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An Empirical Investigation of the Causal Relationship between Gold Price, Exchange Rate Changes and Jakarta Composite Index

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This study aims to determine the co-integration relationship and causality relationship between Gold Price, Exchange Rate Changes and Jakarta Composite Index in BEI (Indonesia Stock Exchange) for the period 2nd January, 2004 to 30th December, 2013. It is important to have a portfolio in investment to diversify the investment to different kinds of instruments. Based on previous research, it is concluded that gold is a good portfolio diversifier, a hedge against stock and safe haven in extreme stock market condition. Since gold is an important saving and investment instrument in Indonesia, it is expected that gold may be looked upon as alternative asset for those holding idle money and for speculative purposes. The prices of the gold are increasing and the price of the gold is affected by the various factors like exchange rate of US dollar with IDR, and Jakarta Composite Index (JCI). The research methodology consists in co-integration and Granger causality tests performed on daily data frequency.

Keywords: Gold Price, Exchange Rates, Jakarta Composite Index, Unit Root Test; Granger Causality Test.

Field of Research: Finance

JEL Codes: F34, G21 and G24

1. Introduction:

The main objective of this paper, is to identify the causal effect of stock price indices and currency exchange rates on the prices of gold in Indonesia. Gold is one mineral that can not be formed or created through the production process but the results obtained from mining, so their presence on this earth is limited. According to Mpofu (2010), China, Australia, USA and South Africa respectively are big giants in the global gold production. Since gold considered as the most traded precious metal in the world which play an important role in shaping macroeconomic condition of a country, and used as a substitute investment for global investors, no wonder the prices continue to increase over time. Demand for gold is influenced by a variety of motives that are affected by macroeconomic conditions of a country as well as globally. Macroeconomic conditions illustrates the prosperity of a nation that is dynamic and very difficult to predict. Gold is an important asset class and has often been seen as a safe haven and counter-cyclical investment vehicle. For at least some investors, an investment in gold has been seen as a good hedge or safe heaven against stock market movements. Effect of increase in the

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price of gold will encourage investors to choose to invest in gold than in the capital markets, because with relatively low risk, gold can give good returns results with the price hike. Diversification is important not only across different global markets, but also within various classes of assets.

Universally, gold price and stock market moves in an opposite direction, during period of stock market slump, the gold always trends higher. Basically, when gold price goes down, people withdraw their investment from gold and invest the same in stock market which in turn increase the value of the stock market due to heavy investment. Gold price increase will push down the stock price index as investors originally invested in the capital markets will shift their funds to investing in gold is relatively safer than investing in the stock market, the price of gold has negative influence on stock market indices in the U.S, Graham Smith (2001). According to Opdyke (2010), the international investors sought a safe haven in the precious metal like gold in the global recession in the history. In other words, the presence of gold is likely to enhance the stability and resiliency of the financial system, because it dampens negative shocks falling on various assets, Baryshevsky (2004).

One of the macroeconomic factors that influence the gold price changes are changes in currency exchange rates. In the event of a devaluation of the currency, normally investors prefer to choose gold as a store of value. These conditions resulted in an increase in the demand for gold that will increase the price of gold itself. Another situation is when the weakening of the U.S. dollar exchange rate will usually also contributed to the rise in gold prices. This condition also occurs in Indonesia, when the current U.S. dollar exchange rate weakened against rupiah, investors sold their US dollar and then buying gold which is considered able to protect the value of their assets. Apergis and Papaulakos (2013) concluded that there is a bi-directional causality between exchange rates of Aus dollar against US Dollar and gold price in Australia since both market driven by the same information set. In addition, the findings uncovered that exchange rates can be used to forecast future gold prices.

2. Literature Review

For an investor, putting their funds in many investment instruments to minimize the risk of large losses is a must. In order to avoid losses due to volatility, the smart investor starts moving his funds to the safer side. Gold is seen as the safest commodities by investors when the stock market occurred bearish on the market. Moreover, if in the stock market bearish and at the same time the exchange rate of U.S. dollar is down, then what will happen is the trend of the gold price will rise. This occurs due to an increase in high demand for gold. Many theories and previous studies revealed that the composite stock price index is influenced by several factors such as the price of gold, oil prices and exchange rate.

Gold is one of the important commodities that can affect the movement of the stock market. This is based on that gold is one of the alternative investments that tend to be safe and risk-free (Sunariyah, 2006). Historical practices give an idea about that in

countries in period of stock market slump, the gold for perpetuity trends higher (Neda Bashiri, 2011). The historical evidence on movements of gold price and stock price in India data indicates that when the stock market crashes or when the dollar weakens, gold continues to be a safe haven investment because gold prices rise in such circumstances (Gaur & Bansal, 2010).

An exchange rate has been defined by Frenkel, Jacob and Johnson (1978) as a relative price of two national monies. More specifically, it can be stated that the exchange rate is the ratio between a unit of one currency and the amount of another currency for which that unit can be exchanged at a particular time. Empirical studies reveal that gold demand is not only price sensitive but also affected by macro economic variables and financial variables, (Sindhu, 2013). Gold price is affected by US Dollar exchange rates. When currencies weaken, people switch to gold; and on when currencies strengthen, they become more confident about the value of currencies, and switch from gold. The US dollar gold price was found to move in opposition to the US dollar and the movement was especially contemporaneous, (Capie et. Al, 2005). The dollar/gold relationship is strategic, but not necessarily tactical. In the long run dollar weaknesses almost always translate into gold strength (strategic), but in the short term the relationship is more difficult to track. By tactical we mean that short term both dollar and gold may rise or fall together. But long term (strategic) the relationship will be inverse as above. Markets are irrational in short time frames and return to the behaviour predicated by theoretical models in the long term, (Zeealllc, 2004).

The relationship between gold and dollar related to the term tangible and financial assets where gold has real value and dollar is a representation of real value. The inverse relationship between the U.S. dollar and the value of gold occurs because gold is typically used as a hedge against inflation through its intrinsic metal value. As the dollar's exchange value decreases, it takes more dollars to buy gold, increasing the value of gold.

Gold is the oldest investment instruments in the history of mankind. Gold has long been used as a means to store wealth and tested for a long period. Gold can be defensive in the sense that gold is used as a protection for investors when the economy weakened, but on the other hand gold can also be offensive because gold can be used for profit seeking through speculation. Gold is used as a financial standard in many countries and is also used as jewelry, and electronics. The use of gold in the monetary and financial field based on absolute monetary value of gold itself against the various currencies around the world, although it is officially in world commodity markets, gold prices are listed in U.S. dollars. Form of the use of gold in the monetary field is typically in the form of gold bullion in various units of grams to kilograms weight.

According to World Gold Council (WGC), Indonesia is the eighth major gold using countries in the world and the second major gold producing countries in the world. As of the 3rd quarter of 2013, demand for gold bullion in Indonesia rose by around 50% compared to the same quarter in the previous year. Demand for goldbars growth was

dominated by markets in Asia and the Middle East, where investors were again motivated by lower average prices.

The Jakarta Composite Stock Price is an aggregate value produced by combining several stocks listed and traded in Indonesia Stock Exchange and expressing their total values against a base value from a specific date. Market indexes are intended to represent an entire stock market and thus track the market's changes over time. The problem in this paper is if there is any correlation between gold prices and the The Jakarta Composite Stock Price.

4. The Methodology and Model:

The data used in this paper are daily stock market indices, exchange rates, and gold price in Indonesia. The required data have been collected from Gold Prioce Network, Central Bank of Indonesia and Jakarta Stock Exchange databases.The sample period runs from January 1, 2004 to December 31, 2013, which covers a reasonably long period of twelve years in our study. The study period have its own contemporary economic, political, and social situation and environment which might affect the prices of the scripts, thus, results are subject to overview of the situations and environment prevailing at that time.

A comparative analysis of various factors has been done on the various parameters like trend analysis, Standard Deviation, Regression, and correlation to make possible the tedious task of analysis of these factors. Further analyzing the factors will suggest the investors that whether it will be profitable for the investors to invest in gold or not. Unit Root Test was applied to check the data stationarity. Further, to study the impact of macroeconomic variables on gold price, Regression Analysis and Granger Casualty Test were applied using Eviews.

Theoritical Model:

The identified model is three variable models which hypothesize that gold price as a function of composite indices and exchange rate.

$$Gold\_Price_t = F(JCI_t, Exch\_Rate_t)$$

Where, Gold_Price represents daily gold price in Indonesia, JCI represents Jakarta Composite Indices, Ech_Rate represents exchange rate in Indonesia (IDR/USD), and t-sign represents time trend

Unit Root Test – Stationary Test:

Time series stationarity is the statistical characteristics of a series such as its mean and variance over time. If both are constant over time, then the series is said to be a stationary process (i.e. is not a random walk/has no unit root), otherwise, the series is described as being a non-stationary process (i.e. a random walk/has unit root). Differencing a series using differencing operations produces other sets of observations such as the first-differenced values, the second-differenced values and so on.

Therefore, prior to testing and implementing the Granger Causality test, econometric methodology needs to examine the stationarity for each individual time series.

To test the stationary of variables, we use the Augmented Dickey Fuller (ADF) test which is mostly used to test for unit root. Following equation checks the stationarity of time series data used in the study:

$$\Delta Y_t = \beta_1 + \beta_1 t + \alpha y_{t-1} + \gamma \sum_{t=1}^{n} \Delta y_{t=1} + \varepsilon_t$$

Where εt is white nose error term in the model of unit root test, with a null hypothesis that variable has unit root. The ADF regression test for the existence of unit root of Y_t that represents all variables at time t. The test for a unit root is conducted on the coefficient of y_{t-1} in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that y contains a unit root is rejected. The null and alternative hypothesis for the existence of unit root in variable y_t is H_0; α = 0 versus H_1: α < 0. Rejection of the null hypothesis denotes stationarity in the series.

If the ADF test-statistic (t-statistic) is less (in the absolute value) than the Mackinnon critical t-values, the null hypothesis of a unit root cannot be rejected for the time series and hence, one can conclude that the series is non-stationary at their levels. The unit root test tests for the existence of a unit root in two cases: with intercept only and with intercept and trend to take into the account the impact of the trend on the series.

Johansen Cointegration Test:

Cointegration, is a precondition for the existence of a long run or equilibrium economic relationship between two or more variables having unit roots. In literature, Co-intregration tests, e.g. Engle and Granger (1987), Johansen (1988), Johansen and Juselius (1990), Pesaran et al (2001) etc are used to ascertain the presence of potential long run equilibrium relationship between two variables.The Johansen approach can determine the number of co-integrated vectors for any given number of non-stationary variables of the same order using two procedures: the Maximum Eigenvalue test and the Trace test. The Maximum Eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of r+1 cointegrating relations for r = 0, 1, 2…n-1. This test statistics are computed as:

$$LR_{max}({}^{r}/_{n} + 1) = -T * \log(1 - \hat{\lambda})$$

Where λ is the Maximum Eigenvalue and T is the sample size. Trace statistics investigate the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variables in the system for r = 0, 1, 2…n-1. Its equation is computed according to the following formula:

$$LR_{tr}(r/n) = -T * \sum_{i=r+1}^{n} log\,(1 - \hat{\lambda}_i)$$

In some cases Trace and Maximum Eigenvalue statistics may yield different results and indicates that in this case the results of trace test should be preferred.

Granger Causality Test:

Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger, 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps to predict changes in another variable. We test for the absence of Granger causality by estimating the following VAR model:

$$Y_t = a_0 + a_1 Y_{t-1} + \cdots + a_p Y_{t-p} + b_1 X_{t-1} + \cdots + b_p X_{t-p} + U_t$$
$$X_t = c_0 + c_1 X_{t-1} + \cdots + c_p X_{t-p} + dY_{t-1} + \cdots + d_p Y_{t-p} + V_t$$

Testing
$H_0 : b_1 = b_2 = ... = b_p = 0$
Against
H_1 : Not H_0
is a test that X_t does not Granger-cause Y_t.
Similarly, testing H0: $d_1 = d_2 = \ldots = d_p = 0$ against
H_1: Not H_0 is a test that Y_t does not Granger cause X_t.
In each case, a rejection of the null hypothesis implies there is Granger causality between the variables.

5. The Findings:

From descriptive statistics we find that all variables have positive skewness which mean that All the variables are asymmetrical.Positive skewness of all series indicating the flat tails on the right-hand side of the distribution comparably with the left-hand side. The Jarque-Bera statistics with p values for variables like GP, CI and ER are lower than 0.10 which implies that variables under our consideration are normally distributed.

The results of Unit Root Test show that all the variables of our interest, namely Gold_Pric, JCI, and Exch_Rate contained unit root at their level and became stationary and do not contain unit root in first difference, I(1), using Augmented Dickey Fuller (ADF). Granger and Newbold (1974) noted that the regression results from the VAR models of the Granger causality tests using non-stationary variables will be spurious. To avoid this, we will run the regression with the stationary variables after differencing.

Determination of lags is done before we do Johansen Cointegration Test. Tabel 3 reports lag order selection statistics. The result shows that AIC lags order at three. So, we precede further tests with lags (3).

Cointegration test is the test for presence of long-run relationship between the variables using the Johansen and Juselius (1992). The most common approach which is used in this study to test cointegration is called the Johansen cointegration approach. Johansen's approach derives two likelihood estimators for the CI rank: a trace test and a maximum Eigen value test. The Johanson approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order. The results reported in Table 4 suggest that the null hypothesis of no cointegrating vectors can be accepted at the 5% level of significance.

The Granger causality test (Awe, O. O, 2012 and Hakan Günes, 2005) is a statistical proposition test for determining whether one time series is helpful in forecasting another. The results of Pairwise Granger Causality between gold price (Gold_Price), Jakarta Composite Indices (JCI) and exchange rate (exch_rate) are contained in Table 5. Tabel 5 exposes that no causality betwen gold price, stock price indices and exchange rate

6. Summary and Conclusions

The goal of this paper was to examine the interrelationships among variables namely gold price, exchange rate, and stock indices using the concept of Granger causality tests developed by Granger(1969). We used Unit Root Test to identify the stationary of data, continued by using Johansen's Co-integration Test to ascertain the presence of potential long run equilibrium relationship between two variables, and ended testing for the absence of Granger causality. The major findings include the following:

The unit root test clarified that both gold price and stock price are non-stationary at their level and became stationary at the first differences in case of Augmented Dickey Fuller test (ADF). The cointegration test confirmed that gold price, exchange rate and stock indices are not cointegrated, indicating that there is no existence of long run equilibrium relationship between the two as confirmed by the Johansen cointegration test results. The Granger causality test finally confirmed that there is no causality relation from gold price to exchange rate and stock indices.

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Appendix

Tabel 1. Descriptive Statistics

	EXCH_RATE	GOLD_PRICE	JCI
Mean	9448.146	303839.6	2530.490
Median	9209.000	304469.2	2371.860
Maximum	12338.00	552056.0	5214.980
Minimum	5454.000	106272.3	668.4800
Std. Dev.	765.0249	136467.2	1279.210
Skewness	1.714427	0.158732	0.255725
Kurtosis	6.414063	1.649029	1.730766
Jarque-Bera	2275.926	187.2141	182.0260
Probability	0.000000	0.000000	0.000000
Observations	2333	2333	2333

Tabel. 2 Unit Root Tests

Gold Price		**t - Statistics**	**Prob.***
Augmented Dickey-Fuller test statistic		-53.1025	0.0000
Test critical values:	1% level	-3.961982	
	5% level	-3.411736	
	10% level	-3.12775	

JCI		**t - Statistics**	**Prob.***
Augmented Dickey-Fuller test statistic		-43.55742	0.0000
Test critical values:	1% level	-3.961982	
	5% level	-3.411736	
	10% level	-3.12775	

Exc_Rate		**t - Statistics**	**Prob.***
Augmented Dickey-Fuller test statistic		-33.81062	0.0000
Test critical values:	1% level	-3.961987	
	5% level	-3.411739	
	10% level	-3.127751	

Tabel. 3 Lag Length Selection Criteria

AIC Value	Lag 0	Lag 1	Lag 2	Lag 3	Lag 4
AIC	1.443435	-5.520547	-5.528868	-5.530003*	-5.529836
SC	1.445905	-5.515606	-5.521457*	-5.520122	-5.517485

Tabel. 4 Results of Co-Integration tests

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.002792	11.77319	29.79707	0.9395
At most 1	0.001793	5.261235	15.49471	0.7805
At most 2	0.000464	1.08109	3.841466	0.2985

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.002792	6.511953	21.13162	0.9705
At most 1	0.001793	4.180146	14.2646	0.8399
At most 2	0.000464	1.08109	3.841466	0.2985

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Tabel . 5 Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
LGOLD_PRICE does not Granger Cause LEXCH_RATE	2330	0.58258	0.6264
LEXCH_RATE does not Granger Cause LGOLD_PRICE		5.23527	0.0013
LJCI does not Granger Cause LEXCH_RATE	2330	21.3448	0.0000
LEXCH_RATE does not Granger Cause LJCI		0.89498	0.443
LJCI does not Granger Cause LGOLD_PRICE	2330	8.08099	0.0000
LGOLD_PRICE does not Granger Cause LJCI		3.51781	0.0145