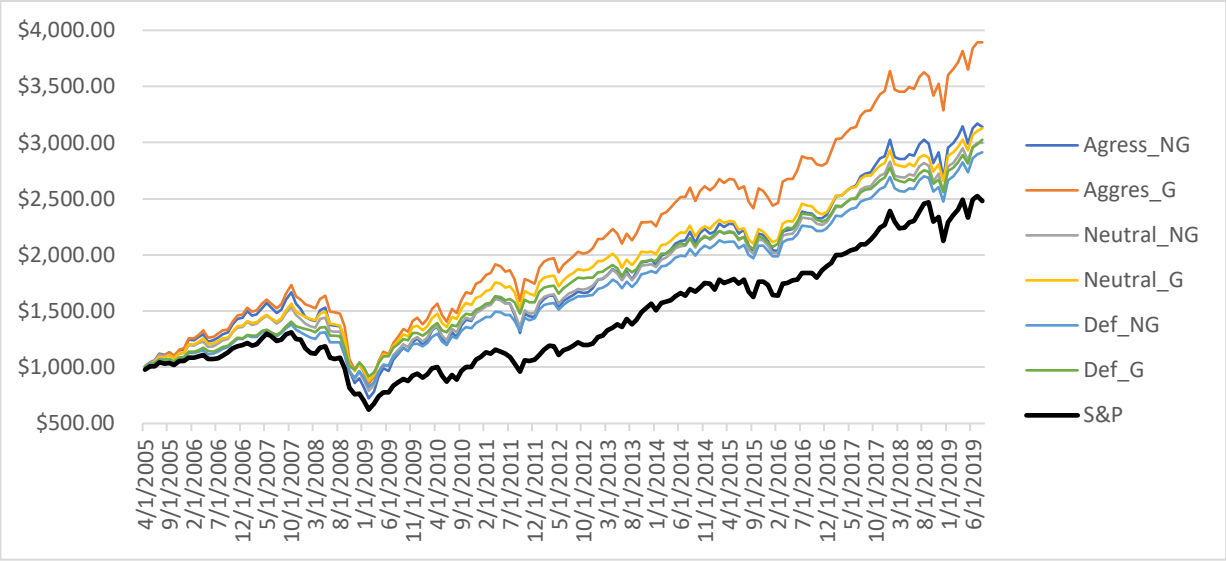



*Figure 1: Gross return of a $1000 investment, March 2005 - September 2019*

When observing the returns for the entire period of collected data, we have found several trends that applies to our case. For an aggressive investor, we have found that the inclusion of gold in a balanced portfolio has yielded higher returns than exclusion would. More precisely, by substituting 1/3 of each asset in the aggressive portfolio with IAU shares, investors would have increased their returns by approximately 20,5%. We found that including gold in the aggressive portfolio would have decreased portfolio risk from 16,3% to 14,1%. Thus, an aggressive strategy including gold would have increased the Sharpe ratio. We also find that the inclusion of IAU shares results in a higher reward-to-risk ratio (Treynor ratio), as well as a higher ratio of excess returns compared to the market (Jensen). These results confirm Agarwal's (1992) findings of gold being an efficient hedging tool for long term investors. The neutral and defensive portfolio strategies give us approximately the same results. The overall trend we see is that the more risk averse the investor becomes, the difference in returns between the gold-including and the gold-excluding portfolios narrows. This is a consequence of the investor having less exposure towards the aggregated market growth throughout this period.

## Aggregate Net Portfolio Performance 2005-2019

*Figure 2* shows the net growth of the initial US$1000 invested in 2005 after deducting management fees for each asset. The management fees for each ETF is shown in *table 7*. These results enable us to observe the more realistic returns investors would have achieved over the last 15 years.

| ETF | Management Fees |
|---|---|
| IVV | 0.04% |
| EEM | 0.67% |
| IYR | 0.42% |
| IAU | 0.25% |

*Table 7: ETF management fees*

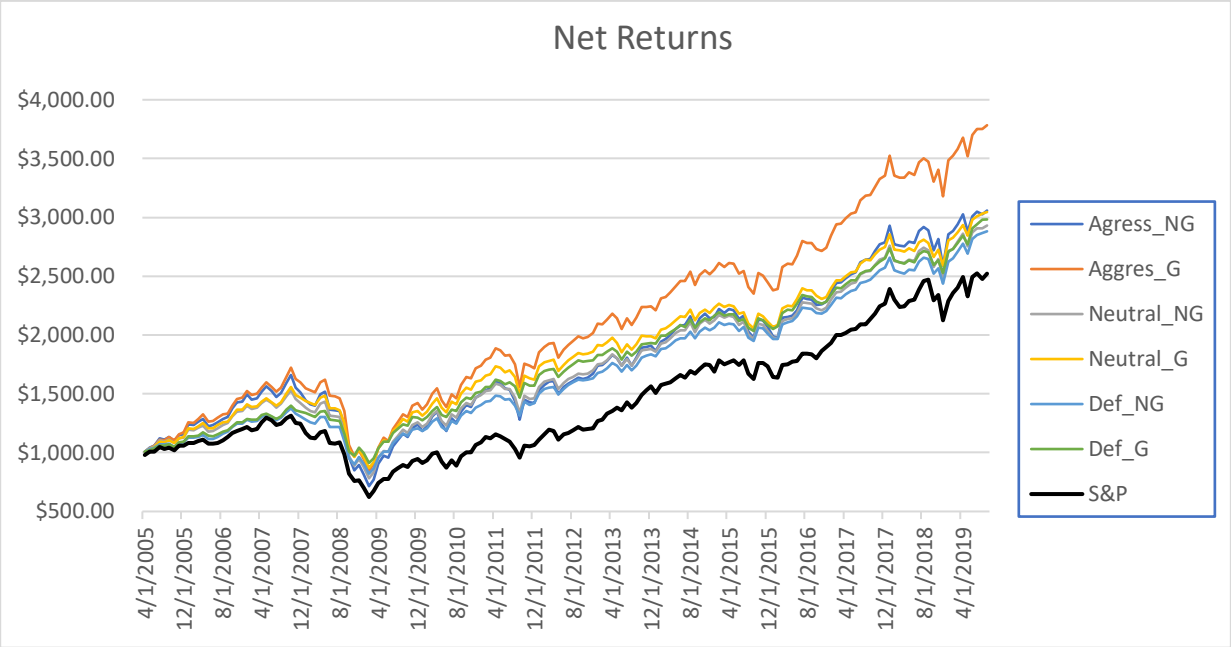



*Figure 2: Net growth of US$1000 invested in 2005 management fees deducted*

Since management fees for the gold ETF (IAU) is 0.25%, which is lower than for EEM and IYR, we did not expect any substantial changes in the portfolio rankings obtained from the gross results. The top performer was still the aggressive gold-including portfolio, which resulted in a total of US$3,753 compared to its gross value of US$3,893. The worst performer was still the defensive gold-excluding portfolio with a net result of US$2,866 compared to its gross result of US$2,913. Overall, the impact of management fees brings all of the net portfolio returns closer to the S&P500-index, but it does not change how the portfolios have performed in relation to each other by any substantial means. The gold-including portfolios still outperformed each gold-excluding portfolio.

This can be explained by two factors. Firstly, the management fee for IAU is low. Therefore, implementing IAU at the expense of other more expensive ETFs will reinforce the gross results and make the difference between gold-including and gold-excluding portfolios even bigger in long term, when keeping all other factors constant. Secondly, gold has been an attractive investment during the period which we have chosen to study. In order to investigate the reasons behind these aggregated results, we will have to dive deeper into each subperiod.

### 2005 – 2010 - Recession

The period spanning from March 2005 – March 2010 is heavily influenced by extreme market conditions caused by the financial crisis, which lasted from the third quarter of 2007 to the first quarter of 2009. During this period the American stock and real estate market completely crashed, losing more than 50% of its values. The US money market and commodity prices also declined during these years. However, in 2009/2010 certain markets quickly recovered and this upturn is also included during this subperiod.

*Table 2* tells us that both EEM and IAU outperformed US equity, real estate and bond markets during this period. Emerging markets recovered quickly from the extreme conditions. In 2010 alone emerging market portfolios attracted more than 73 billion US dollars, a development that favored the aggressive risk profile (Mobius, 2010). The growth in emerging markets is reflected in our portfolios, as the aggressive risk profile achieved the best results before and after the inclusion of gold. We can also see from the collected data that the IAU was an attractive investment, yielding 21% yearly. Therefore, it does not come as a surprise that the gold-including portfolios outperformed all the non-gold ones across the different performance measurements. After including the IAU ETF shares in our portfolios, both market risk and volatility is reduced for all the portfolios, which seems to confirm Baur & Lucey's (2010) findings that gold can be used as an effective hedge against extreme market conditions.

Looking more specifically at the performance measurements, we see an assortment of unhealthy ratios for all the portfolios. Although, after including gold we see some improvements due to its

low correlation to the other assets. The Sharpe-ratio marginally favors the defensive gold-including portfolio, whereas the Treynor's ratio prefers the neutral gold-including portfolio. The aggressive gold-including portfolio is put at a disadvantage due to its high volatility measures. However, because the aggressive portfolio is more exposed to emerging markets, its alpha generating abilities exceeded the others.

### Sub-conclusion

We conclude that for the period 2005-2010, the gold-including portfolios generally improved risk-adjusted returns for an institutional US investor. Moreover, gold served as an effective hedge against other common investment types such as common stocks, US real-estate and money markets due to its low correlation coefficient.

### 2010 – 2015 – Recovery/Growth

The five-year period between 2010 and 2015 can be characterized as a period of recovery from the financial crisis. The effects of Obama's ARRA (American Recovery and Reinvestment Act) resulted in increased government expenditure as well as a decrease in corporate tax rates. As a result, institutional investors were incentivized to invest more aggressively, and the data collected in this study confirms the positive effects from ARRA. This stimulated the economy to grow rapidly in the wake of the financial crisis.

As a result of the rapid market growth in the US from 2010 to 2015, it is fair to assume that an investor would benefit from applying a high beta to their portfolio. Thus, the inclusion of gold in one's investment strategy – which we have proven decreased the portfolio beta – should ultimately result in lower returns.

If an investor were to utilize an aggressive strategy in this period, the inclusion of IAU would result in 1% lower annualized returns than if excluded. The Sharpe ratio of the including portfolio was higher. This is due to the fact that the subsequent standard deviation of a gold-

including portfolio was 1,55% lower. Even though holding gold decreased returns in this period, it resulted in better returns when adjusting for risk. The alpha of the non-gold portfolio was slightly higher than the gold-including portfolio alpha.

If you applied a neutral investment strategy in the given period, the results were the same. Although, the deviation in risk-adjusted returns was narrower due to the reallocation from risky assets in the aggressive strategy, to 10-year treasury bonds in the neutral. This is understandable as neutral investors did not enjoy the same amount of growth-related benefits as the aggressive investors. Lastly, the performance of the defensive portfolio had similar characteristics as the aggressive and neutral, when comparing measures before and after including gold.

### Sub-conclusion

In this period, including gold has yielded lower returns than if left out. This could be due to the gold price plunging in 2013 by over 25% due to the Cyprus banking crisis. At the same time, deviations in performance measures between the non-gold and gold-including portfolio decreased as the investor gets more risk-averse. We also noticed that the Sharpe ratio was consistently higher when including gold, while the alpha was consistently higher when not including gold. Lastly, the Treynor-ratio is higher for both the aggressive and defensive investment strategy when excluding gold.

### 2015 – 2019 – Growth

The period between 2015 and 2019 can be characterized as a period of growth. Although, there has been some incidents that have threatened the global financial outlook. For example, the eurozone debt crisis, Brexit, flash crashes and Trump's initiation of a trade war with China. However, the overall economic growth over the last five years has unquestionably been positive. The S&P500 has grown by 50%, Dow Jones has grown by 56% and US GDP has grown by 12% (The World Bank, 2019). Gold investors also enjoyed the recovery of the gold price after it plunged more than 25% in 2013. Altogether, the summation of these events has shown a different impact on portfolio performance measures compared to the preceding five years.

In contrast to the period between 2010-2015, holding gold in a portfolio resulted in better performance in every measurement, not only the Sharpe ratio. This is due to the recovery of the gold price. IAU carried an annualized return of 4,74% (*table 4*), compared to its annualized returns in the foregoing five-year period of 1,46%. At the same time, the standard deviation of each investment strategy showed a significantly lower portfolio risk when including gold in the portfolio. This observation was also noted in the period 2005-2010 and again confirms gold's hedging abilities.

## Sub-conclusion

During the period between 2015 and 2019, several destabilizing economic events occurred both globally and in the US. Although, all our portfolios have delivered solid annualized returns. The inclusion of gold in a portfolio during this period resulted in better risk-adjusted returns for every investment strategy, lowering each of the portfolio's standard deviation. We conclude that also during this period gold had a hedging function on the portfolios.

## Weaknesses of the analysis

Constructing our portfolios, we did not utilize optimization models to determine the portfolio weights. This makes our portfolios sub-optimal, meaning we easily could increase their performance by changing their assets weights. Nevertheless, our portfolios serve the purpose of finding the best performing option among them, when allocating parts of it in gold. Additionally, our work has been done in hindsight of past economic events. For an institutional investor, it will be far more difficult to determine whether the economy is on the verge of a crash, recovery or long-lasting growth. To determine this, the investor will have to dive deeper into economic indicators that we did not have the chance to present in this paper.

Our analysis focuses on the long-term effect gold might have on a portfolio. Given our choice of sub-periods, this results in our research losing some explanatory power regarding the portfolios performance during specific market events. I.e. the 2005-2010 period contains both a dramatic recession in 2007, followed by a strong bullish trend. As both trends occur in this sub-period the results do not reflect gold's effect on either of them isolated.

To get a widely diversified portfolio we chose to construct them with ETFs only. This makes us unable to accurately track transaction costs beyond the expense ratios ETFs impose on the trader, due to lack of available data. As these costs might have significant impact on the ETFs net performance, they might affect the results concluded within this paper. The long-term perspective reduces the impact of these costs as they are cost affiliated with each round-trip trade.

## Conclusion

The purpose of this paper was to analyze the impact of including gold in a balanced portfolio for an institutional US investor from 2005 to 2019. We aimed to ascertain whether gold can still be used as an effective hedging tool with recent market developments. We found this topic compelling as there are several contradicting studies regarding the benefits of investing in gold. Aggarwal (1992), Sherman (1986) and Shafiee & Topal (2010) all found that holding gold in a balanced portfolio will benefit the investor over time. However, both Wang (2011) and Johnson & Soenen (1997) found that the hedging effects of holding gold were negligible. Since these studies to some regard are outdated, we wanted to fathom how gold has performed during more recent market conditions. We therefore split our analysis into three different subperiods categorized as recession, recovery and growth.

Before analyzing the three sub-periods, we looked at gold in comparison to other precious metals individually. We found gold to outperform silver, platinum, palladium and a collection of industrial metals through the Bloomberg Industrial Metal Index. Gold has since 2005 only been beaten by palladium in terms of returns, a metal with a substantially higher standard deviation. We also found gold to have the lowest correlation coefficient with all the assets we chose for our portfolio construction. We conclude that these findings suggest gold to be the best vehicle amongst the precious metals in terms of market movements, an assertion we investigated further.

We found several reoccurring trends in our analysis. Firstly, the gold-including portfolios for every investment strategy in all the time periods had consistently lower standard deviations and higher Sharpe-ratios than their non-gold peers. These findings suggest that including gold in the portfolio, regardless of risk appetite, has yielded better risk-adjusted returns for investors. In addition, since the standard deviation is lowered for every portfolio, we found the assumption of gold as a hedging tool to be true.

However, during the subperiod 2010-2015, we found the inclusion of gold to show certain signs of weaknesses. Due to the combination of rapid growth in the US equity market and gold's low/negative correlation to this development, we found that the gold-including portfolios yielded a lower excess return. For the aggressive and defensive investment strategies, the non-gold portfolios also obtained a higher Treynor-ratio. This suggests that the US institutional investor should not invest in gold in times of recovery in equity markets.

We have also considered management fees to see if there was any difference between the portfolio's gross and net returns. When we considered management fees, our results did not change. Thus, the management fees were disregarded in our calculations. Our evidence overall confirms that gold has been an attractive investment over time for the US institutional investor. We conclude that the inclusion of gold as a diversifying instrument has improved risk-adjusted returns and been efficient as a hedging tool over the last 15 years.

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