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Macroeconomic Determinants of Gold Industry Stock Returns

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Abstract

Over the past 12 years, the gold bullion continues to become a significant investment. Financial advisors and analysts have recommended investors invest a small portion of their portfolio into this precious metal commodity asset. Gold mining stocks offer investors the ability to leverage volatile but rising gold prices. The expected relationship between gold price and gold stock returns is that for every 1% increase in gold prices, gold stocks can be expected to gain 2-3%. Building on a multifactor model by Faff and Chan (1998), we examine how macroeconomic factors such as market returns, the foreign exchange rate, and the interest rate affect the U.S. gold industry stock returns over the period 1996-2011. We contribute to the literature by exploring the significance of business cycle's in explaining gold stock returns.

1. Introduction

Gold has gathered a lot of attention from both the financial media and investors. The Consumer News and Business Channel (CNBC), television network with financial news coverage, has added a permanent gold price ticker which shares coverage with major indices like the S&P, Dow Jones, and NASDAQ. Starting in 2012, the Illinois Lottery has started offering payouts in gold.

Gold is a commodity asset and investment grade gold is referred to as the gold bullion, which is typically in the form of gold bullion bars or gold bullion coins (BullionVault, 2011). The gold bullion bar is the standard form for spot trading and is 99.5% pure gold and weighs 400 troy ounces. The World Gold Council in 2010 reports that 50.41% of demand for gold was for jewellery, 37.89% for investment, and 11.66% for industrial use. According to the U.S. Geological Survey for the end of 2011, the entire mining industry made up about 15% of U.S. GDP and gold contributed about 30% of total metal mine production. Precious metals can help diversify investment portfolios and offer some hedging ability when it comes to the risk associated with economic or political uncertainty; financial portfolios with a moderate weight in gold perform better than portfolios consisting only of financial assets (Draper, Faff, and Hillier, 2003). We investigate macroeconomic determinants of gold industry stock returns in the U.S, using a model provided by Faff and Chan (1998). Our contribution will be the inclusion of the business cycle represented by GDP and Unemployment Rate's to better understand the relationship between gold miners and economic condition.

As producers of gold, gold mining firms can provide valuable insight into understanding the relationship between the stock price exposures of a publically traded producer to its commodity prices. Tufano (1998) describes a key advantage for studying the gold mining

industry is that firms are structured in a "simple" way – allowing one to develop precise valuation models to predict exposures. While gold mining stock prices can be driven by the price of gold, the mining companies themselves are still operating businesses with exposures to macroeconomic factors.

Gold mining stocks offer investors increased leverage to gold prices, because the gold can be mined at prices lower than the spot price. Investors can buy gold stocks at much cheaper prices allowing them to indirectly take a position in gold by investing in a gold mining firm. As the price of gold rises, miners are in a better position to take advantage allowing their earnings to increase because production costs are generally fixed (Panchapakesan, 1993). According to Brimelow (1996), based on historical prices, gold stocks outperform gold at a factor of two to three. An equity analyst at Morningstar, reports that when gold moves up a percentage, the gold stock will also move up two to three percent (Baden, 2011).

Results from this research can help better understand and explain gold stock returns beyond the market factor. These additional factors may be an important consideration for investors to observe. Gold miners are ultimately businesses with unsystematic risk and can be influenced by macroeconomic factors.

The rest of this paper is structured as follows. Section 2 reviews the theory of Capital Asset Pricing Model, the Intertemporal Capital Asset Pricing Model and Arbitrage Pricing Theory; it is also provides a literature review on previous research related to the gold mining industry and stocks. Section 3 explains the hypothesis of this study and the variables used in the regression models. Section 4 presents the empirical model. Section 5 provides the data and its associated sources. Section 6 provides the regression results. Section 7 concludes.

2. Theory and Literature Review

The Capital Asset Pricing Model (CAPM) describes the relationship between risk and expected returns. Investors need to be compensated for time value of money and risk (Bhole and Mahakud, 2009). Individual investors will consider other investment opportunities and the stock's risk. The CAPM also has several assumptions where all investors: (1) aim to maximize economic utilities, (2) are rational and risk-averse, (3) are broadly diversified across a range of investments, (4) are price takers, (5) can lend and borrow unlimited amounts under the risk free rate of interest, (6) trade without transaction or taxation costs, (7) deal with securities that are all highly divisible into small parcels, and (8) assume all information is available at the same time to all investors (Glen 2005).

The Intertemporal Capital Asset Pricing Model (ICAPM) is an alternative model to the the CAPM and it was presented by Robert Merton (1973). In this model investors require compensation in the form of expected return for (a) systematic risk and (b) the risk of unfavorable shifts in the investment opportunities (Faff and Chan, 1998). The main difference between ICAPM and CAPM is that investors will hedge against uncertainty relating to factors such as the future prices of goods, future expected returns on assets, or future employment. This model assumes that investors are capable of determining these uncertain factors and will realistically hedge against these variables. CAPM's single factor beta does not capture the correlation between assets and uncertainties, while ICAPM is a multi-factor model that incorporates multiple risk factors into its equation (Riley, 2009).

The Arbitrage Pricing Theory removes the restrictions of the CAPM and allows for more freedom for constructing a model to explain expected returns. In this model, asset returns are predicted by using the relationship between the asset and its risk factors through a linear

combination of independent macroeconomic variables (Ross, 1977). The expected return of the asset being investigated can be determined by a number of factors – which is up entirely to the investor or analyst. Factors must be identified and quantified. Some things to look for might be how factors affect the asset, the expected returns of the factors, and the sensitivity of the asset to each of the factors.

This research paper is based on the following two models: Arbitrage Pricing Theory (APT) and the Intertemporal Capital Asset Pricing Model (ICAPM). These two theories form the foundation for creating a multifactor model. Market portfolio plays no significance in the APT model but it is the basis for a multi-beta CAPM, which is justified in an ICAPM setting (Faff and Chan 1998).

This paper seeks to determine macroeconomic variables that explain gold industry stock returns on the US equity market. While gold mining stocks do have a significant relationship with gold they are still ultimately companies with production costs and risks and this is where the business cycle can come into effect. Previous literature has looked at the relationships between gold and gold stocks with additional determinants but has not considered the significance of the business cycle on gold stock returns.

Faff and Chan (1998) seek to find out what types of extra-market factors should be considered when studying gold stock returns by using a multifactor model. Extra-market factors are a form of unsystematic risk (residual) and they are variables with movements that act independently from the overall market - this affects firms that share similar traits, such as being in the same industry (Hagin, 2004). This multifactor model incorporates three extra-market factors: gold price, interest rate, and foreign exchange rate in addition to the market factor; Faff and Chan (1998) apply this model to sample data based on Australian gold stocks from January

1979 to December 1992. Out of the four factors used in the multifactor model, only market and gold price factors showed significant explanatory power; interest rate and foreign exchange rate showed no statistical significance.

The gold price factor plays a significant role as demonstrated by Faff and Chan (1998), McDonald and Solnick (1977) and Twite (2002). Gold stocks have significant price exposure to the volatility of gold prices and the valuation of gold mining companies will change with gold prices (Tufano, 1998). Gold, as a commodity, can act as a hedge against stocks or it can be a safe haven during extreme market conditions (Baur and Lucey, 2010; Draper, Faff, and Hillier, 2003). However, the same cannot be said about gold stocks as the increase in systematic risk makes it less effective when compared to gold (Chua, Sick, and Woodward, 1990; Jaffe, 1989). Blose and Shieh (1995) provide the explanation that as companies, gold miners have risks uncorrelated to gold prices and suggest that gold stocks can offer a better return on investment compared to gold, if the majority of the firm's assets are operating gold mines. The main principle behind hedging is that stock betas should have negative values and Faff and Chan (1998) observes the gold industry as super-cyclical. Jaffe (1989) also observes that while gold has a high correlation with precious metal investments, there is not a conclusive relationship with common stocks, small stocks, long-term government bonds or long-term corporate bonds.

Tufano (1996) observes that 85% of gold-mining firms use a form of gold price risk management based on data from 48 North American gold mines over 1990 – 1993. The most common method of employing risk management for the gold industry is through hedging – where assets are sold at fixed prices – or insurance. Hedging helps gold-mining firms mitigate and decrease gold price exposure. Coleman (2010) does a case study comparing two similar gold-mining firms over 1990-1994; one partaking in hedging activities and the other does not,

with results displaying there is no permanent premium or discount attributed to any sort of risk management related to hedging. The results from Coleman (2010) show no significant difference between the gold beta values of an unhedged gold company versus a hedged company.

Findings by Faff and Chan (1998) regarding the interest rate and foreign exchange factors show contradictions to previous research suggestions. Bolten and Weigand (1998), Stone (1974), Martin and Keown (1977) suggested that gold stocks would be sensitive to interest rates. Loudon (1993) and Khoo (1994) found gold stocks as being as negatively related to the exchange rate.

Chauvet (1999) suggests that investors continuously update their expectations about the state of the economy. Work by DeStefano (2004) using the dividend discount model, demonstrates that stock returns demonstrate clear business cycle patterns; the business cycle is broken down into four stages by the National Bureau of Economic Research (NBER). Economic expansion is broken down into two stages (I and II) and contraction is broken into two stages (III and IV). DeStefano (2004) observes that interest rates increase through Stage II and III and decrease at Stage IV and that stock returns are positive during Stage I but decline to zero in Stage II. DeStefano (2004) suggests that declining returns are due to lower expectations of future earnings and the rise of long-term interest rates. Returns start to become negative in Stage III and then begin to rebound in Stage IV, which can be explained by the growth in expected earnings. DeStefano (2004) also highlights the importance of the timeframe for stock returns as the variation in quarterly or annual periods can easily be missed during recessions. Birz and Lott Jr. (2011) studied the relationship between macroeconomic factors and stock prices using newspaper headlines as an indicator of the expectations of investors, observing that GDP growth and unemployment significantly affect stock returns.

Gold stocks offer investors a convenient way of obtaining a position in gold, however it comes with additional firm specific-risk. There is a significant relationship between gold stocks and gold prices, with gold stocks moving two percent for each one percent change in gold prices (Tufano, 1998). However, gold stocks are still companies and even though there is a correlation in prices, stocks returns move with the business cycle as shown by DeStefano (2004). This paper seeks to build on the multifactor model by Faff and Chan (1998) by including the business cycle as an extra-market factor to observe its significance on explaining gold stock returns in the US. The business cycle factors will be represented by Monthly Real GDP Growth and Unemployment Rate Change.

3. Hypothesis

Based on the findings of Faff and Chan (1998), major drivers for gold stock returns are gold price return and market return. The hypothesis is that the business cycle, represented by Monthly Real Gross Domestic Product (GDP) Growth and Unemployment Rate Change can help explain gold stock returns. A more productive economy will mean less reason for investors to hedge against low interest rates or currency exchange rates, while a less productive economy may indicate political instability and economic uncertainty. Elder, Miao, and Ramchander (2011), demonstrate that the metals market responds in an economically predictable manner – there is a negative impact when there are improvements in economic activity, consumption, and investment.

There are two separate dependent variables used to represent Gold Stock Returns: HUI and XAU. HUI represents a basket of 15 companies which are unhedged and it is expected that the business cycle will have a stronger effect compared to XAU. XAU is a index containing 16 precious metals companies listed on the Philadelphia Stock Exchange. Both HUI and XAU are

observed by investors. The companies in each index are listed in **Appendix F** and **Appendix G**. Nine total models will be tested.

Table 1: Variable Definitions and Expected Signs

Variable	Formula	Definition	Expected
NYSE Arca Gold BUGS Index (HUI)	ln(t/(t-1))	Modified equal dollar weighted index of 15 of the largest unhedged gold miners.	Dependent
Philadelphia Gold and Silver Index (XAU)	ln(t/(t-1))	16 precious metal mining companies traded on the Philadelphia Stock Exchange.	Dependent
Market Return S&P500 (GSPC)	ln(t/(t-1))	Return rate on the S&P 500 index as the market price factor.	+
Gold Price Return	ln(t/(t-1))	Price of the gold bullion from London PM fix.	+
Foreign Exchange Return	ln(t/(t-1))	Return rate on the U.S. Trade Weighted Dollar Index, Broad - Real, provided by the Federal Reserve.	-
Interest Rate Change (90 day, 2 year, 10 year)	t-(t-1)	Interest rates based on 90-day, 2-year, and 10-year treasury rates.	-
Real Gross Domestic Product Growth	ln(t/(t-1))	Monthly Real GDP Growth	-
Unemployment Rate Change	t-(t-1)	Changes in the Unemployment Rate	+

Market Return sets the basis for a multi-beta CAPM. Faff and Chan (1998) were looking to identify additional extra-market factors to look at when studying gold industry stocks. In this paper, the S&P 500 index is used to represent the market return. It is expected that a positive relationship will exist between market return and gold stock returns; gold stocks are still ultimately stocks so if there is a large sell off, investors will act differently. Market Return is calculated by taking the logarithmic average across each month, as observed in **Table 1**.

Gold Price Return was the first extra-market factor included in the literature and its inclusion was justified by McDonakd and Solnick (1977), Beckers and Soenen (1981), Sim and Jeffrey (1991), Clinch et al. (1995) and Blose and Shieh (1995). The results shown from Faff and Chan (1998) demonstrate that gold price plays a very significant role for explaining gold stock returns and has a very strong positive relationship. Gold stocks offer investors increased leverage and the level of significance becomes especially clear for unhedged miners, which can take advantage of higher gold spot prices. Unhedged firms will have a premium in their share price

during times of high gold prices as they can better take advantage of higher spot prices for gold, but the premium diminishes when the gold prices are low (Coleman, 2010). Gold Price Return, like Market Return has been calculated using a logarithmic average across each month. Gold Price Return is taken from the price of the gold bullion from the London PM fix.

Interest Rate Change is the second extra-market factor from the literature and it has been justified by Stone (1974) and Martin and Keown (1977). Both suggested that gold stocks would be highly sensitive to interest rate movements. Interest Rates are measured by treasury notes, in the form of: 90 days, 2 year, and 10 year. It is expected that interest rates will have a negative relationship with gold stock returns. Mishkin (1977) provides evidence that lower interest rates lead to higher stock prices. When there are higher interest rates, investors have the incentive to keep their money in savings accounts because it is a risk free return (Zafar, Urooj, and Durrani, 2008). But when interest rates decrease, investors have the incentive to move their money into equity markets, thereby increasing the demand for stocks leading to higher prices. Interest Rates at the 90 day represent rates at the short term, 2 year represents medium term, and 10 year represents long term. Interest Rate Change is calculated by taking the difference across each month.

Foreign Exchange Return plays the third extra-market factor role from the literature and is justified by Loudon (1993) and Khoo (1994). The Federal Reserve's Trade Weighted Dollar Index (Broad - Real), is a weighted average of the foreign exchange values of the U.S. dollar against the currencies of major U.S. trading partners. When the U.S. dollar strengthens the index value increases. Foreign Exchange Return should have a negative relationship with gold stock returns; a depreciation in the home country's currency leads to an increase in the value of the home country's firms (Shapiro, 1965). Gold itself is used as a hedge against the U.S. dollar and it

benefits from U.S. dollar depreciation (Capie, Mills, and Wood, 2004). Foreign Exchange Return is calculated by taking a logarithmic average across each month.

Monthly Real GDP Growth is an added factor in this paper to account for the business cycle. Gross domestic product (GDP) is the sum of all the output of the economy's sectors (Madigan, 2002). It is composed of consumer spending, investment, government spending and net exports (imports subtracted by exports). GDP growth rate is an important variable for investors because when the reported growth rate differs from expectations the market can react strongly. During a recession, higher GDP growth rate than expected would lead to markets reacting more positively because it could indicate economic improvement leading to higher stock prices, while the reaction is more negative in times of expansion because investors then start to expect contractions in monetary policy leading to higher interest rates and lower stock prices (McQueen and Roley, 1993). Monthly Real GDP Growth is calculated by taking a logarithmic average across each month.

Unemployment Rate Change is another added variable to account for the business cycle. Boyd, Hu, and Jagannathan (2005) observe that during economic expansions, stock prices will rise on average when there is negative labor market news and it falls during contractions. While this occurrence cannot be solely explained by bond prices, on average bond prices will rise when there is negative unemployment news during expansions and show no significant response during contractions. Interest rates also show a strong effect over stock price responses during expansions and interest rates will fall on negative labor market news which leads to a positive effect on stock prices. Unemployment Rate Change is calculated like Interest Rate Change, where the difference is taken across each month.

Recessions is a dummy variable to indicate the occurrence of recessions. From 1996 to 2011, the National Bureau of Economics, reports that there was a recession from March 2001 to November 2001 and another one from December 2007 to June 2009. Each month falling under a recession period has been marked with a "1", and every month under a non-recession period has been marked with a "0".

4. Empirical Model

This paper builds on Faff and Chan's model by including business cycle factors represented by GDP Growth and Unemployment Rate Change. There will be 2 different dependent variables being tested which are represented by gold stock indices: the NYSE Arca Gold BUGS Index (HUI), a basket of unhedged miners and the Philadelphia Gold and Silver Index (XAU), representing 16 precious metal miners traded on the Philadelphia Stock Exchange. These two indices are the most watched by investors and analysts, so they have been selected to represent gold industry stock returns.

7 models will be used to test the hypothesis: (1) Faff and Chan's (1998) original model which includes: market return, gold price return, foreign exchange rate return, and interest rate change.

Model 1: $$\textit{Gold Stock Index Return} = \alpha + \beta_1 \textit{Market Return} + \beta_2 \textit{Gold Price Return} - \beta_3 \textit{Foreign Exchange Return} - \beta_4 \textit{Interest Rate Change} + \varepsilon_i$$

(2) Model 1 with the inclusion of monthly real GDP, with variables lagged at 3 months except for Market Return and Gold Price Return. (3) Model 1 with the inclusion of unemployment, with variables lagged at 4 months except for Market Return and Gold Price Return. (4) Model 1 with the inclusion of monthly GDP and unemployment, with variables lagged at 3 months except for Market Return and Gold Price Return. (5) Model 1 with the inclusion of monthly GDP and

unemployment, with variables lagged at 4 months, except for Market Return and Gold Price Return. (6) Model 4 with the inclusion of the dummy variable, Recessions. (7) Model 5 with the inclusion of the dummy variable, Recessions. While Faff and Chan (1998) established three scenarios for their model, representing interest rates at the 90 day, 2 year, and 10 year, only 90 day interest rates will be presented. 2 year and 10 year interest rates show little variation compared to 90 day; observed results have been included in the Appendix.

2 additional models will also be tested; dubbed Model A and Model B. These models use the dependent variables: HUI or XAU, with the independent variables of Market Return, Gold Price Return, with either GDP Growth lagged at 3 months or Unemployment Rate Change lagged at 4 months – respectively. GDP Growth and Unemployment Rate Change showed no statistical significance until they were lagged at their respective months.

5. Data

The data for this study is from June 1996 to December 2011 with the factors calculated on a monthly basis. Data for Gold Stock Index (HUI, XAU) and the Market Factor (S&P500) was taken from Yahoo! Finance. Gold Price is the London PM fix provided by World Gold Council. Foreign Exchange (Trade Weighted Index – Broad for the US Dollar) and the Interest Rates (90-day, 2-year, and 10-year) were from the Federal Reserve. Monthly GDP is from Macroeconomic Advisers and the Unemployment Rate from the Bureau of Labor Statistics – both were obtained via YCharts.

7. Results

Table 2 displays the summary statistics and is based on 186 observations based on monthly data from June 1996 to December 2011. The dependent variables are represented by the NYSE Arca Gold BUGS Index (HUI) and the Philadelphia Gold and Silver Index (XAU). **Table**

3 displays correlation statistics using Pearson's correlation. Statistical significance at the 1%, 5%, and 10% levels are represented by "***", "**", and "*", respectively.

Table 2: Summary Statistics

Variables	Minimum	Maximum	Mean	Std. Deviation
Gold Index Return1 (HUI)	-0.312	0.249	0.005	0.088
Gold Index Return 2 (XAU)	-0.337	0.230	0.002	0.078
Market Return (S&P500)	-0.228	0.114	0.003	0.042
Gold Price Return	-0.125	0.160	0.008	0.039
ForEX (TWI, Broad Index - Real) Return	-0.034	0.055	0.000	0.012
IR (90-Day T-Bill) Change	-0.009	0.005	0.000	0.002
IR (2 Year Treasury) Change	-0.006	0.005	0.000	0.002
IR (10-Year Treasury) Change	-0.011	0.007	0.000	0.002
Real Monthly GDP Growth	-0.019	0.016	0.002	0.006
Unemployment Rate Change	-0.004	0.005	0.000	0.002

Correlation results from **Table 3**, demonstrate HUI and XAU have significant levels of positive correlation with Market Return and Gold Price Return. Foreign Exchange Return demonstrates a negative correlation with HUI and XAU. Market Return, represented by the S&P500 demonstrates a positive correlation with interest rates and also demonstrates negative correlation with Foreign Exchange Return, Unemployment Rate and Recessions.

Table 3: Correlation Matrix

	HUI	XAU	Market	Gold	ForEx	IR (90 Day)	IR (2 Year)	IR (10 Year)	GDP	UR	Recessions
HUI	1.000	0.952***	0.149**	0.714***	-0.427***	-0.043	-0.037	-0.059	-0.024	-0.009	-0.011
XAU	0.952***	1.000	0.237***	0.693***	-0.476***	-0.007	-0.012	-0.063	-0.001	-0.022	-0.032
Market Return	0.149**	0.237***	1.000	-0.090	-0.399***	0.265***	0.344***	0.214***	0.165**	-0.170**	-0.249***
Gold	0.714***	0.693***	-0.090	1.000	-0.384***	-0.047	-0.139	-0.139	-0.084	-0.016	-0.003
ForEX	-0.427***	-0.476***	-0.399***	-0.384***	1.000	0.050	0.084	0.113	-0.048	0.033	0.089
IR (90D)	-0.043	-0.007	0.265***	-0.047	0.050	1.000	0.678***	0.318***	0.101	-0.196***	-0.390***
IR (2Y)	-0.037	-0.012	0.344***	-0.139*	0.084	0.678***	1.000	0.776***	0.141*	-0.119	-0.204***
IR (10Y)	-0.059	-0.063	0.214***	-0.139*	0.113	0.318***	0.776***	1.000	0.111	-0.042	-0.009
GDP	-0.024	-0.001	0.165**	-0.084	-0.048	0.101	0.141*	0.111	1.000	-0.078	-0.273***
UR	-0.009	-0.022	-0.170**	-0.016	0.033	-0.196***	-0.119	-0.042	-0.078	1.000	0.519***
Recessions	-0.011	-0.032	-0.249***	-0.003	0.089	-0.390***	-0.204***	-0.009	-0.273***	0.519***	1.000

HUI and XAU, are the dependent variables. Market Return is the S&P500 Return, Gold is Gold Price Return, ForEx is Foreign Exchange Return, IR 90D, IR 2Y, and IR 10Y represent Interest Rates 90-day, 2 year, and 10 year, respectively, GDP is Real Gross Domestic Product Growth, UR is Unemployment Rate Change, and Recessions is a dummy variable.

For the purpose of interpretation, **Tables 4** through **7** show results only using 90 Day interest rates. Attached as **Appendix A** through **D,** are the 2 year and 10 year interest rates. The differences between each Interest Rate Change show no significant differences. **Table 4** and **Table 6** provide linear regression results for the 7 models with dependent variables HUI and XAU, respectively. The regression results present the coefficient and the standard error in parenthesis. **Table 5** and **Table 7** follows up with multicollinearity results.

Table 4: Regression Results for HUI

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**A**	**B**
Constant	-0.009**	-0.007	-0.010**	-0.007	-0.009*	-0.006	-0.006	-0.006	-0.010**
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Market	0.410***	0.406***	0.482***	0.496***	0.479***	0.490***	0.448***	0.468***	0.458***
	(0.123)	(0.104)	(0.103)	(0.105)	(0.103)	(0.107)	(0.106)	(0.104)	(0.103)
Gold	1.564***	1.607***	1.62***	1.607***	1.619***	1.605***	1.609***	1.616***	1.630***
	(0.124)	(0.110)	(0.109)	(0.111)	(0.109)	(0.111)	(0.109)	(0.111)	(0.110)
ForEx	-0.551	0.693**	0.657*	0.694**	0.645*	0.705**	0.716**		
	(0.436)	(0.349)	(0.351)	(0.350)	(0.352)	(0.353)	(0.356)		
IR (90 Day)	-2.395	-3.084	-3.24	-3.098	-3.096	-3.338	-4.312*		
	(2.142)	(2.053)	(2.059)	(2.094)	(2.071)	(2.283)	(2.287)		
GDP		-1.283*		-1.284*	-0.556	-1.317*	-0.734	-1.441*	
		(0.752)		(0.755)	(0.741)	(0.767)	(0.754)	(0.757)	
UR			6.183**	-0.100	6.050**	0.182	7.073**		7.259***
			(2.691)	(2.728)	(2.700)	(2.932)	(2.818)		(2.661)
Recessions						-0.004	-0.019		
						(0.015)	(0.015)		
D-W	1.680	1.726	1.708	1.725	1.720	1.732	1.752	1.659	1.649
Observations	186	183	182	183	182	183	182	183	182
Adjusted R^2	0.552	0.565	0.574	0.563	0.573	0.560	0.575	0.556	0.556

Constant is the Alpha, Market is Market Return (S&P 500), Gold is Gold Price Return, ForEx is Foreign Exchange Return, IR is Interest Rate Change at the 90-day, GDP is Real Gross Domestic Product Growth, UR is Unemployment Rate, Recessions is a dummy variable, D-W is the Durbin-Watson test result. HUI is the dependent variable.

Model 1 as found in **Table** 4, column 1, reaffirms Faff and Chan's (1998) findings; the only significant factors for explaining Gold Stock Returns are the Market Return and Gold Price Return. For every increase in Gold Price Returns, there is an expected 1.564 increase in Gold Stock Returns, which falls somewhat short of the general consensus of gold stocks increasing 2-3% for every 1% increase in gold price. Models 2 – 7 also lend further evidence of Market Return and Gold Price Return's statistical significance.

Model 2 adds Monthly Real GDP Growth, as a business cycle indicator, to the previous model. However initial results showed no significant results until every variable, excluding Market Return and Gold Price Return, were lagged by 3 months. Real Monthly GDP Growth starts to become statistically significant at the 10% level; GDP is reported on a quarterly basis. Foreign Exchange Return becomes statistically significant at the 5% level. Interest rate remains statistically insignificant.

Model 3 adds Unemployment Rate Change, as another business cycle indicator, to Model 1 and the results turn out to be interesting. Model 3's Unemployment Rate Change showed no statistical significance until it was lagged by 4 months; Foreign Exchange Rate and Interest Rates were also lagged by 4 months. Unemployment Rate Change is statistically significant at the 5% level and Foreign Exchange Return becomes statistically significant at the 10% level. Interest rate again is statistically insignificant. It is important to note that compared to Model 2, Model 3's Unemployment Rate Change has more explanatory power over Real Monthly GDP Growth. Unemployment Rate Change demonstrates that for every increase in the change of Unemployment Rate, Gold Stocks increase by 6.183.

Model 4 adds both Real Monthly GDP Growth and Unemployment Rate Change, with all independent variables, excluding Market Return and Gold Price Return, lagged by 3 months.

Model 4 demonstrates similar levels of significance as Model 2, where Foreign Exchange Return is statistically significant at the 5% level and Real Monthly GDP Growth is statistically significant at the 10% level; Unemployment Rate Change has no statistical significance when lagged at 3 months.

Model 5 is similar to Model 4, except instead of Foreign Exchange Return, Interest Rate Change, GDP Growth, and Unemployment Rate Change, being lagged by 3 months it is lagged by 4 months. It is in this model that Unemployment Rate Change becomes statistically significant at the 5% level and Foreign Exchange Rate at the 10% level, much like Model 3. Real Monthly GDP loses statistical significance when lagged beyond 3 months.

Model 6 and Model 7 include the dummy variable, Recessions. Model 6 has all variables except Market Return and Gold Price Return, lagged at 3 months and Model 7 at 4 months. The dummy variable, Recessions, has demonstrated no statistical significance.

Model A and Model B affirm the statistical significance of the Market Returns and Gold Price Returns. GDP Growth, while lagged at 3 months, is statistically significant at the 10% level in Model A. Model B demonstrates Unemployment Rate as being statistically significant at the 1% level, when lagged at 4 months.

Table 4 displays the Durbin-Watson test with a result range of 1.649 – 1.732; while the results are near 2, this is an indication that there may be some level of autocorrelation. **Table 5** checks for multicollinerty among the variables in the regression model by measuring the variance inflation factor (VIF). The VIF values are less than 2.5 which indicate no issues of multicollinerty amongst the models.

Table 5: Multicollinearity Results for HUI

Model		1	2	3	4	5	6	7	A	B
Market	Tolerance	0.695	0.96	0.977	0.956	0.976	0.923	0.919	0.979	0.991
	VIF	1.438	1.042	1.023	1.046	1.024	1.083	1.088	1.022	1.009
Gold	Tolerance	0.779	0.979	0.989	0.978	0.989	0.973	0.984	0.981	0.991
	VIF	1.284	1.022	1.011	1.022	1.011	1.028	1.016	1.019	1.009
ForEx	Tolerance	0.641	0.993	0.992	0.99	0.989	0.978	0.964		
	VIF	1.561	1.008	1.009	1.01	1.011	1.267	1.037		
IR (90 Day)	Tolerance	0.898	0.966	0.943	0.933	0.935	0.789	0.764		
	VIF	1.114	1.035	1.061	1.071	1.07	1.267	1.309		
GDP	Tolerance		0.966		0.962	0.982	0.939	0.946	0.974	
	VIF		1.036		1.039	1.019	1.065	1.057	1.026	
UR	Tolerance			0.957	0.951	0.953	0.828	0.872		0.999
	VIF			1.044	1.052	1.049	1.208	1.147		1.001
Recessions	Tolerance						0.638	0.631		
	VIF						1.569	1.586		

Market is Market Return, Gold is Gold Price Return, ForEx is Foreign Exchange Return, IR is Interest Rate Change at the 90-day, GDP is Real Monthly GDP Growth, UR is Unemployment Rate Change, and Recessions is a dummy variable. HUI is the dependent variable.

The expected relationships between the dependent variable and the independent variable followed as expected though with varying levels of significance. Market Return and Gold Price Return were not lagged at all because of their immediate levels of significance. Gold stocks are still stocks and if there is a massive selloff, investors will be indifferent toward gold stocks and the spot price of gold means unhedged firms have significant price exposure. The higher the spot price, the better position gold miners are in to take advantage; this offers investors increased leverage to the gold bullion, U.S. operating costs for gold miners are generally fixed.

Foreign Exchange Rate Return only seemed to show significance when lagged by 3 or 4 months; its relationship is negative, but this only occurs in Model 1. Foreign Exchange Rate Return ends up being positive for models that introduce a business cycle indicator. Foreign Exchange Rate Return is taken from the Federal Reserve's Real Trade Weighted Index for the

U.S. Dollar and it is the monthly Broad Index. The initial intuition being that increases in Foreign Exchange Rate Return indicates a stronger U.S. dollar and that translates to lower gold stock returns. A stronger U.S. dollar decreases the purchasing power for gold and stocks. However, this does not seem to be the case when the Foreign Exchange Rate Return is lagged by 3 or 4 periods; and becomes clear across Interest Rate Changes at the 90 Day, 2 Year, and 10 Year. When Foreign Exchange Rate Return is lagged at 3 months in Model 2 and 4 it becomes statistically significant at the less than 5% level; the relationship is a positive one where an increase in Foreign Exchange Rate Return leads to a 0.69 change in the dependent variable, HUI. The positive relationship between the Lagged Foreign Exchange Rate Return and HUI could be due to the currency depreciations by the countries in the basket pushing foreign investors to hedge through gold or U.S. equities.

Interest Rate Change holds little significance across the spectrum; even when lagged by 3 or 4 periods. The expected relationship is negative, however, there seem to be some cases where the coefficient is positive but insignificant. Global interest rates should be observed or interest rates in countries where gold demand is high, such as China or India.

Real Monthly GDP Growth has statistical significance at the 10% level when lagged by 3 months in Models 2 and 4. Since GDP is only reported on a quarterly basis, it is understandable that having a 3 month lag causes GDP to have some statistical significance. The relationship, as expected, is negative. The more productive an economy, the less likely investors will need to hedge against uncertainty; whereas an unproductive economy may indicate rising uncertainty due to factors such as political instability.

Unemployment Rate Change displays very noteworthy results – in Models 3 and 5, it is statistically significant at the 5% level and has a much higher coefficient compared to Gold Price

Return which is a major driver for Gold Stock Returns. The relationship is positive and for every increase in Unemployment Rate Change, Gold Stock Returns, represented by HUI increases by around 6; the Gold Price Return coefficient is only around 1.6. In this model, Unemployment Rate Change proves to be a more statistically significant indicator for the business cycle than GDP Growth. High levels of Unemployment Rate could indicate a weak economy and lead to high levels of investor uncertainty.

Recessions is a dummy variable used to represent the two recessions (March 2001 – November 2001 and December 2007 – June 2009) that occurred during June 1996 – December 2011 time period. Recessions were expected to play a significant role in driving up Gold Stock Returns, but **Table 4** demonstrates that is has no statistical significance. The intuition here is that Gold Stocks are still ultimately stocks and during massive sells offs that occur in recessions, investors will act indifferently.

Table 6 provides regression results with XAU as the dependent variable and **Table 7** follows up with multicollienarity results. XAU is another index which includes 16 precious metal miners that are traded on the Philadelphia Stock Exchange, but the difference is that it includes both unhedged and hedged firms. Statistical significance at the 1%, 5%, and 10% levels are represented by "***", "**", and "*", respectively.

Table 3 demonstrates that XAU is similar to HUI in terms of correlations to Market Return, Gold Price Return, and Foreign Exchange Return. XAU as the dependent variable for the 7 models provides interesting results. Compared to HUI, there are higher levels of significance for Interest Rate Change at the 90 day when lagged at either 3 or 4 months and the Unemployment Rate Change shows no statistical significance – except when all variables are removed excluding Market Return and Gold Price Return.

Table 6: Regression Results for XAU

Model	1	2	3	4	5	6	7	A	B
Constant	-0.011***	-0.009**	-0.012***	-0.009**	0.011***	-0.008*	-0.009*	-0.008*	-0.012***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
Market	0.491***	0.612***	0.593***	0.609***	0.592***	0.604***	0.569***	0.583***	0.569***
	(0.107)	(0.091)	(0.090)	(0.091)	(0.091)	(0.093)	(0.093)	(0.091)	(0.091)
Gold	1.342***	1.403***	1.419***	1.402***	1.419***	1.400***	1.412***	1.413***	1.429***
	(0.704)	(0.096)	(0.096)	(0.091)	(0.096)	(0.097)	(0.096)	(0.097)	(0.097)
ForEx	-0.704*	0.680**	0.713**	0.688**	0.707**	0.698**	0.757**		
	(0.381)	(0.303)	(0.309)	(0.304)	(0.310)	(0.307)	(0.314)		
IR (90 Day)	-1.443	1.784*	-3.131*	-3.497*	-3.058*	-3.727**	-3.922**		
	(1.873)	(0.654)	(1.811)	(1.818)	(1.824)	(1.983)	(2/017)		
GDP		-1.282*		-1.303**	-0.279	-1.334**	-0.406	-1.445**	
		(0.654)		(0.656)	(0.653)	(0.666)	(0.665)	(0.662)	
UR			3.810	-1.312	3.743	-1.041	4.470*		4.880*
			(2.367)	(2.369)	(2.378)	(2.546)	(2.486)		(2.355)
Recessions						0.002	-0.013		
						(0.009)	(0.013)		
D-W	1.931	2.023	1.977	2.012	1.988	2.021	2.014	1.920	1.895
Observations	186	183	182	183	182	183	182	183	182
Adjusted R^2	0.572	0.587	0.586	0.585	0.584	0.583	0.584	0.573	0.573

Constant is the Alpha, Market is Market Return (S&P 500), Gold is Gold Price Return, ForEx is Foreign Exchange Return, IR is Interest Rate Change at the 90-day, GDP is Real Gross Domestic Product Growth, UR is Unemployment Rate, Recessions is a dummy variable, D-W is the Durbin-Watson test result. XAU is the dependent variable.

Across Models 2 to 5, Foreign Exchange Rate Return remains statistically significant at the 5% level. The expected relationships remain the same as when HUI is the dependent variable. Foreign Exchange Rate has a positive relationship when lagged and GDP Growth has a negative relationship, similar to HUI.

The models using XAU as the dependent variable also show higher Durbin-Watson test results, showing a range from 1.895 – 2.023. This indicates lower levels of autocorrelation compared to HUI as the dependent variable, where its Durbin-Watson range was 1.649 – 1.732. **Table 7** checks for multicollinearity results as measured by the variance inflation factor (VIF),

which present values of less than 2.5 – which indicates no issues of multicollinearity in the model.

Table 7: Multicollinearity Results for XAU

Model		1	2	3	4	5	6	7	A	B
Market	Tolerance	0.695	0.96	0.977	0.956	0.976	0.923	0.919	0.979	0.991
	VIF	1.438	1.042	1.023	1.046	1.024	1.083	1.088	1.022	1.009
Gold	Tolerance	0.669	0.979	0.989	0.978	0.989	0.973	0.984	0.981	0.991
	VIF	1.284	1.022	1.011	1.022	1.011	1.028	1.016	1.019	1.009
ForEx	Tolerance	0.641	0.993	0.992	0.99	0.989	0.978	0.964		
	VIF	1.561	1.008	1.009	1.01	1.011	1.023	1.037		
IR (90 Day)	Tolerance	0.898	0.966	0.943	0.933	0.935	0.789	0.764		
	VIF	1.114	1.035	1.061	1.071	1.07	1.267	1.309		
GDP	Tolerance		0.966		0.962	0.982	0.939	0.946	0.974	
	VIF		1.036		1.039	1.019	1.065	1.057	1.026	
UR	Tolerance			0.957	0.951	0.953	0.828	0.872		0.999
	VIF			1.044	1.052	1.049	1.208	1.147		1.001
Recessions	Tolerance						0.638	0.631		
	VIF						1.569	1.586		

Market is Market Return, Gold is Gold Price Return, ForEx is Foreign Exchange Return, IR is Interest Rate Change at the 90-day, GDP is Real Monthly GDP Growth, UR is Unemployment Rate Change, and Recessions is a dummy variable. XAU is the dependent variable.

8. Conclusion

We represent the business cycle by using GDP Growth and Unemployment Rate Change as its indicators. The regression results support the hypothesis of the business cycle having statistically significant explanatory power at only the 10% or 5% level for Real Monthly GDP Growth and 5% level for Unemployment Rate Change at a 3 month lag or 4 month lag, respectively. Other variables such as Foreign Exchange Rate Return can also become significant at the 10% or 5% significant level when lagged by 3 or 4 months, but the relationship becomes positive which may indicate that it takes time to see the impact on gold stock returns. Interest Rate Change remains insignificant unless XAU is introduced as the dependent variable, where

Interest Rate Change has significance at the 10% level. When lagged at 3 or 4 months, Unemployment Rate Change has no significant explanatory power for XAU returns.

Model 1 demonstrates consistent results with finding from Faff and Chan (1998), where the major drivers of Gold Stock Returns are Market Return and Gold Price Return. When taking into consideration the business cycle, Unemployment Rate Change has more significant explanatory power compared to GDP Growth for only HUI. GDP Growth remains statistically significant at the 10% level for both HUI and XAU. Interest Rate Change offers no significant explanatory power for HUI, while the opposite is true for where it has some significant explanatory power at the 10% level.

This study presents interesting results; time lag should be considered when introducing new variables to better understand their effects on the dependent variable. GDP Growth is only significant when lagged at 3 months for both dependent variables, HUI and XAU. Unemployment Rate Change at 4 months for HUI. Foreign Exchange Rate Return varies at 3 or 4 months. Interest Rate Change at 3 or 4 months seems to be only relevant for XAU. The significance of these lagged variables show that the system has some memory. Under an ICAPM scenario, investors are most likely to hedge against uncertainty by investing in gold and gold stocks when GDP Growth declines or when Unemployment Rate Change increases.

Autocorrelation may be an issue when using HUI as the dependent variable, the Durbin-Watson test for HUI have a range of a little below 2. HUI and XAU are also not reflective of the Gold Mining Industry as a whole; these indices account the larger firms and the weights are continually adjusted. Both indices are more than likely to only reflect medium to large cap miners.

The results provided by this paper can help investors and researchers better understand the determining macroeconomic factors for Gold Stock Returns. It takes time for the market to react to Foreign Exchange Return, Interest Rate Change, GDP Growth, and Unemployment Rate Change. Decrease in GDP Growth or rising Unemployment Rates leads to flight-to-quality, where investors will gravitate toward gold and gold stocks to hedge against the rising levels of uncertainty.

Future studies may want to consider countries where gold is highest in demand, such as China or India. If data is available, capturing daily volatility may also provide interesting insights into the relationship between the gold bullion and gold stock returns. Other considerations may be to find the beta coefficients using estimated forward interest rates.

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Appendix A.

IR 2 Year Regression Results for HUI

Model	1	2	3	4	5	6	7
Constant	-0.008*	-0.006	-.010**	-0.006	-0.009*	-0.007	-0.007
	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Market	0.359***	0.476***	0.460***	0.478***	0.459***	0.484***	0.437***
	(0.128)	(0.104)	(0.103)	(0.105)	(0.103)	(0.108)	(0.108)
Gold	1.555***	1.613***	1.623***	1.613***	1.622***	1.615***	1.617***
	(0.125)	(0.111)	(0.110)	(0.111)	(0.110)	(0.112)	(0.110)
ForEx	-0.656	0.671*	0.640*	0.668*	0.625*	0.657*	0.662*
	(0.442)	(0.352)	(0.354)	(0.353)	(0.355)	(0.356)	(0.360)
IR (2 Year)	0.293	-0.529	-1.138	-0.486	-0.934	-0.338	-1.357
	(2.054)	(1.888)	(1.870)	(1.904)	(1.889)	(1.984)	(1.994)
GDP		-1.348*		-1.339*	-0.609	-1.309*	-0.700
		(0.761)		(0.764)	(0.749)	(0.774)	(0.762)
UR			6.820**	0.564	6.669*	0.253	7.289**
			(2.674)	(2.714)	(2.683)	(2.949)	(2.841)
Recessions					0.004		-0.010
					(0.014)		(0.014)
DW	1.666	1.702	1.690	1.709	1.704	1.705	1.715
Observations	186	183	182	183	182	183	182
Adjusted R^2	0.551	0.560	0.569	0.557	0.568	0.555	0.567

Multicollinearity		1	2	3	4	5	6	7
Market	Tolerance	0.649	0.977	0.987	0.970	0.987	0.923	0.900
	VIF	1.540	1.024	1.013	1.031	1.014	1.084	1.111
Gold	Tolerance	0.782	0.979	0.986	0.979	0.986	0.975	0.982
	VIF	1.279	1.021	1.014	1.021	1.014	1.025	1.019
ForEx	Tolerance	0.628	0.988	0.988	0.986	0.985	0.974	0.962
	VIF	1.592	1.012	1.012	1.014	1.015	1.026	1.039
IR (2 Year)	Tolerance	0.824	0.970	0.971	0.959	0.954	0.888	0.859
	VIF	1.213	1.031	1.030	1.043	1.048	1.127	1.165
GDP	Tolerance		0.955		0.952	0.973	0.932	0.942
	VIF		1.047		1.051	1.028	1.073	1.062
UR	Tolerance			0.981	1.972	0.977	0.828	0.874
	VIF			1.019	1.029	1.024	1.208	1.145
Recessions	Tolerance						0.698	0.694
	VIF						1.432	1.440

Appendix B.

IR 10 Year Regression Results for HUI

Model	1	2	3	4	5	6	7
Constant	-0.008*	-0.006	-0.009*	-0.006	-0.008*	-0.007	-0.007
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Market	0.360***	0.475***	0.470***	0.477***	0.469***	0.485***	0.456***
	(0.121)	(0.104)	(0.104)	(0.105)	(0.104)	(0.108)	(0.108)
Gold	1.556***	1.614***	1.625***	1.615***	1.623***	1.617***	1.621***
	(0.125)	(0.111)	(0.110)	(0.111)	(0.110)	(0.112)	(0.110)
ForEx	-0.658	0.662*	0.601*	0.659*	0.584	0.648*	0.604*
	(0.438)	(0.353)	(0.356)	(0.354)	(0.356)	(0.357)	(0.361)
IR (10 Year)	0.394	-0.029	0.782	-0.013	0.852	0.049	0.830
	(1.926)	(1.861)	(1.866)	(1.867)	(1.875)	(1.881)	(1.904)
GDP		-1.375*		-1.363*	-0.695	-1.321*	-0.756
		(0.758)		(0.761)	(0.745)	(0.774)	(0.762)
UR			7.086***	0.638	6.888**	0.248	7.277**
			(2.660)	(2.700)	(2.670)	(2.949)	(2.843)
Recessions						0.005	-0.006
						(0.014)	(0.014)
DW	1.670	1.703	1.677	1.711	1.684	1.706	1.700
Observations	186	183	182	183	182	183	182
Adjusted R^2	0.551	0.560	0.569	0.557	0.568	0.555	0.566

Multicollinearity		**1**	**2**	**3**	**4**	**5**	**6**	**7**
Market	Tolerance	0.717	0.975	0.972	0.968	0.972	0.681	0.892
	VIF	1.395	1.026	1.029	1.033	1.029	1.467	1.122
Gold	Tolerance	0.782	0.979	0.988	0.979	0.987	0.768	0.986
	VIF	1.279	1.022	1.012	1.022	1.013	1.302	1.014
ForEx	Tolerance	0.640	0.982	0.979	0.980	0.976	0.610	0.958
	VIF	1.562	1.019	1.021	1.020	1.024	1.640	1.044
IR (10 Year)	Tolerance	0.907	0.971	0.957	0.970	0.948	0.894	0.924
	VIF	1.102	1.030	1.045	1.031	1.055	1.119	1.082
GDP	Tolerance		0.964		0.959	0.981		0.942
	VIF		1.038		1.043	1.020		1.061
UR	Tolerance			0.992	0.983	0.986		0.874
	VIF			1.008	1.018	1.014		1.145
Recessions	Tolerance						0.876	0.752
	VIF						1.141	1.330

Appendix C.

IR 2 Year Regression Results for XAU

Model	1	2	3	4	5	6	7
Constant	-0.010**	-0.009**	-0.012***	-0.008**	-0.011***	-0.009*	-0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Market	0.460***	0.592***	0.569***	0.590***	0.568***	0.595***	0.551***
	(0.111)	(0.091)	(0.090)	(0.091)	(0.090)	(0.094)	(0.095)
Gold	1.337***	1.408***	1.418***	1.407***	1.418***	1.409***	1.414***
	(0.109)	(0.097)	(0.096)	(0.097)	(0.097)	(0.094)	(0.097)
ForEx	-0.770**	0.671**	0.714**	0.675**	0.707**	0.667**	0.737**
	(0.386)	(0.306)	(0.311)	(0.307)	(0.312)	(0.310)	(0.316)
IR (2 Year)	0.226	-1.457	-2.158	-1.511	-2.067	-1.399	-2.406
	(1.793)	(1.643)	(1.641)	1.657**	(1.660)	(1.727)	(1.753)
GDP		-1.303*		-1.315	-0.272	-1.292*	-0.345
		(0.662)		(0.665)	(0.658)	(0.674)	(0.670)
UR			4.241*	-0.712	4.174*	-0.950	4.671*
			(2.346)	(2.362)	(2.358)	(2.567)	(2.497)
Recessions						0.003	-0.008
						(0.013)	(0.013)
DW	1.926	2.000	1.971	1.992	1.981	1.986	1.994
Observations	186	183	182	183	182	183	182
Adjusted R^2	0.571	0.581	0.583	0.579	0.581	0.576	0.580

Multicollinearity		1	2	3	4	5	6	7
Market	Tolerance	0.649	0.977	0.987	0.970	0.987	0.923	0.900
	VIF	1.540	1.024	1.013	1.031	1.014	1.084	1.111
Gold	Tolerance	0.782	0.979	0.986	0.979	0.986	0.975	0.982
	VIF	1.279	1.021	1.014	1.021	1.014	1.025	1.019
ForEx	Tolerance	0.628	0.988	0.988	0.986	0.985	0.974	0.962
	VIF	1.592	1.012	1.012	1.014	1.015	1.026	1.039
IR (2 Year)	Tolerance	0.824	0.970	0.971	0.959	0.954	0.888	0.859
	VIF	1.213	1.031	1.030	1.043	1.048	1.127	1.165
GDP	Tolerance		0.955		0.952	0.973	0.932	0.942
	VIF		1.047		1.051	1.028	1.073	1.062
UR	Tolerance			0.981	0.972	0.977	0.828	0.874
	VIF			1.019	1.029	1.024	1.208	1.145
Recessions	Tolerance						0.698	0.694
	VIF						1.432	1.440

Appendix D.

IR 10 Year Regression Results for XAU

Model	1	2	3	4	5	6	7
Constant	-0.010***	-0.008*	-0.011***	-0.008*	-0.011**	-0.009*	-0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Market	0.471***	0.592***	0.573***	0.591***	0.572***	0.599***	0.567***
	(0.106)	(0.091)	(0.091)	(0.091)	(0.091)	(0.094)	(0.096)
Gold	1.336***	1.409***	1.428***	1.408***	1.427***	1.411***	1.426***
	(0.109)	(0.097)	(0.087)	(0.097)	(0.097)	(0.097)	(0.096)
ForEx	-0.744*	0.667**	0.686	0.670**	0.677**	-0.658**	0.686**
	(0.382)	(0.308)	0.314**	(0.309)	(0.315)	(0.311)	(0.319)
IR (10 Year)	-0.359	-0.923	-0.345	-0.936	-0.254	-0.867	-0.311
	(1.682)	(1.621)	(1.644)	(1.627)	(1.655)	(1.638)	(1.681)
GDP		-1.347**		-1.357**	-0.371	-1.311*	-0.399
		(0.660)		(0.663)	(0.658)	(0.674)	(0.673)
UR			4.587*	-0.526	4.481*	-0.958	4.663*
			(2.344)	(2.353)	(2.356)	(2.569)	(2.511)
Recessions						0.005	-0.003
						(0.012)	(0.012)
DW	1.922	1.986	1.955	1.979	1.979	1.972	1.974
Observations	186	183	182	183	182	183	182
Adjusted R^2	0.571	0.580	0.579	0.578	0.578	0.576	0.575

Multicollinearity		1	2	3	4	5	6	7
Market	Tolerance	0.717	0.975	0.972	0.968	0.972	0.924	0.892
	VIF	1.395	1.026	1.029	1.033	1.029	1.083	1.122
Gold	Tolerance	0.782	0.979	0.988	0.979	0.987	0.976	0.986
	VIF	1.279	1.022	1.012	1.022	1.013	1.025	1.014
ForEx	Tolerance	0.640	0.982	0.979	0.980	0.976	0.972	0.958
	VIF	1.562	1.019	1.021		1.024	1.029	1.044
IR (10 Year)	Tolerance	0.907	0.971	0.957	0.97	0.948	0.960	0.924
	VIF	1.102	1.03	1.045	1.031	1.055	1.041	1.082
GDP	Tolerance		0.964		0.959	0.981	0.934	0.942
	VIF		1.038		1.043	1.02	1.071	1.061
UR	Tolerance			0.992	0.983	0.986	0.828	0.874
	VIF			1.008	1.018	1.014	1.208	1.145
Recessions	Tolerance						0.747	0.752
	VIF						1.339	1.330

Appendix E.

HUI Index Components as of 12/01/11

Company Name	Symbol	Weighting
Goldcorp Inc	GG	16.20%
Barrick Gold	ABX	15.37%
Newmont Mining	NEM	10.88%
Harmony Gold Mining Adr	HMY	5.21%
Coeur d'alene Mines	CDE	5.11%
Yamana Gold	AUY	5.00%
Anglogold Ashanti Ltd Ads	AU	4.88%
Gold Fields Ltd Adr	GFI	4.80%
Randgold Resources Ads	GOLD	4.71%
Iamgoldcorp	IAG	4.43%
Eldorado Gold Corp	EGO	4.34%
Hecla Mining	HL	4.14%
Comp de Minas Buenaventura Ads	BVN	4.08%
New Gold Inc	NGD	3.90%
Kinross Gold	KGC	3.85%
Angnico Eagle Mines	AEM	3.11%

Data provided by Interactive Data; weighting adjustments made quarterly.

http://www.amex.com/othProd/prodInf/OpPiIndComp.jsp?Product_Symbol=HUI

Appendix F.

XAU Index Components as of 4/12/12

Company Name	Symbol
Barrick Gold Corporation	ABX
Agnico-Eagle Mines Limited	AEM
AngloGold Ashanti Ltd.	AU
Yamana Gold, Inc.	AUY
Compania Mina Buenaventura, S.A	BVN
Freeport-McMoRan Copper & Gold	FCX
Gold Fields Ltd. American Depos	GFI
Goldcorp Incorporated	GG
Randgold Resources Limited	GOLD
Harmany Gold Mining Co. Ltd.	HMY
Kinross Gold Corporation	KGC
Newmont Mining Corporation	NEM
Pan American Silver Corp.	PAAS
Royal Gold, Inc.	RGLD
Silver Wheaton Corp	SLW
Silver Standard Resources	SSRI

Data provided by Yahoo! Finance; weightings not provided.

Appendix G.

Trade Weighted U.S. Dollar Index (Real – Broad) – Included Currencies:

1. Argentina
2. Australia
3. Brazil
4. Canada
5. Chile
6. China
7. Colombia
8. Europe (euro countries)
9. Hong Kong
10. India
11. Indonesia
12. Israel
13. Japan
14. Korea
15. Malaysia
16. Mexico
17. Philippines
18. Russia
19. Saudi Arabia
20. Singapore
21. Sweden
22. Switzerland
23. Taiwan
24. Thailand
25. United Kingdom
26. Venezuela

Data provided by the Federal Reserve Bulletin.