ANALYSIS OF PRECIOUS METAL AS HEDGE TO STOCK MARKET: A CASE STUDY IN MALAYSIA

BY

FOONG CHUN HUA
FONG CHIA WEI
TING YEE
TYO WEI WEI
WONG JUN KIT

A research project submitted in partial fulfillment of the requirements for the degree of

BACHELOR OF ECONOMICS (HONS)
FINANCIAL ECONOMICS

UNIVERSITY TUNKU ABDUL RAHMAN

FACULTY OF BUSINESS AND FINANCE
DEPARTMENT OF ECONOMICS

APRIL 2014

DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes or learning.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research project is 13688.

	Name of Student:	Student ID:	Signature:
1.	Foong Chun Hua	1103087	
2.	Fong Chia Wei	1200566	
3.	Tyo Wei Wei	1105770	
4.	Ting Yee	1103922	
5.	Wong Jun Kit	0902642	

Date: 18 APRIL 2014

ACKNOWLEDGMENT

No writing can be done smoothly without cooperation and support by others. With the assistance and co-operation of various remarkable individual, this research project has been smoothly and successfully carried out. Therefore, we would like to take this opportunity to offer our deepest sincerity and appreciation to those people, who helped, guided, supported, and encourage us in completing this research.

First of all, we would like to take this opportunity to thanks University Tunku Abdul Rahman (UTAR) for giving us this opportunity to involve in the research and providing us useful resources, good environment and facilities to complete the research.

Secondly, we would like to offer our deepest sincerity and appreciation to our supervisor, Ms. Thavamalar a/p Ganapathy who provided us the valuable information, tremendous support, encouragement and guidance in the research. Her patient and advice ensured this research to be on a right direction and her guidance has helped us to deal with all sorts of obstacles.

Thirdly, we would like to thank to Ms. Vivien Wong Zi Wen as well. Ms Vivien as our second examiner has provided us all the precious comments for us to make amendment required in our final year project. We are grateful for her information, suggestions and advices during VIVA as these are going to further improve our final year project.

Besides, we are truly grateful to Mr. Go You How, who had given us some suggestions and clues in our research. He was willing to teach us although he was busy in his work. We are so greatly appreciate to them.

Furthermore, we would like to express our greatest gratitude to our beloved parents and family members. Without their support and understanding the research cannot be preceded smoothly.

Finally, we would like to express our appreciation to the members in the research. Without their co-operation, valuable time, contribution the research cannot be preceded successfully. Last but not least, a warm appreciation to friends who had supported us to the end of the research.

TABLE OF CONTENTS

Page

LIST OF FIGURE

LIST OF TABLES

Abstract

This research investigates the hedging property of precious metal to stock market in Malaysia for period of pre-crisis of year 2000-2007, and post-crisis of year 2008-2012. We would like to determine that is precious metal hedge to the Kuala Lumpur Composite Index (KLCI), and which precious metal is the best hedge. We concluded that gold is the hedge for pre-crisis period, and gold and silver is the hedge for post-crisis period. Among all the precious metals, gold is the best hedge. The policy implication of this study is that gold should be used as a hedge in investment to minimize risk. Individual investors, corporate investors are advised to include gold in their portfolio, same goes for the government should involve gold as asset diversification in portfolio of employee pension fund, and to FELDA as well.

Keyword: Malaysia, Precious Metals, Gold, Silver, Palladium, Platinum, KLCI, Hedge, Impulse Response, Variance Decomposition

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

Investment activities have been carried out by investors in precious metal or stock market for the purpose either to increase their wealth or to reduce their risk in investment. Throughout the decades, precious metal such as gold has been regarded as a hedge to risk and safeguard to wealth. This can be seen by the constant increase in value of precious metal for example gold for the last decades. Stock market has been regarded as relatively higher risk in comparison to investment in precious metal, such as gold. (Hammoudeh, Malik & McAleer, 2011). Therefore, gold has been selected as one of their alternatives to diversify their portfolio.

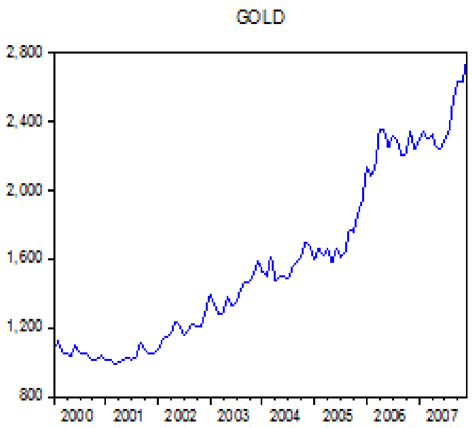


Figure 1.1: Price of Gold during Pre-crisis

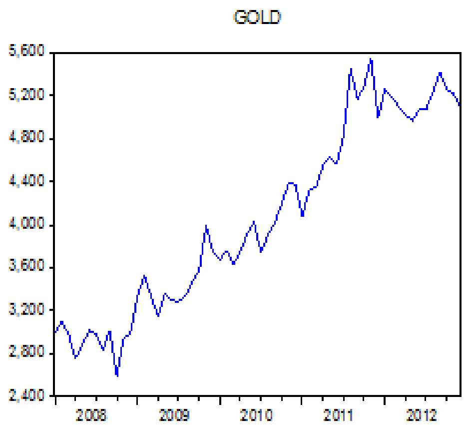


Figure 1.2: Price of Gold during Post-crisis

The above figures show the price of gold at different time. We have divided the graph into two parts, which is the pre-crisis (Figure 1.1) and post-crisis (Figure1.2) period. The reason behind is to find out whether there will be any changes in gold price for pre-crisis and post-crisis period? During the pre-crisis period, it can be seen that gold price is rising steadily. Same goes to the post-crisis period, gold price have been increasing steadily, with some correction of price in between.

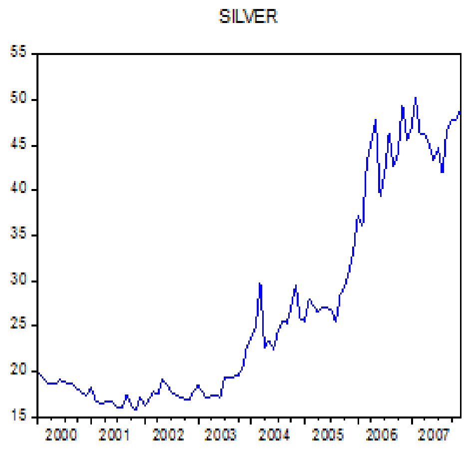


Figure 1.3: Price of Silver during Pre-crisis

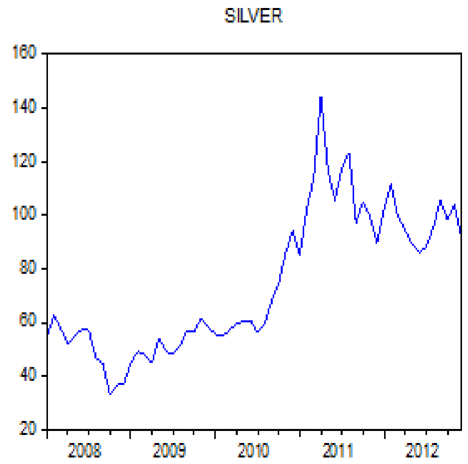


Figure 1.4: Price of Silver during Post-crisis

Besides, a statement - “Gold is the key” proposed by Zeal (2014) to prove the high correlation between gold and silver has further concluded that silver was affected significantly by gold due to the same reaction and movement. This was evident observationally to the investor. The white metal, silver mirrored closely by the yellow metal, gold and they categorized gold as the main primary driver for silver.

This is proven statistically by Zeal (2014) as well as mathematically quantifies the relationship between two data series of gold and silver. Therefore, for those who thinking of using gold as a hedge might consider silver as an alternative as well. The Figure 1.3 and 1.4 show that silver is closely correlated to the price of gold where it rise gradually before crisis and drop significantly initially before raise again recently in 2011. Since silver and gold seems to be sharing the same properties, do silver serve the same function as gold?

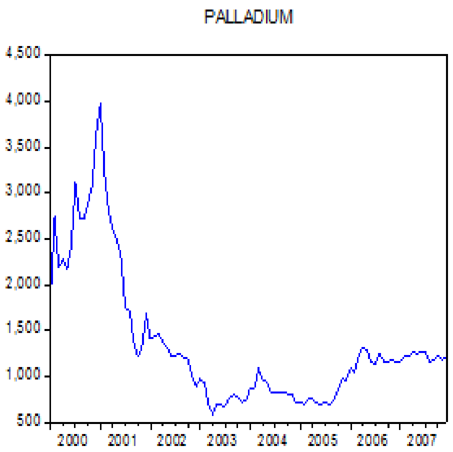


Figure 1.5: Price of Palladium during Pre-crisis

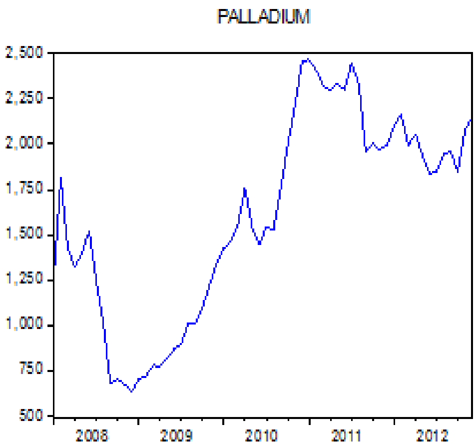


Figure 1.6: Price of Palladium during Post-crisis

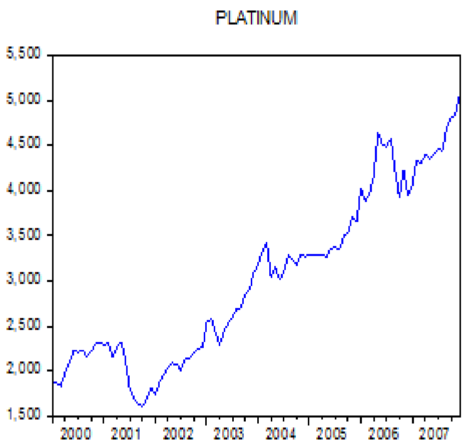


Figure 1.7: Price of Platinum during Pre-crisis

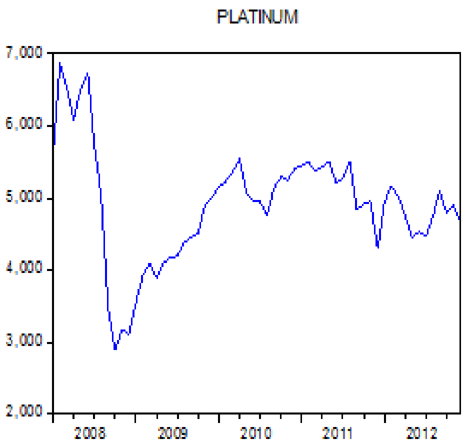


Figure 1.8: Price of Platinum during Post-crisis

Palladium and platinum are two members of Platinum Group Metals (PGMs) family. Throughout the decades, platinum is usually more expensive than gold. According to Morgan (2013), 40 years before financial crisis that was happened in 2008, platinum was traded at a premium to gold of between 30% and 180%. Prices for gold and platinum are closely-related just like the same thing happened to silver. Palladium was considered 15 times rarer than platinum. We can found components of palladium in automotive industry in catalytic converters.

There are 40% of the world's palladium supplied came from Norilsk, Russia. Platinum and palladium are so crucial in many industrial uses such as electronic components, jewelry and chemical. Another genuine fact is that palladium and platinum being categorized in a relatively small market (O'Connor, 1999). Both of them illustrated the potential for more volatility both upside and downside as compared to gold (Sensoy, 2013).

By observing the Figure 1.5 and 1.6 for palladium and platinum (Figure 1.7 and 1.8), we can see that palladium started to drop in the mid-year of 2000, for many years they have been maintaining a relatively low price and after happening of crisis in 2008, price of palladium increase significantly and then maintained at a higher price. The price of platinum is similar to gold price before crisis, but platinum encountered a major drop after crisis, and rebounded later. However, the same thing we can observe is that both palladium and platinum are dropping in price at year 2008.

The main purpose of this project is to investigate the hedging properties between these precious metals with stock market by using various time series analysis methodology. The objective of this project is to let the readers to have better understanding on using precious metal as hedge for pre-crisis and post-crisis. In this chapter, readers will be introduced to know about our background of research, problem statement, research objectives, research questions, and the significances of our study. This may provide the readers insight on precious metal and stock market before reading in depth to our study.

1.1 Research Background

1.1.1 Background of the Kuala Lumpur Stock Exchange (KLSE)

Malaysia is one of the wealthiest and well developed countries in Southeast Asia (Popescu & Corbos, 2011). Malaysia consists of thirteen states and three Federal Territories, with landmass of 329,845km^2, and with capital city of Kuala Lumpur.

The Stock Exchange of Malaysia was established at year 1964. It was renamed into Kuala Lumpur Stock Exchange (KLSE) after the separation of Singapore from Malaysia. It is also called as Bursa Malaysia in Malay Language.

KLSE mainly deal in a few major markets, which are securities, derivatives, Islamic markets and Labuan international financial exchange. Securities market mainly deal on the trading of equities, initial public offering, right issues, and other stocks trading activities; Derivatives market mainly deal on commodity, equity and financial derivatives; Products that are shariah-compliance, which means products that obey the law of Islamic offered by Islamic market; Offshore banking products offered by Labuan International Financial Exchange. In our project, we are prioritizing only at main equity market index of Kuala Lumpur Composite Index (KLCI).

1.1.2 Background of Financial Times Stock Exchange (FTSE) Bursa Malaysia Kuala Lumpur Composite Index (FBMKLCI)

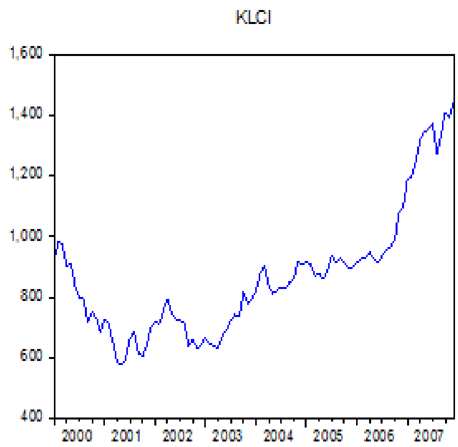


Figure 1.9: KLCI during Pre-crisis

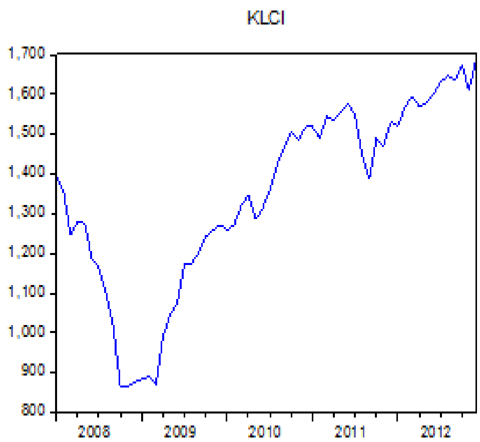


Figure 1.10: KLCI during Post-crisis

The KLCI Figure 1.9 and 1.10 shows, Malaysia stock price increase progressively from 2000 and a drop in 2001, and rise again until a drop in 2008. The KLSE equity market consists of 1038 stocks, with 991 stocks in main market. Indexes are being used as benchmark for the performance of Malaysian Stock Market, such as the FTSE Bursa Malaysia KLCI, FTSE Bursa Malaysia Mid 70

Index, and so on. FTSE Bursa Malaysia KLCI was frequently used compared to the other indexes as it was comprised of top 30 largest firms stocks, which was also known as the blue chips stocks. These top 30 largest firms hold a significant market share in Malaysia, hence representing the overall performance of the Malaysian stock market. FTSE Bursa Malaysia KLCI is short formed as FBMKLCI.

1.1.3 Background of 2007-08 Global Financial Crisis

Global Financial Crisis happened in mid-year of 2007 and ended in year 2008 is considered by many economists as the worst financial crisis since the happening of Great Depression in 1930. Global Financial Crisis was initiated in US market sector where cheap mortgage loans, systematic misevaluation of assets, and soaring household leverage have caught American bankers under harsh pressure (Feldkircher, 2014). Since US is the largest and most influential economy, many countries was also affected by the spreading effects in their financial markets (Wang, 2014). He found out that Global Financial Crisis provides a distinct natural experiment for determining dynamic interrelationships among global stock markets where these findings are very crucial in the field of finance. As according to Goh and Lim (2010), during Global Financial Crisis in 2008, Malaysia was one of the countries being affected by huge outflow of portfolio investments as well as banking system.

1.2 Problem statement

Precious metal has been treated as the wealth that can be preserved compared to other asset such as the currency that we are using nowadays which considered as fiat money. Precious metal is what people cannot simply create it as they wish, whereas the other asset such as currency can be simply printed by the country government as many as they demand. These assets are valued based on the “trust” given by the government legally, the value of the assets itself might be more worthless than the value given. For precious metal, the value cannot be created like fiat assets did since there are limited supplies of precious metal in the world. A good example to explain is gold, gold has been used as reserve for many countries.

In the past, many countries have been growing prosperously because they owned good amount of precious metal. The best example is the Spain which is controlling the majority of supply of gold during the 18th century, and after that England became the strongest country after they have taken the Caribbean gold supply from Spain. However, when England started to print fiat money and people started to lose faith when inflation because the value of fiat money went down, bank run happens and this was solved after Isaac Newton bind pound sterling to gold (Micheal, 2008).

History has shown that people have faith at precious metal as the precious metal has its intrinsic value. This concept has been embraced by people especially for investors who invested in stock market. As gold has been regarded as a tool to reduce risk of the stock market as well as investors who seek to preserve their purchasing power (Klement, 2011). Well, how about the other precious metal such as silver, palladium and platinum? What has driven the investors to include the precious metal into a part of balancing their investment portfolio? Does the effect of risk reducing of precious metal behaving strong or weak?

These questions has been questioned and answered by many researchers. Countless studies have been carried out by previous researchers to find out the real answer. For example, Hood and Malik (2013) had stated out that precious metal – gold, silver, platinum, palladium, which relative to volatility can be a superior hedging tool to against risk of uncertainty in stock market, especially during financial liberalization and economic crisis. They also found out that volatility of precious metal can be served as a better safe haven, which is negatively correlated in extreme stock market declines.

Besides, other research that was done by Morales and Andreosso-O'Callaghan (2011), in which they found out that precious metal market are not affected on main findings evidence volatility spillovers running in a bidirectional way during both serious crisis period – Asian and global crisis. Even it is with the exception of gold that tends to cause effects in all other metal markets.

However, although there are studies that proved these findings regarding the hedging properties of precious metal with the stock market, to the best of our knowledge, there is also limited literature studies report about the hedging properties of precious metal to stock market for pre-crisis and post-crisis. Due to the property of time series data is that, time series data in different period may have different outcome, therefore, we decided to carry out this research to find out the hedging properties of precious metal during pre-crisis, and are there any changes during post-crisis.

1.3 Research Questions

First of all, estimation of the hedging properties precious metal to KLCI during pre-crisis and post-crisis is important to investors who trade in precious metal. This is because comparison can be made by investors during pre-crisis period and post-crisis period to know whether precious metal is being affected by crisis or not. If one is a good hedge for KLCI during the pre-crisis period, will it still serve as a good hedge during the post-crisis period?

Secondly, after knowing the hedging properties of precious metal to KLCI, the next thing comes in mind is that which precious metal is a better hedge to KLCI? Finding out this definitely helps the investors to balance their portfolio by knowing which precious metal can really act as a hedging tool to the KLCI. In other words, it helps the investors to minimize the risk of losses. So, which precious metal is a better hedge to KLCI?

1.4 Research Objectives

Our research objective is to study the hedging properties between the precious metal and the stock market (KLCI) during the period of pre-crisis and post-crisis in Malaysia. This research will be able to serve as a significant contributor and act as a reference to the investor for hedging when investing on the stock market in Malaysia.

In our empirical research, we are intended to investigate three objectives. Firstly, we are going to determine the hedging properties of precious metal to KLCI during the pre-crisis and post-crisis period. Secondly, we would like to determine which the better hedge tool among the precious metal is for KLCI.

1.5 Significances of Study

Our final year project provides beneficial information to the investors, government and those who are interested on it as to the best of our knowledge, there is not much similar journals done especially in Malaysia.

Firstly, our research provides a cautionary tale of the relationship between precious metals and KLCI, especially during the pre-crisis and post-crisis. By understanding the hedging properties during the pre-crisis and post-crisis, investors are able to have better understanding how does the hedging property of precious metal changed before and after the crisis.

Secondly, our research provides an insight on which precious metal is a better hedge. Finding out which precious metal is a better hedge to KLCI this definitely helps the investors in balancing their portfolio. Knowing which precious metal can really act as a hedging tool to the KLCI helps the investors to minimize the risk of losses.

1.6 Chapter Layout

Our research will be broken into five chapters where the first chapter will be an introduction to our project. In this chapter, we will let the readers know about the background of the KLSE, FBMKLCI and 2007-08 Global Financial Crisis, problem statement, research objective, research question, and significance of study of our research.

Second chapter is the literature review. In this chapter, we will analyze the journals that we read and feel that it is related to our study. We also find out the gap of the previous research which we feel it will be useful for our study and for the knowledge of the readers.

Third chapter is the methodology. In this chapter we are going to let the readers know about our data sources, the theories and the techniques we will be using for our study, and the definition of the specific terms that we use.

Fourth chapter is the data analysis. We are going to run some test in attempt to check for any econometric errors in our model and try to fix any possible errors. After that we will proceed to analyze our data. Results of our test will also be provided in this chapter.

Fifth chapter is the conclusion. This chapter will conclude the results that are obtained from the previous chapter. We are going to present the major findings, policy implication, limitations, and our recommendations.

1.7 Conclusion

Our study focused on finding out the hedging properties of the precious metals for gold, silver, palladium and platinum, with the stock performance of Malaysia. We are going to find out this relationship between precious metals and stocks performance during the pre-crisis and post-crisis period.

We are particularly interested for the changes before and after the shock event period, which the period of our study will cover the financial crisis. In next chapter we are going to review past studies that also study about the precious metal and the stock market, to find out what is the previous researchers' findings and the suitable methodology that we may also apply it in our study.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In chapter 1 of this project, we have introduced about the general background of the Kuala Lumpur Stock Exchange (KLSE) and the background of FTSE (Financial Times Stock Exchange) Kuala Lumpur Composite Index (KLCI),problem statement, objectives, and our hypothesis in our studies. From the perspective of a researcher, before carrying out any empirical analysis, we have to review the past researches that are related to the precious metals and stock market.

As mentioned in the problem statement of our chapter 1, precious metals especially gold has been regarded by the investors as a hedge to the stock market traditionally. We have reviewed journal articles that are being carried out in the past and to the best of our knowledge, there are limited literature studies on the relationship between precious metals and stock market in Malaysia.

Prices of gold and silver are much more volatile while comparing to the other precious metals in the past 30 years. The rationale behind comes from the unequal demand and supply of these two components. Both gold and silver have an outstanding result over the past. However, it will never be good news to the investors when the market is too bullish. This is because it is not worth to invest in something that which is over its true value from an investor's perspective. In year 2013, the total holdings of gold and silver have dropped $60.6 billion and $6.3 billion respectively. In other hand, the demand of palladium had exceeded 1.33 million ounces, which is more than the whole production of the North America. The increased demand of palladium has significantly caused the price of palladium to raise by 3.6% to $729.60whereas the decreased demand of gold and silver caused the prices of gold and silver fell by 23% and 36% respectively.

2.1 Reviews on Hedging of Precious Metal to Stock Market

2.1.1 Review on Hedging of Gold to Stock Market

There are many researches among the effectiveness of gold as a hedging risk tool on stock market. Various studies has carried out by researchers had presented with these issues and are evidently having one of the highest dispute as tests and research are carried out internationally. We have chosen some of the most critical research and reviewed them as they have important empirical studies as well as models in order for us to develop the objectives for the prove of the effectiveness of gold as a hedging risk tool on stock market.

One of the researchers, Ziaei (2012) found out there was a significant negative relationship between gold price and the equity in ASEAN +3 countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, China, Japan and South Korea). Gold plays an important role to hedge against equity because of its significant effects on equity. On the other hand, the effect of gold price on both bond and equity is significant. It is because there have large gold stock in ASEAN +3 countries, especially China, Japan, Singapore and Malaysia. Besides, there is a high demand for jewelry in these nations. Gold, unlike other precious metals, serve as a hedge for the US stock market (Hood & Malik, 2013).

Clements (1998) mentioned that gold will decrease a stock portfolio's risk level. Gold bullion can show huge profits for helping to offset our stock-market losses at the times of political crisis or accelerating inflation. According to the researchers, Garcia-Feijoo, Jensen and Johnson (2012), precious metals, especially gold is particularly effective in hedging equity market moves during the periods of high inflationary pressures. It would have improved the shock. Besides, Hillier, Draper and Faff (2006) stated out gold has low correlations with stock index returns. It can help to diversify in broad-based investment portfolios. Gold also exhibits some hedging capability, particularly during periods of abnormal stock market volatility. Financial portfolios containing a moderate weighting of gold is performed better. Gold was perceived to be important hedging mechanisms against economic uncertainty for many centuries. Li (2013) found that there is a positive conditional correlation of gold-stock returns on average over time. However, gold-stock correlation drop below zero during subprime crisis and sovereign debt crisis, which highlights that gold is used as a strong hedge against stock during financial crisis periods.

According to the research of Choi and Hammoudeh (2010), their commodity markets included energy, food, gold and beverages. Their results showed there is a significant transmission for return and volatility spillover among the S&P 500 and commodity markets. The oil and gold markets are strongly affected by the past shocks and volatility of the S&P 500. Their study found that the conditional correlation between the S&P 500 and gold index is one of the highest correlations. The researchers also examined the optimal weights and hedge ratios for commodity-stock portfolio. The result stated the significance of adding commodities to a stock-diversified portfolio will improve its overall risk-adjusted return performance. Kumar (2014) claimed that gold can be considered as a valuable asset class that can improve the risk-adjusted performance of a well-diversified portfolio of stocks and acts as a hedge against different market.

2.1.2 Review on Hedging of Silver to Stock Market

Previous researcher has carried out many studies on the review on hedging of silver to the stock market. Hiller et al. (2006) stated silver has the potential to act as a diversifying role in wide–based investment portfolios in US stock market. It plays some hedging capability, especially during the periods of abnormal stock market volatility. From the study of Conover, et al. (2009) also suggests investors should improve their portfolio performance by adding a significant exposure to the equities of silver firms in US stock market to diversify away the risk that may contain in their portfolio.

The other researches, Jain and Ghosh (2013) mentioned investors can make an efficient portfolio by utilizing the relative independent silver. A relative independence of silver can be utilized to make the portfolio efficient by diversifying risk to provide superior risk adjusted returns. Besides, Arouri et al. (2010) and Daskalaki et al. (2011) stated silver also appeared as part of diversified portfolios that can be used as a hedging tool in diversifying away the increasing risk in the stock markets. There's another research has proved a contradicting results, Hood and Malik (2013) has carried out a research found out silver does not serve as a hedge for the US stock market.

2.1.3 Review on Hedging of Palladium to Stock Market

Research of Dumont (2012) shows palladium was one of the rarest precious metals in the world therefore it is considered as a hard asset. In fact, it has an industrial demand from the market. There are times that palladium used as a United States' hedge at the end of 1997 and 2007 (Skoyles, 2013).

When we linked to the stock market, it is advisable to consider an alternative investment instrument as a hedging tool in order to minimize the volatility of stock market. Palladium can be served as a suitable asset that is eligible for hedging in stock market (Arouriet al. &Daskalakiet al.). This means we can invest in palladium to minimize our investment risk. According to Hammoudeh, Santos and Al-Hassan (2013), they found out that palladium could provide diversification within broad investment portfolios and contain hedging capabilities. They proved that as palladium is having low correlations with stock as well as different volatilities with the other precious metals, hence palladium is considered as international portfolio diversification.

However, there is also other evidence showing that the most risky investment of precious metals (in terms of standard deviation) is palladium, which means it is not suitable to serve as a hedging tool (Dominik, 2012). Meanwhile, this is collided with the earlier researchers' journals and articles where the authors found palladium is not suitable as hedging tool.

2.1.4 Review on Hedging of Platinum to Stock Market

Platinum was considered as a portfolio hedging tools against adverse movement of equity prices. According to Hillier et al. (2006), they also found that precious metals (which included gold, silver, and platinum) have the abilities to hedge inverse equity price movements especially in US market. This allows a comparative analysis of the different roles of precious metals where platinum is included as well to allow us to compare investment properties of gold and silver. Besides, major findings from a research done by Conover et al. (2009) had confirmed that platinum appears to be providing a better hedge and could improve portfolio performance significantly by adding a portion exposure to the equities of precious metals. This shows that we might preserve platinum's values if we were to invest in platinum during bearish market.

By analyzing precious metal, Jain et al. (2013) had found that platinum also could be employed to create an efficient portfolio where it can diversify our risks in investments. In order to prove that platinum could be utilized as one of the hedging tools, Arouriet al. and Daskalakiet al. proven that precious metals such as platinum appeared as desirable assets which qualified as portfolio diversification with the increasing risk in stock market.

In another way, a research done by Hood & Malik (2013) showed that platinum does not serve as a hedge for the US stock market. This suggested that we are not encouraged to use platinum as a hedging tool. However, this result contradicts with our other findings on platinum served as a hedging tool.

2.2 Conclusion

There are much previous researchers had carried out the gold is the better hedge tool among the other precious metals on the stock market performance. However, there are some contradict results had highlighted by the previous authors stated the silver, palladium and platinum cannot be used as a hedging tool in the stock market. Therefore, we are going to conduct the empirical analysis to test whether our findings whether can match with the status of previous articles.

CHAPTER 3: METHODOLOGY

3.0 Introduction

In chapter 3, we are going to introduce the methodology. The econometric method we are going to use in our study. This methodology is used to examine the relationship between the precious metal (gold, silver, platinum and palladium) with the stock performance in Malaysia.

The methodology can generate the reliable empirical analysis and evidence to support our findings in this study. Therefore, we are going to introduce the nature of our data in our study. We will distinguish whether the data we have chosen whether is primary or secondary data and to find the reason for using it. Besides, we will specify the reliable sources where we get our data from for our analysis. To the best of our knowledge, this study will be a rare study that focuses in Malaysia.

3.1 Research Design

The data that are used in our study are quantitative data. It is time series data type that covers data across a specified period. We use monthly spot price for the precious metals of gold, silver, platinum and palladium, and the daily closing index for the index of FTSE KLCI. The pre-crisis period consists of monthly data from year 2000 to year 2007, and the post-crisis period consists of monthly data from year 2008 to 2012. The reason we use time series data is to find out the long run information from each of the series. This will lead to find out the hedging properties of each precious metal to stock market.

3.2 Data Collection Methods

There are five data we had collected for our study. For the precious metal of gold, silver, palladium and platinum, the spot prices are denoted in the Malaysian currency of Ringgit Malaysia (RM). For stock performance benchmark, we use the FTSE KLCI index that represented the performance of overall Malaysian stock market.

We had collected our research data from DataStream, that is provided in the library, UTAR. Data that collected inclusive of our precious metal' prices - gold prices, silver prices, palladium prices and platinum prices and our dependent variable, Kuala Lumpur Stock Exchange Composite Index (KLCI).

The data we collected covers the period of 13 years, thatis from Jan of 2000 to end of 2012. Between the periods, economic crisis comprisedwhere shock happened during the year 2007-2008 Global Financial Crisis. The analysis will break the data into two different periods. Pre-crisis period is from year 2000 to year 2007, and post-crisis period is from year 2008 to year 2012. Breaking down of the data split up into two different parts to find out any changes in the hedging properties before and after the crisis happened.

3.3 Data Analysis

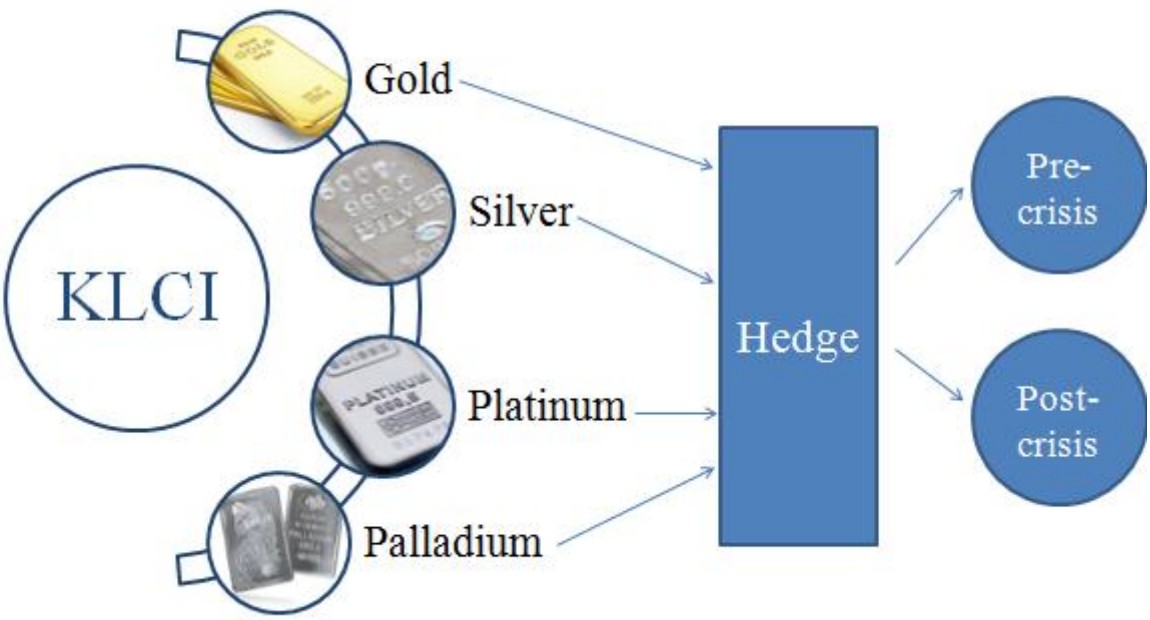
To analyze the data, we use the famous statistical program of Econometric View (E-View) as our statistical analysis software. It is used primarily for time series data for econometrics analysis. It can also be used to estimate cross-section and panel data analysis as well as forecasting.

The data we are using is time series data. Due to the nature of time series data, our data consists of different order in time and hence we have to be alert of autocorrelation problem during our research. Besides, time series data are dynamic model which means our data will not be consistent and keep on changing.

This can be explained by the monthly prices of the precious metal we used in research.

In our research, we are first going to test the stationarity of our data by running unit root test to make sure our data is stationary. A stationary data implied that we have achieved the Classical Linear Regression Model assumptions and avoid spurious regression problem in our research. After that, we will run cointegration test to make sure our data is cointegrated, before proceeding to Johansen andJuselius test. We will then run Impulse Responsive and Variance Decomposition test to achieve our objectives.

3.3.1 Theoretical Framework



In our research, we are examining whether precious metal of gold, silver, palladium, and platinum can be used as an hedge for the stock market of KLCI. We are to see the differences for the hedging properties of precious metal to KLCI during the pre-crisis and post-crisis period, are there any changes In the hedging properties of the precious metal to KLCI.

Gold is a highly valued metal with many applications. Its yellow color and luster make it become an attractive metal for fine jewelry and other precious objects. It has deployed in coinage and monetary exchange, jewelry, dental work, electronics and so on. Kumar and Aroba (2011) stated gold is the oldest precious metals, compare to other metals on this earth. It has been used as a standard currency for a long time. Sharma, Prashar, Aggarwal and Kaur (2013) reported gold has outperformed the Dow Jones Precious Metals Index and the S&P 300 Index over the past 10 year.

Silver is one of the precious metals which are scarce and expensive, although not as expensive as gold but it's the next best thing even if it is more volatile compare with gold. Demand for silver is dominated by industrial requirements and jewelry. Hiller et al. (2006) found the demand for gold for private investment is higher than for silver. Furthermore, Alva (2011) mentioned silver market is also much smaller compare with the gold market. However, silver was recognized to be significant hedging tools against uncertainty in the economics.

Palladium never is the most popular or expensive precious metals. Although the demand for palladium has grown however the demand of gold and silver has dropped dramatically where this result indicate that investor begins to shift their interest from gold and silver to palladium. In other words, palladium is having potential to be very bullish and it might be a good hedging tool for the stock market in the near future (Richter, 2013).Past history shows that palladium, instead of used as a hedging tool for stock market, it is more to use for inflation shelters when inflation goes up. In fact, it might be a good move to park some asset appreciation into palladium bullion as the market spikes up.

Platinum is one of the uncommon precious metals that make it resistant to oxidation and corrosion due to its non-reactive refractory metal with high boiling and melting points (Bond, 1991). Platinum was used widely in catalytic converters, industrial applications, dental alloys,spark plugs, sensors, biomedical and application and fuel cells (Elshkaki, 2013).According to Elshkaki and Van der

Voet (2006), they have included a fully comprehensive and detailed description of the intentional platinum flows and stock also in their research.

3.3.2 Diagnostic Checking

In our research, we are using time series data. The time series data will be sure of violation at the autocorrelation, heteroscedasticity, multicollinearity and normality. The reason for the violation is due to the ARCH effect that caused by stylized facts of time series data. Firstly, the data are high frequency data, not low frequency data. Secondly, the volatility clustering arises. When it is small changer in a period, the volatility will follow by smaller change and vice versa. The effect of volatility clustering will show to the error terms. Thirdly, people are more responsive to the bad news compare to the good news. The changes in good news and bad news are different. Therefore, it is a leverage or asymmetric effect in the model. Fourthly, the stylized facts also included leptokurtosis. Normally, the return in stock market is normal distributed, which kurtosis is equal to 3. However in reality, it is low chance getting extreme return or losses if get nothing in stock market is very high. The kurtosis will be more than 3. If we are continued to use linear model to run, which has estimated by OLS, all the four characteristics will capture by the error term. This will lead to no constant variance. The results of hypothesis testing, t-statistic value, F-statistic value and P-value will be misleading and spurious.

Due to the reasons that had mentioned above, there are stylized facts which caused ARCH effect in time series data. There will be redundant if we carry out diagnostic checking. We would not be using linear model as the result produced by OLS will be unreliable due to the violation in assumptions.

Table 3.1: List of Reviewed Journals for Diagnostic Checking

Title:	Authors (year):	Publisher:
The role of financial sector in economic development: the Malaysia case	Ibrahim, M. H. (2007)	International Review of Economics
Economic development, pollutant emissions and energy consumption in Malaysia.	Ang, James, B. (2008)	Journal of Policy Modeling
Investigation of environment Kuznets curve for carbon emissions in Malaysia: do foreign direct investment and trade matter?	Lau, L. S., Choong, C. K. &Eng, Y. K. (2014)	Energy Policy

We have come out our conclusion from studying some journals. According to Table 3.1, Ibrahim (2007) and Ang & James (2008) do not conduct diagnostic checking as they do not interpret in linear form. However, Lau, Choong and Eng (2014) do carried out diagnostic checking as they do interpret in linear form. Usually, we solve all the autocorrelation, heteroscedasticity, multicollinearity and normality to ensure the results are reliable. Nevertheless, as we are using VAR and VECM, it will be unnecessary for diagnostic checking to be carried out, as we are interpreting results from the impulse responsive and variance decomposition.

3.3.3 Stationarity

Stationarity is important in time series analysis. It defined as the movement of a time series over the time is always constant. It belongs to a type of stochastic process that has received a great deal of attention. A stationary time series exhibit statistical properties such as mean, variance and autocorrelation are all constant over time which is unaffected by change of time origin. Such statistical properties are only useful to describe the future behavior of the variable if the series is stationary.

Typical regression model assumes mean and variance of time series should tend to fixed finite constant in large sample. Nonetheless, mean and variance typically exhibit stochastic trend if the series consistently increase over time. This stochastic trend will lead to an underestimation of mean and variance in future periods. It is crucial for one to meet the stationarity in financial time series. Furthermore, when non-stationary time series used in regression model, results may be spuriously indicate a significant relationship when series were independent. Spurious correlation can persist in large samples with non-stationary time series and results in spurious regression problem. In short, classical regression model was devised to deal with relationship between stationary variables and should not be applied to non-stationary series.

Most financial data collected through time are far from stationary and still subject to trend even after made the seasonal adjustment. In our studies, we are using unit root test to detect for stationarity of the series.

3.3.4 Unit Root Tests

Stationarity is important in time series analysis. It defined as the movement of a time series over the time is always constant. It belongs to a type of stochastic process that has received a great deal of attention. A stationary time series exhibit statistical properties such as mean, variance and autocorrelation are all constant over time which is unaffected by change of time origin. Such statistical properties are only useful to describe the future behavior of the variable if the series is stationary.

Typical regression model assumes mean and variance of time series should tend to fixed finite constant in large sample. However, mean and variance typically exhibit stochastic trend if the series consistently increase over time. This stochastic trend will lead to an underestimation of mean and variance in future periods. Therefore, it is crucial for one to meet the stationarity in financial time series. Furthermore, when non-stationary time series used in regression model, results may be spuriously indicate a significant relationship when series were independent. Spurious correlation can persist in large samples with non-stationary time series and results in spurious regression problem. In short, classical regression model was devised to deal with relationship between stationary variables and should not be applied to non-stationary series.

Most financial data collected through time are far from stationary and still subject to trend even after made the seasonal adjustment. In our studies, we are using unit root test to detect for stationarity of the series. There are several classes of unit root tests, which are Dickey-Fuller (DF) unit root test, Augmented Dickey-Fuller (ADF) unit root test and Phillips-Perron (PP) unit root test. DF unit root test is only valid if error is white noise and the time series is well characterized by an Autoregressive Process, AR (1) model.

$$y_t = \beta_0 + \beta_1 y_{t-1} + \varepsilon_t$$

However, our time series have a more complicated dynamic structure than is captured by a simple AR (1) model. Moreover, the error is not white noise and it is common the error term is not white noise for financial time series. In particular, error will be autocorrelated if there was autocorrelation in the dependent variable of the regression (Δy_t). Therefore, the solution is to augment DF unit root test using p lags of dependent variable.

ADF unit root test is captured by Autoregressive Moving Average process, ARMA (p, q) model. The issue arises when using ADF test is in determining the optimal number of dependent variable lag length p. If p is too small then the remaining serial correlation in the errors will bias the test. If the p is too large then the power of the test will suffer. However, there are two ways in determining the lag length which is by using the information criteria or fixing p as a function of T.

PP unit root test is different from ADF unit root test. There are different in term of the way of dealing with serial correlation and heteroscedasticity in the errors. PP unit root test directly modifying the test statistic to correct for any serial correlation and heteroscedasticity in the errors of the regression. Besides, PP unit root test need not have to specify a lag length of the regression. ADF and PP unit root tests are somehow same but may be different due to the way of dealing with serial correlation in the regression.

The criticism of ADF and PP unit root tests is not able to differentiate highly persistent stationary process from non-stationary process very well. Also, the power of the tests drops when the sample size is small and PP unit root test is more size distorted than ADF unit root tests. Thus, after take a few of considerations we decided to use both ADF unit root test and PP unit root test to test for stationarity and compare the results of ADF unit root test with PP unit root test to see if we obtain the same result.

3.3.5 Cointegration

After making sure the stationarity, the most important thing is that, although they are stationary, are the stationary just coincidence or in fact there is genuine relationship? In this case, we have to run cointegration test to find out whether we are running a spurious regression series. There are two ways to determine whether they are cointegrated or not, either firstly by using the theories, or secondly by using cointegration test.

Cointegration means there are co-movement of the data, and hence prove that it is a genuine relationship. If there aren’t any genuine relationship but merely just coincidently stationary, it will cause a serious econometric problem of the Spurious Regressive Problem (SPR). SRP happens when a regression involves a non-stationary time series data is tested on another non-stationary time series data which may cause the result to be statistically significant, while theoretically meaningless. Moreover, our estimation results should not be taken too serious as this leads us to a wrong conclusion that our series are correlated but in fact they are not.

Besides, appearance of SRP also implies that our estimation results (t-test and F-test) are misleading as well as unreliable. However, there are some economic theories proposed that certain series with underlying theories are not necessary to be spurious as they are sharing a common trend.

There are some macroeconomic variables which known as difference stationary variables. They require a 1-time differencing to become stationary variables such as consumption and income. We refer these variables as I(1). In order to confirm that our series are cointegrated, we have to ensure our variables are I(1) and a one-level lower order for residual, I(0), this shows they are having a co-movement and there is no SRP problem in our estimation. According to Stock (1987), his research found out that if our variables found out to be cointegrated, and then our estimates are consistent and reliable. This results are so-called super-consistent especially in large sample size.

However, although we are able to explain the series by differencing, however there is an disadvantage as we might lost the long run information for the series if we differencing the series to make it stationary.

3.3.6 Johansen and Juselius Test

In this section, we are going to brief about the usage and advantages of the Johansen and Juselius test over the Engle-Granger and Phillips-Ouliaris methods. Johansen and Juselius procedure was introduced by Johansen and Juselius in year 1990 and it is well-known for the testing of more than one time series cointegration.

Basically, the test outperformed the Engle-Granger which depends on the Dickey–Fuller test for unit roots in the residuals from a single cointegrating relationship and the Phillips-Ouliaris test which can only estimate one cointegrating relationship. It is too often to have more than one time series in real life. When there is more than one time series occurs, it is likely to have more than one cointegration relationship.

Therefore, we use the Johansen's procedure to solve the problem. In other words, it allows the testing for the multiple cointegration relationship when the data set contains more than one time series. Johansen had proposed two different types of tests which namely Trace Test and Maximum Eigenvalue Test.

The Johansen's procedures start with the Vector Autoregression (VAR) of order of p:

$$y_t = \mu + A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t ,$$

Where y_t is the vector of variables integrated 1 I(1), while ε_t is an n x1 vector of innovations. It can be then reconvert to the following formula:

$$\Delta y_t = \mu + \pi y_{t-1} + \sum_{i=1}^{p-1} r_i \Delta y_{t-1} + \varepsilon_t$$

Where,

$$\pi = \sum_{i=1}^{p} x_i - I \text{ And } r_t = -\sum_{j=i+1}^{p} x_j$$

The next step is to find out the cointegration rank (Eigenvalue) either by Trace test (J_{trace}) or the lambda-maximum Eigenvalue (J_{max}) test. These formulas were introduced by Johansen (1998).

The following are the formulas for both tests:

$$J_{trace} = -T \sum_{i=r+1}^{n} In(1 - \hat{\lambda}_i)$$

$J_{max} = -T\ ln(1 - \hat{\lambda}_{r+1})$

λ_{trace} Test the null hypothesis of r cointegrating vectors against cointegrating vectors.

$\lambda_{trace} = 0$ When all the $\lambda_i = 0$, so it is a joint test.

λ_{max} Test is quite similar to the trace test. The difference between both tests isλ_{max}test the number of cointegrating vectors is less than or equal to 1 while the alternative is r>1(Ssekuma, 2011).

In our studies, we are going to choose the Maximum-Eigenvalue approach over the Trace test due to the reason of it can find out a more accurate cointegration rank. According to Erik and Paul (2007), the rejection rate of null hypothesis for simple bivariate system by using Maximum-Eigenvalue can reach 20 percent while the Trace test can reach about 40 percent by using 5 percent of significant value. The result is even higher in a trivariate and multivariate system which means that the Trace values is far more less significant compare to the Maximum-Eigenvalue test.

3.3.7 Vector Autoregressive (VAR) models

VAR model represents an equation for a few variables in which all the variables depend not only on its own history, where it also includes other variables' history. It might sometimes considered as an extension of AR model where include multiple variables. VAR models are widely used in describing macroeconomic data, economic forecasting, and in analysis of the effects of structural shocks. An important step in the specification of VAR models is determination of the lag length.

According to Braun and Mittnik(1993), they showed the importance of determining lag length by saying that estimates of the lag length of a VAR model is different from the true lag length are inconsistent. This also applies to impulse response functions and variance decompositions derived from the estimated VAR.

However, selecting a higher order of lag length than the true one also causes an increase in mean-square-forecast errors of our VAR model while under fitting lag length causes auto-correlated problems.

Most of the VAR models are forecasted using the same lag length for all variables in each equation in the model. Lag lengths are selected using Akaike's Information Criterion (AIC) and Schwarz's Information Criterion (SIC). Symmetric lag VAR models are easier to estimate since we can use OLS to estimate the model with the same specification. The reason why we have selected VAR model as one of our methodologies is because it can be used to capture short run dynamic relationship between the variables. A VAR model can be expressed in the following form:

$$C_t = D_1 C_{t-1} + D_2 C_{t-2} + \ldots\ldots + D_p C_{t-p} + \varepsilon_t$$

Where C_t is a vector of endogenous variables at time t, D_i (i= 1,…, p) are coefficient vectors, p is the number of lags included in the model, and ε_t is a vector of residuals.

Estimation of the parameters of the VAR requires both dependent and independent variables are covariance stationary, with the first two moments, that is time-invariant and finite. In this case, our dependent variable refers to stock market performance (KLCI) and independent variables refer to gold, silver, palladium and platinum. If variable of (KLCI) is not covariance stationary, however it is after first difference, thus they can be estimated using a Vector Error Correction Model (VECM). Furthermore, if there is cointegration exists among the variables or series, VAR model can be extended to VECM method.

3.3.8 Vector Error Correction Model (VECM)

If a set of variables are found to have one or more cointegrating vectors have been detected in our series, we can apply VECM to determine the short run properties and deviations from equilibrium of the series. This can be done since we are informed that it exist a genuine long-run equilibrium relationship among them. However, if there is no cointegration proven, VECM is not necessary to apply in our estimation.

VECM can be estimated using STATA, statistical software widely used in research of economic field. VECM will be employed in the research is because our time series data might appeared to be not stationary and exhibiting unit root in level, but stationary in first difference. In VECM, the cointegration rank shows the number of cointegrating vectors in our series. Furthermore, VECM yields more efficient estimators of cointegrating vectors. This is because VECM is a full information maximum likelihood estimation model, where it allows testing of cointegration in the whole system equations in a simple one step. Besides, VECM does not require a particular variable to be normally distribution as well.

Vector Error Correction Model (VECM):

$$\text{Log } \Delta yt = \beta 10 + \gamma \text{ [Log } yt\text{-}1 - \beta 0 - \beta 1 \text{ Log } xt\text{-}1] + \varepsilon 1t$$

Where,

YT = Kuala Lumpur Composite Index

xt = Gold, silver, palladium, platinum

γ = Error correction coefficients, they showed how much Δyt response to cointegrating vectors.

3.3.9 Impulse Response Analysis

We will be using impulse response analysis to evaluate how the effect of shocks of one variable to the dynamic paths of adjustment of another variable in the data series. In our studies, we plot the chart as horizontal axis represent shocks of one variable and vertical axis is represent price of another variable. This computation can provides us the clearer picture of the response of one standard deviation shock of one variable to the adjustment of another variable.

3.3.10 Variance Decomposition

In the econometrics or time series analysis, Variance Decomposition(VD) can be also called Forecast Error Variance Decomposition (FEVD), which has been widely use to examines the importance of each random innovation to the variables in VAR. Some previous research proved that VD for stock returns is solid to changes in VAR lag length and data frequency (Campbell, 1991). It generally breaks down the variation in the endogenous variable by forming a component shocks to the endogenous variables in the VAR.

In other words, it measures the percentage of changes of one variable that comes from 1 percent shock from another variable. Higher percentage of VD means the more significant of 1 percent shock that comes from another variable in the VAR model. In our studies, we will generate the VD test by using E-views software. It shows a table/diagram which consist of percentage of the variance due to each variable (KLCI index, Gold, Silver, Platinum, Palladium) in different diagram. The percentage can be maxed up to 100. Decomposition of variance is relying heavily on the ordering of equation.

3.4 Empirical Models

3.4.1 Models for Pre-crisis

Model 1 : $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogGold_{t-i} + u_t$

Model 2 : $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogSilver_{t-i} + u_t$

Model 3: $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogPalladium_{t-i} + u_t$

Model 4 : $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogPlatinum_{t-i} + u_t$

Where,

LogKLCI = Index of KLCI in logarithm form

LogGold = Spot price of gold in logarithm form (RM/ounce)

LogSilver = Spot price of silver in logarithm form (RM/ounce)

LogPalladium = Spot price of palladium in logarithm form (RM/ounce)

LogPlatinum = Spot price of platinum in logarithm form (RM/ounce)

3.4.2 Models for Post-crisis

Model 5 : $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogGold_{t-i} + u_t$

Model 6 : $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogSilver_{t-i} + u_t$

Model 7: $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogPalladium_{t-i} + u_t$

Model 8 : $\Delta LogKLCI = \beta o + \sum \beta_i \, \Delta LogKLCI_{t-i} + \sum \beta_j \, \Delta LogPlatinum_{t-i} + u_t$

Where,

LogKLCI = Index of KLCI in logarithm form

LogGold = Spot price of gold in logarithm form (RM/ounce)

LogSilver = Spot price of silver in logarithm form (RM/ounce)

LogPalladium = Spot price of palladium in logarithm form (RM/ounce)

LogPlatinum = Spot price of platinum in logarithm form (RM/ounce)

3.5 Conclusion

In order to avoid the spurious regression problem, the first step in the chapter 4 is to run the unit root test to make sure the stationarity of the variables. Next, we will run the cointegration test to find out whether the stationarity of variables is just coincidence or in fact there is genuine relationship. After that, we will run the following tests which are Johansen and Juselius Test, Impulse Response, and Variance Decomposition in order to find out the relationships between variables respectively. The final result will be showing in the next chapter.

CHAPTER 4: EMPIRICAL RESULT AND INTERPRETATIONS

4.0 Introduction

In chapter 4 the focus point will be the analysis of the data and the results obtained from the data analysis. Stationarity has been tested on each variable by using unit root test. Augmented Dickey-Fuller Test (ADF) and Phillips-Perron Test (PP) have been employed in testing the presence of unit roots. Besides, after testing the stationarity of the variables, we proceed to the next crucial analysis of the cointegration test, as to make sure the data that we are going to analysis is cointegrated.

Without cointegration, spurious regression that will cause unreliable results will happen. Next, we used Schwarz Information Criterion (SIC) to find out the optimal lag length of each of the variables. After that, we proceed to Johansen and Juselius Test (JJ) to find out the rank of the variables, to determine whether it should use Vector Error Correction Model (VECM) or Vector Autoregressive Model (VAR).

The relationship will be tested in combination of KLCI with GOLD, KLCI with Silver, KLCI with Palladium, and KLCI with Platinum, for pre-crisis period and post-crisis period, by using VECM or VAR model. We will use the following tests which are Johansen and Juselius Test, Impulse Responses, and Variance Decomposition between them. For each variable, we have applied logarithms to each of variable as the value of the price is very big, applying logarithms with the purpose of reducing the value of the variables without affecting the accuracy of the results.

4.1 Unit Root Test

The first test that has to be carried out is the unit root test. Each variable of KLCI, Gold, Silver, Palladium and Platinum are being tested by using the Augmented Dickey-Fuller test (ADF) and Philips-Perron test (PP). The results of the unit root test are shown as the Table 1. For ADF and PP test, the null hypothesis is there is unit root. If the null hypothesis is not rejected, that mean there is unit root in the variables, if the null hypothesis is rejected, there is no unit root in the variables. As stationarity is very important, we do not carry out only ADF test, the reason we carry out both ADF test and PP test is to make sure that it is stationary.

Table 4.1 - Stationarity Test for All Variables for Pre-Crisis

Details	In Level – I(0)				In 1st Difference – I(1)			
Variables	With Trend		Without Trend		With Trend		Without Trend	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
LogKLCI	-2.214769	-2.181932	0.317987	0.236106	-9.544007***	-9.557184***	-8.936582***	-8.939477***
LogGOLD	-3.216996*	-3.058814	0.541931	0.904324	-11.41113***	-11.58136***	-11.19350***	-11.25116***
LogSILVER	-2.792648	-2.653741	0.319334	0.335424	-12.28004***	-12.34444***	-12.12091***	-12.03636***
LogPALLADIUM	-1.667848	-1.199743	-1.480956	-1.366666	-8.012797***	-10.57281***	-10.96327***	-10.39479***
LogPLATINUM	-2.165194	-2.362468	-0.249788	-0.292589	-9.159876***	-9.162423***	-9.189337***	-9.191881***

Note: *, **, *** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

The results in Table 4.1 show that T-statistics value of unit root test for each variable, for pre-crisis period of year 2000 to year 2007. From the result we can see that from the perspective of the ADF test, all the variables (KLCI, Gold, Silver, Palladium and Platinum) are not significant in the level form. Which means that the null hypothesis of there is unit roots will not be rejected, hence indicate that there is unit roots for all the variables when in the level form. After using the method of differencing one time, all the variables are significant, which means the null hypothesis of there is unit roots will be rejected now, hence indicate there is no unit roots for all the variables in the first difference.

The second test that has been carried out is the Phillip-Perron Test (PP). All the variables are insignificant in the level form, which the null hypothesis of there is unit root will not be rejected; there is unit root in the variables. The variables are significant at the first difference, where the null hypothesis is rejected, and hence there is no unit root.

Therefore, we can safely conclude that the variables during the pre-crisis period is not stationary at level form, it is stationary after first differencing, which means all the variables are I(1).

Table 4.2 - Stationarity Test for All Variables for Post-Crisis

Details / Variables	In Level – I(0)				In 1st Difference – I(1)			
	With Trend		Without Trend		With Trend		Without Trend	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
LogKLCI	-2.767821	-2.820706	-0.424468	-0.876307	-5.936103***	-6.093597***	-5.809845***	-5.962494***
LogGOLD	-3.891549	-3.837120**	-1.054592	-0.784322	-9.921845***	-11.00057***	-10.01158***	-11.11533***
LogSILVER	-2.213703	-2.221244	-1.177784	-1.123164	-7.820125***	-7.836688***	-7.876659***	-7.890549***
LogPALLADIUM	-1.702823	-1.894968	-0.884245	-1.068631	-7.495787***	-7.471230***	-7.412501***	-7.415750***
LogPLATINUM	-2.025484	-2.380623	-2.013642	-2.386293	-4.542251***	-6.409059***	-4.528379***	-6.406253***

Note: *, **, *** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

The results in Table 4.2 show that T-statistics value of unit root test for each variable, for pre-crisis period of year 2009 to year 2012. The unit root test that has been tested is ADF and PP tests, which is the same with the test that are used to test the variables for pre-crisis period.

The result shows, for both ADF and PP test, all the variables are not significant at level form, which the null hypothesis of no hypothesis is rejected, hence there is unit root in level form. After differencing for one time, all the variables are significant, which means the null hypothesis of there is unit root will be rejected, hence there is no unit root in first differencing.

Therefore, it is concluded that all variables for post-crisis period are insignificant in level form, but significant after first differencing, all the variables are I(1).

4.2 Cointegration Test

<u>Table 4.3 - Stationarity for The Residual Of The Each Precious Metal With KLCI for Pre-crisis</u>

Details / Variables	In Level – I(0)		In 1st Difference – I(1)	
	ADF	PP	ADF	PP
LogKLCI-LogGOLD	-2.645036***	-2.607367***	N/A	N/A
LogKLCI-LogSILVER	-0.948238	-0.799765	-12.28318***	-12.50431***
LogKLCI-LogPALLADIUM	-0.776024	-0.841744	-10.16247***	-10.12100***
LogKLCI-LogPLATINUM	-2.895003***	-2.895003***	N/A	N/A

Note : *,**,*** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

Table 4.4 - Stationarity For The Residual Of The Each Precious Metal With KLCI for Post-crisis

Details Variables	In Level – I(0)		In 1st Difference – I(1)	
	ADF	PP	ADF	PP
LogKLCI-LogGOLD	-2.901019***	-2.989749***	N/A	N/A
LogKLCI-LogSILVER	-1.790075*	-1.681339*	N/A	N/A
LogKLCI-LogPALLADIUM	-1.934119*	-1.934119*	N/A	N/A
LogKLCI-LogPLATINUM	-1.429891	-1.383900	-8.718249***	-8.795663***

Note : *,**,*** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

Table 4.5- Order of Integration of Variables and Residual for Pre-Crisis

Series	KLCI	Gold	Residual	
LogKLCI-LogGold	I(1)	I(1)	I(0)	Cointegrated
LogKLCI-LogSilver	I(1)	I(1)	I(1)	Not Cointegrated
LogKLCI-LogPalladium	I(1)	I(1)	I(1)	Not Cointegrated
LogKLCI-LogPlatinum	I(1)	I(1)	I(0)	Cointegrated

Table 4.6-Order of Integration of Variables and Residual for Post-Crisis

Series	KLCI	Gold	Residual	
LogKLCI-LogGold	I(1)	I(1)	I(0)	Cointegrated
LogKLCI-LogSilver	I(1)	I(1)	I(0)	Cointegrated
LogKLCI-LogPalladium	I(1)	I(1)	I(0)	Cointegrated
LogKLCI-LogPlatinum	I(1)	I(1)	I(1)	Not Cointegrated

Table 4.5 and table 4.6 show the order of integration of all the variables with residual for pre-crisis and post-crisis period. To complete the Engle-Granger 2 steps cointegration test, we need to compare the order of integration for variables and the residual of it. We need to make sure the order of integration for the residual is I(0) since all the variables are having the order of I(1) as done in the unit root test. The order of integration of residual generated for each series for pre-crisis and post-crisis period will be used to compare with the variables tested.

During the pre-crisis period, only gold and platinum are at the I(0), in another word, only gold and platinum are cointegrated with KLCI during the pre-crisis period. Next, during the post-crisis period, the order of integration for gold, silver and palladium are at I(0), which means they are cointegrated with KLCI during the post-crisis period.

4.3 Johansen and Juselius Test

Table 4.7- Result of Johansen and Juselius Test for Pre-crisis for KLCI and Gold

	Hypothesis		Trace Test		Hypothesis		Maximum-Eigen Value	
r	H_o	H_1	λ_{Trace}	95% Critical Value	H_o	H_1	λ_{Max}	95% Critical Value
0	r=0	r>1	15.03425	15.49471	r=0	r=1	14.91842*	14.26460
1	r≤1	r>2	0.115830	3.841466	r=1	r=2	0.115830	3.841466

Note : *,**,*** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

.

Table 4.8- Result of Johansen and Juselius Test for Pre-crisis for KLCI and Platinum

	Hypothesis		Trace Test		Hypothesis		Maximum-Eigen Value	
r	H_o	H_1	λ_{Trace}	95% Critical Value	H_o	H_1	λ_{Max}	95% Critical Value
0	r=0	r>1	15.47846	15.49471	r=0	r=1	14.36985*	14.26460
1	r≤1	r>2	1.108610	3.841466	r=1	r=2	1.108610	3.841466

Note : *,**,*** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

Table 4.9- Result of Johansen and Juselius Test for Post-crisis for KLCI and Gold

	Hypothesis		Trace Test		Hypothesis		Maximum-Eigen Value	
r	H_o	H_1	λ_{Trace}	95% Critical Value	H_o	H_1	λ_{Max}	95% Critical Value
0	r=0	r>1	9.180554	15.49471	r=0	r=1	8.227837	14.26460
1	r≤1	r>2	0.952827	3.841466	r=1	r=2	0.952827	3.841466

Note : *,**,*** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

Table 4.10- Result of Johansen and Juselius Test for Post-crisis for KLCI and Silver

	Hypothesis		Trace Test		Hypothesis		Maximum-Eigen Value	
r	H_o	H_1	λ_{Trace}	95% Critical Value	H_o	H_1	λ_{Max}	95% Critical Value
0	r=0	r>1	5.685779	15.49471	r=0	r=1	4.688724	14.26460
1	r≤1	r>2	0.997048	3.841666	r=1	r=2	0.997048	3.841466

Note : *,**,*** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

Table 4.11- Result of Johansen and Juselius Test for Post-crisis for KLCI and Palladium

	Hypothesis		Trace Test		Hypothesis		Maximum-Eigen Value	
r	H_o	H_1	λ_{Trace}	95% Critical Value	H_o	H_1	λ_{Max}	95% Critical Value
0	r=0	r>1	7.400558	15.49471	r=0	r=1	15.49471*	14.26460
1	r≤1	r>2	1.019505	3.84166	r=1	r=2	1.019505	3.84166

Note : *,**,*** denotes that reject the null hypothesis at the level of significance of 10%, 5% and 1% respectively.

After making sure which variables are cointegrated, then the Johansen and Juselius test (JJ test) will be tested to see which rank (r) of cointegration they belong to. We will proceed with VAR if the r is equal to zero, or r is equal to or more than zero. If the r is equal to one, we will proceed our analysis with the VECM model.

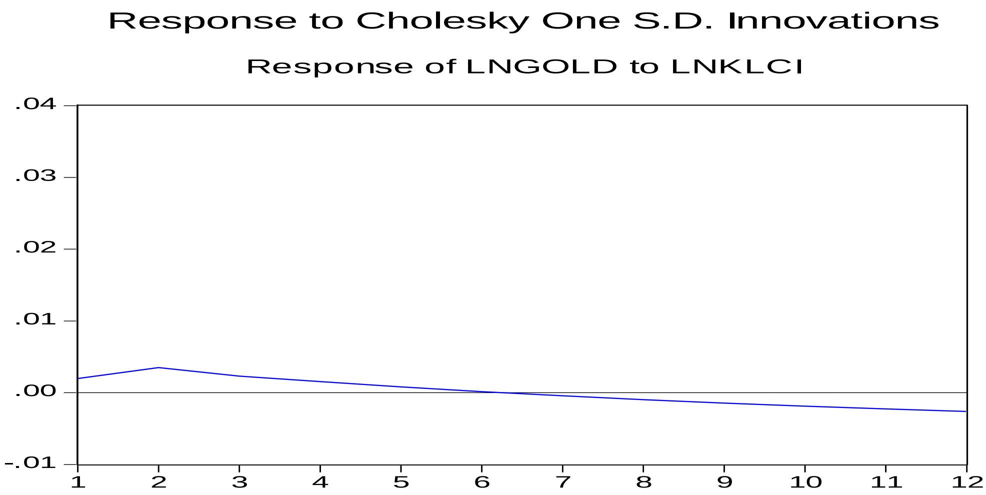
Based on the result of the JJ test on the pre-crisis period, the rank of cointegration for KLCI with gold and KLCI with Platinum is one, which means that it will be using VECM model. Whereas for the period of post-crisis, KLCI with gold, KLCI with silver is ranked zero, which means that it will be using VAR model. Last but not least, for KLCI with palladium, it is ranked one, hence it will be using VAR model.

4.4 Impulse Responsive Analysis

4.4.1 Impulse Responsive Analysis for Pre-crisis Period

4.4.1.1 KLCI-GOLD

Figure 4.1- Impulse Response of Gold with KLCI during pre-crisis

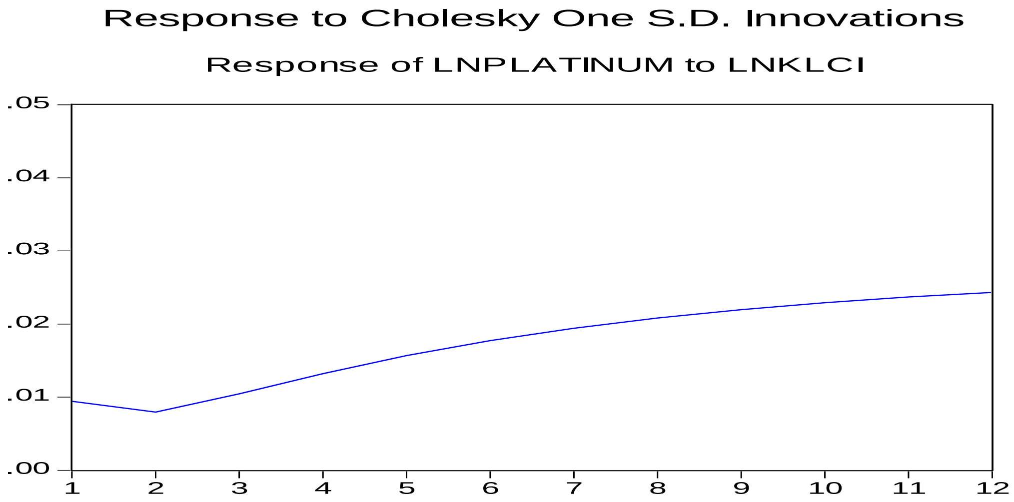


The graph 4.1 shows the impulse responsive analysis for Gold and KLCI during the pre-crisis period. We can see that from the response of Gold to KLCI, Gold is very irresponsive when one unit of shock happens in KLCI. If the shock getting bigger, the response of Gold to KLCI even comes to negative.

This indicates that if KLCI experienced a big shock, the response of Gold towards KLCI will be very minimal. The investor with the portfolio consist of KLCI component stocks will not need to worry much in the fluctuation in Gold, provided they have included gold into the investment portfolio. From this we can say that gold is a good hedge for KLCI during the pre-crisis period.

4.4.1.2 KLCI – Platinum

Figure 4.2- Impulse Response of Platinum with KLCI during pre-crisis



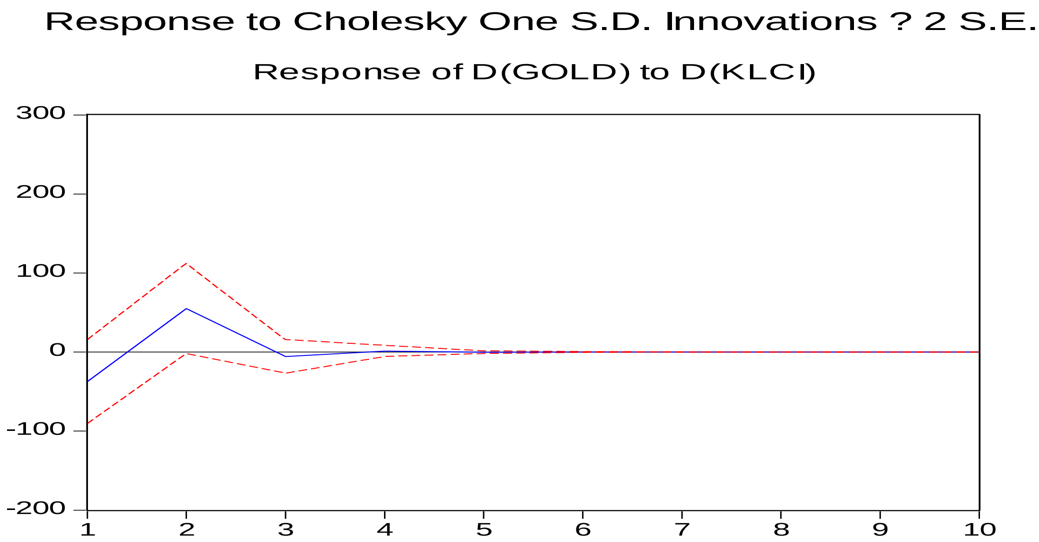
The graph 4.2 shows the impulse response analysis for Platinum and KLCI during the pre-crisis period. From the graph of response of Platinum to KLCI, we can see that the Platinum response to KLCI is getting larger when the shock happens in KLCI getting bigger.

If KLCI experienced a shock, the platinum will be very responsive and hence the fluctuation will be very high. The fluctuation in price of platinum will be very high when the shock in KLCI is bigger, the investors will have to worry about the movement in price of platinum, this indicates that platinum is a bad hedge for shock in KLCI during the pre-crisis period.

4.4.2 Impulse Responsive Analysis for Post-crisis Period

4.4.2.1 KLCI – GOLD

Figure 4.3 – Impulse Response of Gold with KLCI during post-crisis

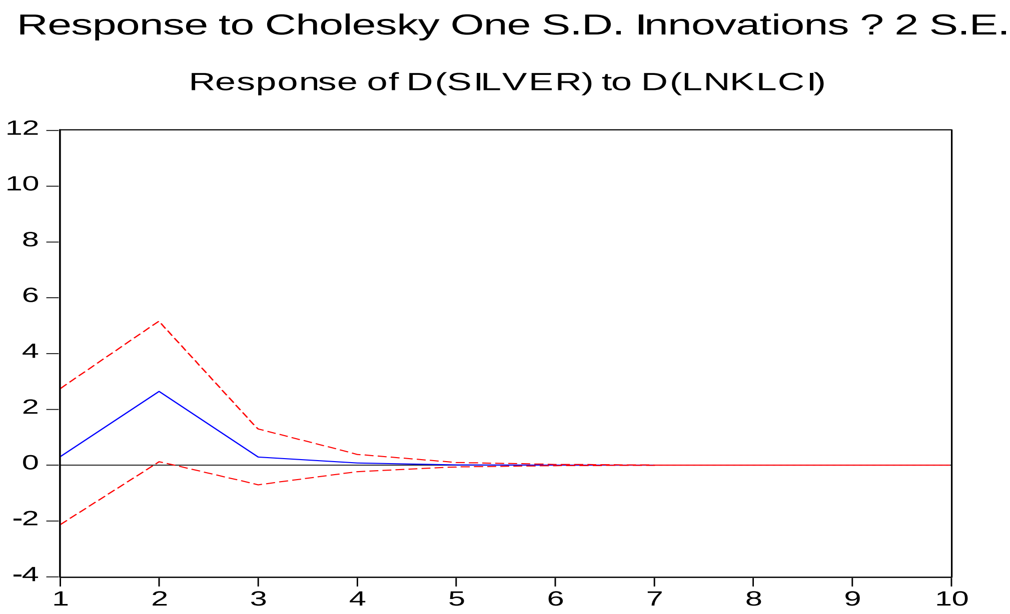


Graph 4.3 shows the impulse response analysis for Gold and KLCI during the post-crisis. For post crisis, the response of Gold to KLCI shock does change much from pre-crisis, it has become responsive to small unit of shock happen in KLCI, but very irresponsive to bigger shock happen in KLCI.

That means from pre-crisis to post-crisis, Gold has increase the irresponsive property towards KLCI. The response of Gold to KLCI approach zero in bigger shock. Hence, it has increase in its hedging property towards KLCI after the 2007-08 Global Financial Crisis.

4.4.2.2 KLCI – SILVER

Figure 4.4 – Impulse Response of Silver with KLCI during post-crisis

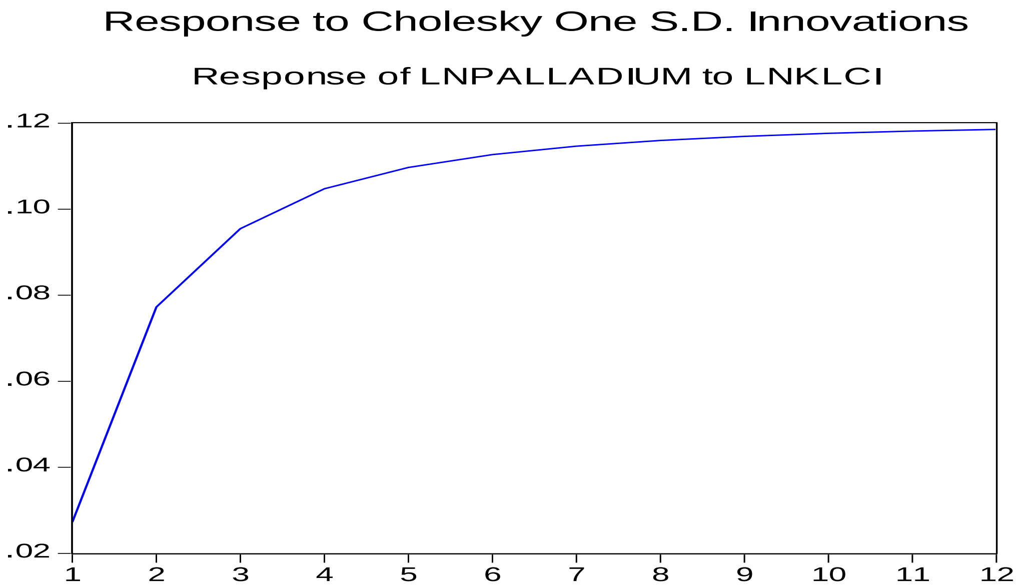


Silver does not appear to be co-integrated during the pre-crisis and hence there is no impulse response analysis being done on KLCI vs. Silver for pre-crisis period. However, as Silver co-integrated with KLCI during post crisis period. Impulse response is carried out for KLCI with Silver.

The result shows that Silver is very responsive to small unit of shock happen in KLCI, but it is not very responsive in bigger shock happen in KLCI. Silver does show similar responsiveness that is being demonstrated by Gold to KLCI. Silver is a good hedging tools against the shock in KLCI but are inferior to Gold.

4.4.2.3 KLCI – PALLADIUM

Figure 4.5 – Impulse Response of Palladium with KLCI during post-crisis



For Palladium, it also do not co-integrated with KLCI during pre-crisis and hence no impulse responsive done on pre-crisis. It does co-integrate with KLCI during post-crisis period.

For Palladium we can see that it is very responsive to the shock happen in KLCI. The response is very big, that mean if any shock happen on KLCI, the Palladium will be very volatile. This shows that Palladium is a very bad hedge to shock in KLCI.

4.5 Variance Decomposition Analysis

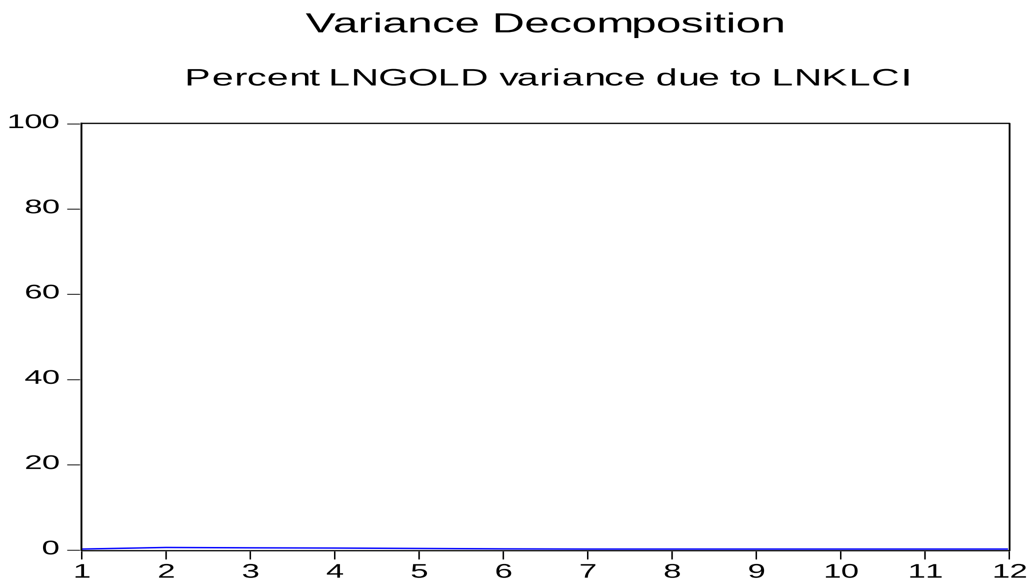
4.5.1 Variance Decomposition Analysis for Pre-crisis Period

Table 4.12- Variance Decomposition of Precious Metal with KLCI during Pre-crisis

Period	Gold	Platinum
2	0.62	3.31
4	0.48	5.00
6	0.33	8.07
8	0.25	11.50
10	0.24	14.82
12	0.27	17.88

4.5.1.1 KLCI – GOLD

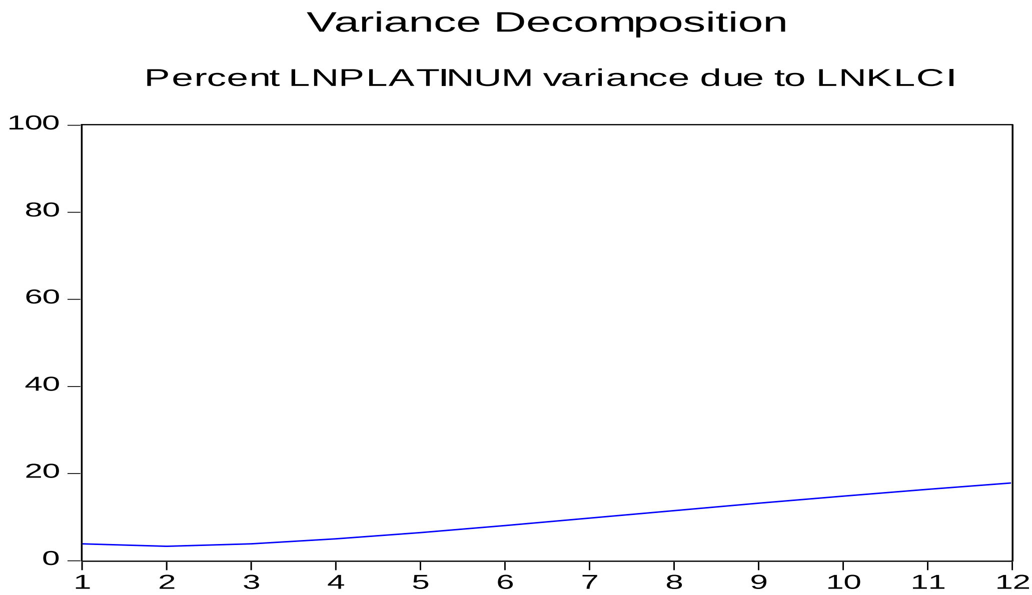
Figure 4.6 – Variance Decomposition of Gold with KLCI during pre-crisis



The graph 4.6 above shows that variance decomposition analysis for Gold and KLCI during the pre-crisis period. The graph of "percent of Gold variance due to KLCI" shows that the movement happens in Gold doesn't really cause by the KLCI. There's not even one percent of the variance in Gold are due to KLCI. The variance decomposition is very low as shown in table 4.12 only 0.62% at the beginning, and during the 12 months the variance decomposition decline until 0.27% only, we can see that the composition of the variation is extremely low.

4.5.1.2 KLCI – PLATINUM

Figure 4.7 – Variance Decomposition of Platinum with KLCI during pre-crisis



The graph above shows that variance decomposition analysis between the Platinum and KLCI during the pre-crisis period. From the graph of "Platinum variance due to KLCI", we can see that the variance in platinum is quite significant to KLCI, which the composition of its movement even reach 20% in a year.

The composition of its movement that affected by KLCI are showing an increasing trend, as time goes, the effect of KLCI on the movement of Platinum become larger. Based on the table 4.12, the variance decomposition is 3.31% at the beginning. However, the variance decomposition increased to 17.88% during the 12th month.

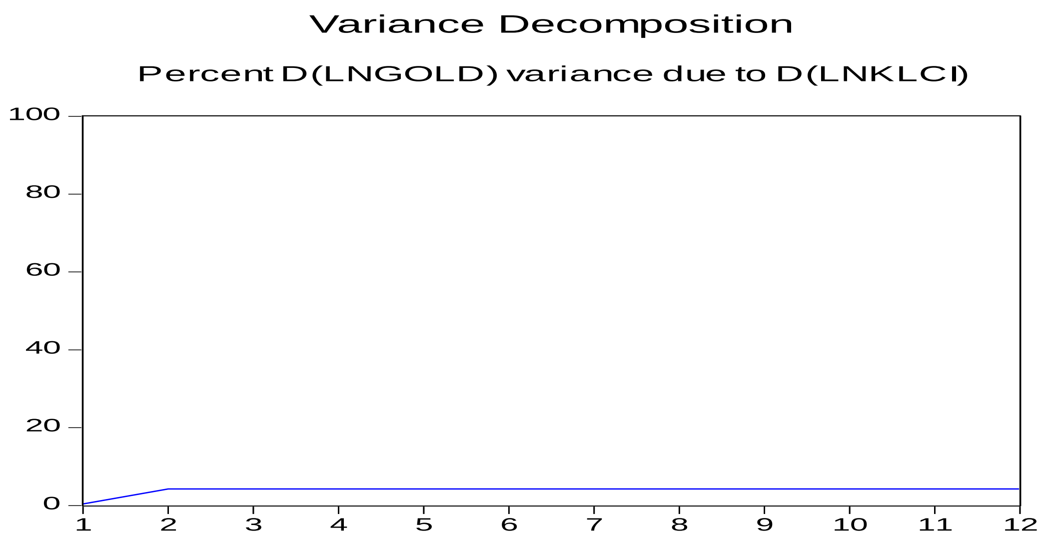
4.5.2 Variance Decomposition Analysis for Post-crisis Period

Table 4.13- Variance Decomposition of Precious Metal with KLCI during Post-crisis

Series	Gold	Silver	Palladium
2	4.25	11.37	36.51
4	4.26	11.74	58.52
6	4.26	11.87	68.38
8	4.26	11.87	74.03
10	4.26	11.87	77.69
12	4.26	11.87	80.22

4.5.2.1 KLCI – GOLD

Figure 4.8 – Variance Decomposition of Gold with KLCI during post-crisis

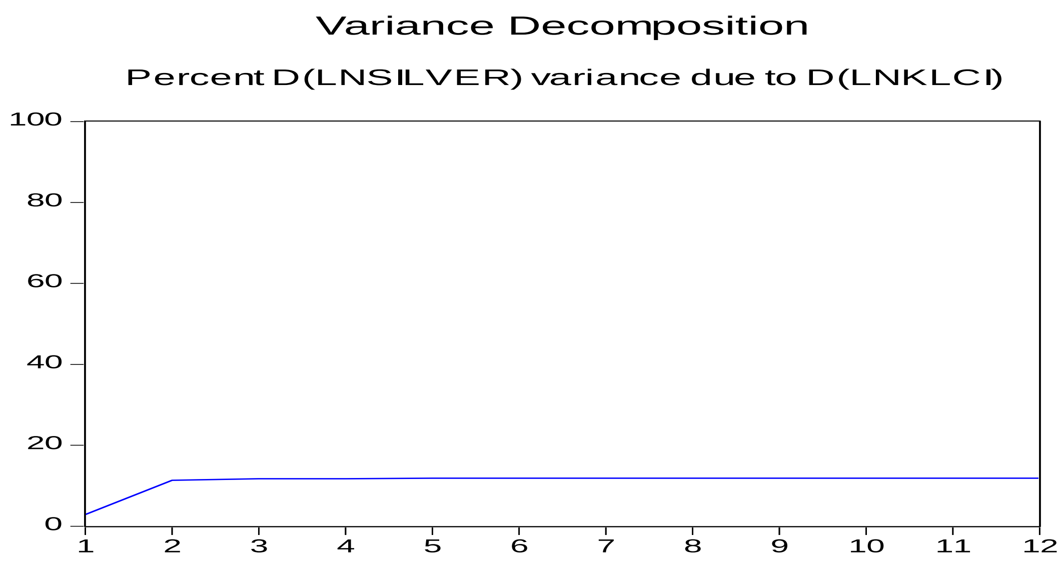


The graph shows variance decomposition analysis of Gold with KLCI during the post-crisis period. In comparison with the variance decomposition analysis during the pre-crisis period, the percentage of Gold variance is still not significantly affected by the KLCI. There is increase in composition compared to pre-crisis, but still it shows that Gold is not really affected much by KLCI. Gold is still largely affected by other variables.

The variance decomposition is low as shown in table 4.13 which there is only 4.25% at the beginning, and during the 12 months the variance decomposition remain constant at 4.26% only. This shows that gold is not really being affected by KLCI as time goes.

4.5.2.2 KLCI – SILVER

Figure 4.9 – Variance Decomposition of Silver with KLCI during post-crisis



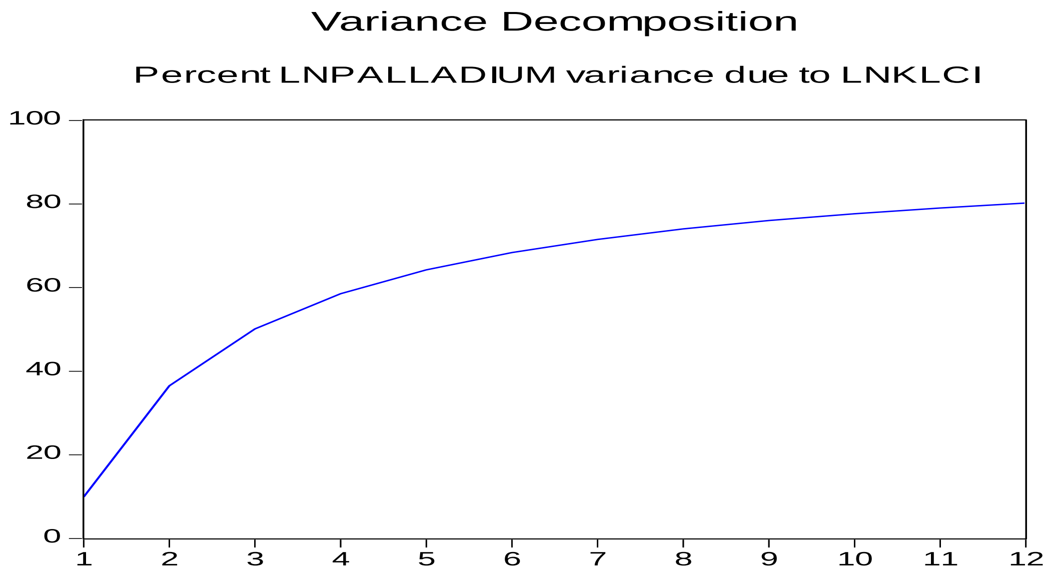
The graph shows variance decomposition analysis of Silver with KLCI during the post-crisis period. The variance decomposition analysis shows that Silver does affect by KLCI but only to a limited extend.

From the graph we can see that at first KLCI tends to have increasingly affected at the variance of Silver, but looking at the period 3 onwards, the effect is fixed and no longer increase. This shows that Silver are not really affected much by KLCI, it is higher when compared to Gold. Hence, silver is inferior to gold in hedging to the KLCI.

Besides, the variance decomposition shown in table 4.13 which there is 11.37% at the beginning. After that, the variance decomposition remain constant at 11.87% only. This shows that silver also not really being affected by KLCI as time goes.

4.5.2.3 KLCI – PALLADIUM

Figure 4.10 – Variance Decomposition of Palladium with KLCI during post-crisis



The graph shows variance decomposition analysis of Silver with KLCI during the post-crisis period, we can see that the percentage of variance in Palladium is greatly affected by KLCI, the variance composition even increase as time goes.

An upwards movement at the graph of percent of palladium variance due to KLCI shows that Palladium is increasingly affected by KLCI as time goes, and it is very high and significant as it is approaching 80%. It is a very bad hedge, and should not have used as KLCI is the major variables that affect the price movement in Palladium as it is very high risk.

Next, the table 4.13 shows that the variance decomposition of Palladium to KLCI has an increasing trend, and the variation in palladium is largely affected by KLCI. The variance decomposition is 36.51% at the beginning, and it rose sharply to 80.22% at the 12th month, this shows that palladium is significantly affected by KLCI as 80.22% of the movement of palladium is because of KLCI.

4.6 Conclusion

We have run a series of time series statistical analysis to examine the hedging properties of precious metals to the Malaysian stock market indicates by KLCI. We examined the stationarity and cointegration between precious metals and KLCI, then we determine whether to use VAR or VECM model by looking at the Johansen and Juselius test results. After all, impulse responsive and variance decomposition are applied so that we can assess their dynamic interaction which will give us reliable result for our objectives.

Our results suggest that during the pre-crisis period, gold and platinum are cointegrated with KLCI, whereas silver and palladium do not. From the impulse responsive and variance decomposition, we can see that gold is irresponsive to the shock happen in KLCI, and the variance in gold attributable to KLCI is very low. For platinum, it is responsive to the shock happen in KLCI, from the variance decomposition shows that the variation in platinum is increasingly affected by KLCI as time goes.

Next, for the post-crisis period, gold, silver and palladium are cointegrated with KLCI, whereas platinum do not cointegrated with KLCI. From the impulse responsive and variance decomposition, gold and silver sharing similar behavior as they are irresponsive to the shock happen in KLCI, and there are slight differences for gold and silver, which the variation in silver caused by KLCI is much higher than gold. For palladium, it is very responsive to shock happen in KLCI, and the variation in palladium is highly attributable to KLCI.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.1 Introduction

Chapter 5 aims to provide a more detailed explanations and linkage to our chapter 4. Besides, we are also going to list out our implications of major findings and what limitations we have during our research. Recommendations for future researchers would be also provided as well to further improve their skills and knowledge during their research. Lastly, we would end our project with an overall conclusion for the whole research.

5.2 Major Findings

The main objective of our research is to find out the hedging property of each precious metal to the stock market in Malaysia, and we wanted to find out which precious metal is the best hedging tool to the stock market.

Our result in chapter 4 shows that during the pre-crisis period, gold can be served as a hedging tool to the stock market, and it remains the same for post-crisis period. Gold do not responds much to the shock in KLCI and the investors will not have to worry about the movement in price of gold if there is a sudden shock such as major correction happens in KLCI, provided they have asset allocation consist of gold. The composition in the movement of gold does not really affected by KLCI and hence it shows that the movement in price of gold is actually affected by other variables. The previous research that carried out by Garcia-Feijoo & Jensen and Johnson (2012) is consistent with our result which showing that gold is a good hedge for KLCI.

Next, Silver does not have any hedging effect during the pre-crisis period and it only emerged to the spotlight as a hedge during the post-crisis period. The response of silver to shock in KLCI is very minimal and thus it is not much affected by the stock market. In other words, it can serve as an alternative hedging tool for KLCI other than gold. Besides, previous research that carried out by Hiller et al. (2006) is sharing the same idea with our result. As the price of silver is lower than gold, it is much more affordable especially for investors with smaller capital. However, the hedging effect of Silver is much more inferior when compared to gold.

On other side, Palladium only started relate to the stock market during the post-crisis period. Based on the impulse responsive analysis, Palladium is very responsive to the shock in KLCI. Other than that, our results shows that KLCI is the major factor that affects the variance in palladium. As such, it is not even a hedge to KLCI, and it is very risky investment. Dominik (2012) have also come out with same conclusion pointing that palladium is not a good hedge and risky investment, and it is consistent to our conclusion on palladium.

Lastly, Platinum is cointegrated with KLCI during the pre-crisis period. Platinum is very responsive to shock in KLCI and if the shock is bigger, platinum will be more responsive, hence it mean increasing volatile. However, after the crisis, platinum is no longer cointegrated to KLCI, hence meaning that it has lost the long run relationship with KLCI, it is no longer related to KLCI. We can conclude platinum is not a hedge to KLCI.

5.3 Policy implication

5.3.1 Investor - Individual Investors

What can you buy as an investor that will protect your monetary values and reliably rally as stock markets fall? The answer will be gold. Our finding showed that Gold can be serve as a hedging tool to the stock market. Thus individual investors will be able to minimize their risk if they chose to include gold in their investment portfolio to safeguard the value of their portfolio. As our results has shown that gold is the best hedging tool among all the precious metal to hedge against the stock market. Although purchasing gold may not fully reduce all the risk, but it may now eliminated the unsystematic risk with the stocks.

5.3.2 Investor – Corporate

According to economics theory, companies are more likely to minimize the overall risk of company so it can protect their profit from investment, especially during the shock event. This study is beneficial for them as the result has proven that they can hedge the risk by using gold. Gold is more preferable than silver, platinum and palladium, to reduce the risk. It may not eliminate all the risk but can minimize it. For example, investment bank can invest in gold, to protect their value. It is because investment bank is a financial institution for the investor to raise the capital, from the perspective of individuals, corporations and governments. They can use gold to minimize the risk, to make the investors will not worry about the loss especially during crisis period.

5.3.3 Employee Provident Fund (EPF)

Other than that, since gold is the best hedge among all the precious metals of silver, palladium and platinum, and it were recommended to be included into investment portfolio. It is wise that the government to include gold into the portfolio of the Employee Provident Fund (EPF) as an additional asset allocation. EPF is to invest a portion of salaries from employees and grow the fund to provide retirement fund for employee. Putting in gold as an extra hedging asset would help in minimizing risk of the investment portfolio of EPF.

5.3.4 FELDA

Federal Land Development Authority (FELDA), listed as the world's largest plantation sector, can consider allocating some investment into gold as one of their investment strategy. FELDA has a huge business line that consists of palm oil product, planting materials, Pest control, Rubber products, Cocoa products, analytical services, construction and others segment.

However, businesses such as plantation and agriculture are not earning profits for the whole year due to the seasonal cycle of plants and vegetables. Their profits will drop significantly during the planting period which is before those plants were mature and ready for sold. Therefore, it is advisable that FELDA can expand their businesses by investing in gold. By investing in gold, FELDA able to further expand their business line and hence minimizing their risk.

5.4 Limitation of the Study

Other than VAR model, there are other advanced methodologies which can be used to find out the relationship between the precious metals. For example, DCC(GARCH) can be used to examine the dynamic correlation between difference commodities. However, to the best of our knowledge, the analytical software that we used, E-view do not support DCC(GARCH) model. The software that can support DCC(GARCH) is a software with the name of "R". There is limitation in knowledge to use this software as this software requires knowledge in commanding knowledge.

Besides, we unable to include the volatility index (VIX) as a variable to test the effect of stock market. Hood and Malik (2013) found that VIX is a superior hedge than gold to stock market volatility. VIX is the indicator for the expectation of the market movement in the next 30 days, this index is trademarked for the Chicago Board Options Exchange and it is available for the index of S&P

500. VIX is not available for Malaysia KLCI, as such we are unable to include this as a variable in our research.

Other than that, our paper focus on the changes in hedging property of precious metals to stock market in pre-crisis period which is the year of 2000 to 2007 and post crisis which is the year of 2008 to 2012. There is another latest crisis brewing in gold market as there is significant drop in gold price, which causes debate on is gold still a hedge for stock market. However, as the dropping in gold price is still happening, we cannot test on this as the crisis is not finalized yet, we can only test on it when the crisis has confirmed by reaching the bottom and rebounded.

5.5 Recommendation for Future Research

Future researchers who are professionally trained to use R software are recommended to perform analysis on similar topic by using DCC(GARCH) model by using R software in the future. By using DCC(GARCH) model it can yield different result which can give readers more information on similar topic.

Besides, future researches should include VIX in their research if VIX has become available for KLCI. VIX has been identified as the superior hedge than gold in the United States market. This means when VIX increase, the market volatility are expected to increase, and this also indicate the fear factor. Pessimistic sentiment on future market means investors expect market to drop in future, and expectation should be able to apply at worldwide as it involve human psychology. This is solid enough to recommend future researchers to include VIX once it has become available in Malaysia.

Next, we look at the changes in hedging property of precious metals to stock market in pre-crisis period which is the year of 2000 to 2007 and post crisis which is the year of 2008 to 2012. The economic crisis where shock happened from year 2000 to the end of 2012 was during 2008, subprime mortgage crisis and

US housing bubble. Therefore, for the extension of studies, we recommend future researchers to coverage the crisis that happening recently. Future researchers are highly recommended to conduct research that revisit and find out the structural change based on the latest issues which are happening nowadays in year 2013.

5.6 Conclusion

In a nutshell, our paper provides a new set of idea on which precious metals can serve individuals investors, corporate, and government. Apart from that, it is beneficial as it provides a better understanding between precious metals stock performance (KLCI index). Based on the result generated, precious metals have different effect on the equity market during pre and post crisis and gold is the only precious metal that we found which can be serve as a hedging tool during pre and post crisis and therefore it remain as the best hedging tool among the 4 precious metals.

As a result, this may be essential for the investors who came from individuals, corporate, or government side as they can hedge their risk by investing in gold. At the same time, they can earn a lucrative capital gain and dividend, as long as the gold price does not affect by shock event.

REFERENCES

Alva, M. (2011, Aug 22). Silver producers shine as precious metal prices go vertical industry trends. *Investor's Business Daily*. Retrieved from http://search.proquest.com/docview/915068268?accountid=50207

Anand, R., & Madhogaria, S. (2012). Is gold a 'safe-haven'? An econometric analysis.*Procedia Economics and Finance, 1*, 24-33. Retrieved from http://ac.els-cdn.com/S2212567112000056/1-s2.0-S2212567112000056-main.pd?_tid=a2a3ef66-029a-11e3-81d8-00000aab0f26&acdnat= 1376235072_23db765db7a690dac6bc59cca9371684

Ang, James, B. (2008). Economic development, pollutant emissions and energy consumption in Malaysia. *Journal of Policy Modeling, 30,* 271-278. http://dx.doi.org/10.1016/j.jpolmod.2007.04.010

Arouri, M. E. H., & Nguyen, D. K. (2010). Oil prices, stock markets and portfolio investment: evidence from sector analysis in Europe over the last decade. *Energy Policy, 38*(8), 4528. Retrieved from http://search.proquest.com/docview/517998721?accountid=50207

Asari, F.F.A.H., Baharuddin, N.S., Jusoh, N., Mohamad, Z., Shamsudin, N., & Jusoff, K. (2011). A vector error correction model (vecm) approach in explaining the relationship between interest rate and inflation towards exchange rate volatility in malaysia. *World Applied Sciences Journal, 12*(3), 49-56. Retrieved from http://www.idosi.org/wasj/wasj12(BES)11/8.pdf

Baur, D.G., & Lucey, B.M. (2010). Is gold a hedge or a safe haven? An analysis of stock, bonds and gold. *The Financial Review, 45,* 217-229.

Baur, D.G., & McDermott, T. K. (2010). Is gold a safe haven? International evidence. *Journal of Banking & Finance, 34,* 1886-1898.

Bond, G.C. (1991). General introduction to catalysis by platinum group metals. *Studies in Inorganic Chmistry, 11*, 32-59.http://dx.doi.org/10.1016/B978-0-444-88189-2.50007-9

Boyer, B.H., Kumagai, T., & Yuan, K. (2006). How do crises spread? Evidence from accessible and inaccessible stock indices. *Journal of Finance, 61*, 957-1003.doi:10.1111/j.1540-6261.2006.00860.x

Braun, P.A., & Mittnik, S. (1993). Misspecifications in vector autoregressions and their effects on impulse responses and variance decompositions. *Journal of Economics, 59*(3). http://dx.doi.org/10.1016/0304-4076(93)90029-5

Campbell. (1991). A variance decomposition for stock returns. *Journal of Economic, 101*(405), 157-179.doi:10.2307/2233809

Caporin, M. (2013). Equity and CDS sector indices: dynamic models and risk hedging.*North American Journal of economics and Finance, 25*, 261-275. http://dx.doi.org/10.1016/j.najef.2012.06.004

Cavaliere, G., Phillips, P.C.B., Smeekes, S., & Taylor A.M.R. (2011). Lag length selection for unit root tests in the presence of nonstationary volatility. *Department of Statistical Sciences*. Retrieved 4th March, 2014, from http://cowles.econ.yale.edu/P/cd/d18a/d1844.pdf

Christensen, J.I. (2011). Oil price shock and stock returns: empirical evidence for the g-7 and norway.

Christian, J. M. (1999). Platinum, palladium and rhodium in 1998. *Engineering and Mining Journal, 200(4),* 5. Retrieved from http://search.proquest.com/docview/195220834?accountid=50207

Chua, J. H. (1990). Diversifying with gold stocks. *Financial Analysis Journal,* 76-79. Retrieved from http://www.jstor.org/discover/10.2307/4479351?uid=2&uid=4&sid=21103642744367

Ciner, C., Gurdgiev, C., & Lucey, B. M. (2013). Hedges and safe havens: an examination of stocks, bonds, gold, oil and exchange rates. *International Review of Financial Analysis.*http://dx.doi.org/10.1016/j.irfa.2012.12.001

Clements, B. J. (1998). Gold is a poor long-term investment, but still has a shine in rough times. *Wall Street Journal*. Retrieved from http://search.proquest.com.libezp.utar.edu.my/docview/398634961/BD07C1F3E32445A DPQ/13?accountid=50207

Cochrane, J. H. (1990). A critique of the application of unit root tests. *Journal of Economic Dynamics and Control, 15,* 275-284. Retrieved from http://faculty.chicagobooth.edu/john.cochrane/research/papers/cochrane%20unit%20root%20critique%20jedc.pdf

Cong, R.G., Wei, Y.M., Jiao, J.L., & Fan, Y. (2008). Relationships between oil price shocks and stock market: an empirical analysis from China. *Energy Policy, 36,* 3544-3553.

Conover, C. M., Jensen, G. R., Johnson, R. R., & Mercer, J. M. (2009). Can precious metals make your portfolio shine? *Journal of Investing, 18*(1)*,* 75-86. Retrieved from http://search.proquest.com/docview/220724313?accountid=50207

Creti, A., Joets, M., & Mignon, V. (2013). On the links between stock and commodity markets' volatility. *Energy Economics, 37,* 16-28.

Daskalaki, C., & Skiadopoulos G. (2011). Should investors include commodities in their portfolios after all? New evidence. *Journal of Banking & Finance, 35,* 2606-2626. doi:10.1016/j.jbankfin.2011.02.022

Dee, J., & Li, L. (2013). Is gold a hedge or a safe haven? Evidence from inflation and stock market. *International Journal of Development and Sustainability, 2*, 2168-8662.

Dominik, K. (2012). Non-classical measures of investment risk on the market of precious non-ferrous metals using methodology of stable distributions. *Journal of Business and Economics*.

Draper, P., Fatt, R.W., & Hillier, D. (2006). Do precious metals shine? An investment perspective. *Financial Analysts Journal, 62*(2), 98-106.

Dumont, C. (2012). A premer on Palladium. Retrieved from http://www.investopedia.com/articles/fundamental-analysis/12/a-primer-on-palladium.asp

Elshkaki, A. (2012). An analysis of future platinum resources, emissions and waste streams using a system dynamic model of its intentional and non-intentional flows and stocks. *School of Forestry and Environmental Studies*. *38*(2013), 241-251. http://dx.doi.org/10.1016/j.resourpol.2013.04.002

Enders, W. (2010). *Lecture 6: Cointegration: Bivariate Cointegration Methodology.*

Feldkircher, M. (2014). The determinants of vulnerability to the global financial crisis 2008-2009: credit growth and other sources of risk. *Journal of International Money and Finance, 43,* 19-49. http://dx.doi.org/10.1016/j.jimonfin.2013.12.003

Garcia-Feijoo, L., Jensen, G. R., & Johnson, R. R. (2012). The effectiveness of asset classes in hedging risk. *Journal of Portfolio Management, 38*(3), 40-55, 8-10. Retrieved from http://search.proquest.com.libezp.utar.edu.my/docview/1366018111/1FABA07E2E734A CAPQ/9?accountid=50207

Goh, S., K., & Lim, M., H., M. (2010). The impact of the global financial crisis: the case of Malaysia. Retrieved 8th March, 2014, from http://www.twnside.org.sg/title2/ge/ge26.pdf

Hammoudeh, S., Malik, F., & McAleer, M. (2011). Risk management of precious metals. *The Quarterly Review of Economics and Finance, 51*(4), 435-441. http://dx.doi.org/10.1016/j.qref.2011.07.002

Hillier, D., Draper, P., & Faff, R. (2006). Do precious metals shine? An investment perspective. *Financial Analysts Journal, 62*(2), 98-106.

Hjalmarsson, E., & Osterholm, P. (2007). Testing for cointegration using the johansen methodology when variables are near-integrated. *Journal of Finance*.

Hood, M. & Malik, F. (2013). Is gold the best hedge and a safe haven under changing stock market volatility? *Review of Financial Economics, 22*(2013), 47-52. http://dx.doi.org/10.1016/j.rfe.2013.03.001

Ibrahim, M. H. (2007). The role of the financial sector in economic development: the Malaysia case. *International Review of Economics, 54,* 463-483. http://dx.doi.org/10.1007/s12232-007-0023-4

Jaffe J. F. (1989). Gold and gold stocks as investments for institutional portfolios. *Financial Analysis Journal,* 53-59.

Jain, A., & Ghosh, S. (2013). Dynamics of global oil prices, exchange rate and precious metal prices in India. *Resource Policy*, *38*(1), 88-93. http://dx.doi.org/10.1016/j.resourpol.2012.10.001

Klement, J. (2011). Investment management is risk management-nothing more, nothing less. *The Journal of Wealth Management*, *14*(3), 10-16. Retrieved from http://search.proquest.com/docview/906522610?accountid=50207

Kumar, D. (2014). Return and volatility transmission between gold and stock sectors: application of portfolio management and hedging effectiveness. *IIMB Management Review, 26*(1), 5-6.doi.org/10.1016/j.iimb.2013.12.002

Lau, L. S., Choong, C. K. & Eng, Y. K. (2014). Investigation of the environment Kuznets curve for carbon emissions in Malaysia: do foreign investment and trade matter? *Energy Policy, 68,* 490-497. http://dx.doi.org/10.1016/j.enpol.2014.01.002

Li, Z. (2013). European stock market contagion during sovereign debt crisis and the effects of macroeconomic announcements on the correlations of gold, dollar and stock returns. *Dissertations and Theses.* Retrieved from http://search.proquest.com.libezp.utar.edu.my/docview/1426182461/previewPDF?accountid=50207

Luundeen, M. (2013) A long-term look at the stock market and precious metals. Retrieved from http://www.gold-eagle.com/article/long-term-look-stock-market-and-precious-metals

Malik, F. (2011). Estimating the impact of good news on stock market volatility. *Applied Financial Economics. 21,* 545-554.

McMillin, W.D (n.d.). Lag length selection in vector autoregressive models: symmetric and Asymmetric Lags. *Journal of Applied Economics, 31*(4). doi=10.1.1.27.4267&rep=rep1&type=pdf

Micheal, D.B. (2008). Gold standard.*The Concise Encyclopedia of Economics.* Library of Economics and Liberty. Retrieved January 8, 2014, from http://www.econlib.org/library/Enc/GoldStandard.html

Morales, L,. & Andreosso, O.C.B. (2011). Comparative analysis on the effects of the Asian and global financial crises on precious metal markets. *Research in International Business and Finance*, *25*(2011), 203-227. doi:10.1016/j.ribaf.2011.01.004

Morgan, D. (2013). Platinum: today's 'Rich Man's Gold'. Retrieved January 28th 2014 from http://www.silverseek.com/commentary/platinum-today%E2%80%99s-%E2%80%98rich-man%E2%80%99s-gold%E2%80%99-palladium-tomorrow%E2%80%99s-12688

O'Brien, R. J. (n.d.).A guide to metals hedging. New York mercantile exchange. Retrieved from https://www.rjobrien.ca/documents/shared/metals/a_guide_to_metals_hedging_small.pdf

O'Connor, G. (1999). Beneficiaries of the green revolution: platinum and palladium by gillian O'connor: The twin metals are vying with each other in the important autocatalyst market. *Financial Times*. Retrieved from http://search.proquest.com/docview/248761477?accountid=50207

Popescu, I. R., & Corbos, R. (2011). Successful strategic practices in building Malaysia's country brand. *Administratie Si Management Public,* (16), 82-113. Retrieved from http://search.proquest.com/docview/927580567?accountid=50207

Richter, J. (2013). Hedge funds bullish on palladium prices. Retrieved from http://www.bdlive.co.za/markets/2013/08/07/hedge-funds-bullish-on-palladium-prices

Sanibel, M. (2010).Investing in Precious Metals. Retrieved September 8, 2013, from Forbes website http://www.forbes.com/2010/06/22/investing-precious-metals-personalfinancegold.html

Sensoy, A. (2013). Dynamic relationship between precious metals. *Resources Policy, 38*(4), 504-511.http://dx.doi.org/10.1016/j.resourpol.2013.08.004

Ssekuma R, 2011. A study of cointegration models with applications. *Journal of Statistics.* Retrieved from http://uir.unisa.ac.za/bitstream/handle/10500/4821/thesis_ssekuma-r.pdf?sequence=1

Sharma, M., Prashar, E., Aggarwal, R., & Kaur, G. (2013). Gold and precious metals: a comparative analysis. *The Journal of Private Equity, 16*(4), 93-97. Retrieved from http://search.proquest.com.libezp.utar.edu.my/docview/1444145718/EF2D16247CAE43C6PQ/1?accountid=50207

Spano, M. (2004). Determinants of hedging and its effects on investment and debt. *Journal of Corporate Finance, 10*, 175-197. doi:10.1016/S0929-1199(02)00037-8

The R project for statistical computing (n.d). *Institute for Statistics and Mathematics*. Retrieved March 11th, 2014, from http://www.r-project.org/

Virginie, C., & Helene, R. (2011). Gold and financial assets: are there any safe havens in bear markets? *Economics Bulletin, 31*, 1613-1622.

Wang, L.H. (2014). Who moves east asian stock markets? The role of the 2007-2009 global financial crisis. *Journal of International Financial Markets, Institutions and Money, 28,* 182-203.http://dx.doi.org/10.1016/j.intfin.2013.11.003

Wang, K. M., Lee, Y. M., & Thi, T. B. N. (2011). Time and place where gold acts as an inflation hedge: an application of long-run and short-run threshold model. *Economic Modelling, 28,* 806-819. doi:10.1016/j.econmod.2010.10.008

Ziaei, S. M. (2012). Effects of gold price on equity, bond and domestic credit: evidence from Asean +3. *Procedia – Social and Behavioral Sciences, 40,* 341-346. Retrieved from http://www.sciencedirect.com/science/article/pii/S1877042812006647

Zeal, L.L.C (2014). Gold drives silver price - expecting incredibly bullish 2014. *Journal of Finance*. Retrieved February 6th, 2014, from http://www.marketoracle.co.uk/Article44015.html

Appendices

Impulse Responsive Analysis during Post-Crisis

KLCI and Gold

Response of LNKLCI:		
Period	LNKLCI	LNGOLD
1	0.044896	0.000000
2	0.042343	-0.000477
3	0.037459	0.003841
4	0.033201	0.007161
5	0.029343	0.010236
6	0.025874	0.012990
7	0.022751	0.015471
8	0.019941	0.017703
9	0.017411	0.019712
10	0.015135	0.021520
11	0.013086	0.023148
12	0.011243	0.024612
Response of LNGOLD:		
Period	LNKLCI	LNGOLD
1	0.001969	0.038798
2	0.003488	0.032496
3	0.002304	0.034200
4	0.001541	0.034696
5	0.000808	0.035295
6	0.000155	0.035811
7	-0.000434	0.036279
8	-0.000964	0.036700
9	-0.001441	0.037079
10	-0.001870	0.037420
11	-0.002256	0.037727
12	-0.002604	0.038003
Cholesky Ordering: LNKLCI LNGOLD		

KLCI and Platinum

Response of LNKLCI:		
Period	LNKLCI	LNPLATINUM
1	0.046609	0.000000
2	0.047205	-0.002185
3	0.043903	0.000908
4	0.040179	0.004470
5	0.036886	0.007638
6	0.034124	0.010298
7	0.031843	0.012497
8	0.029966	0.014306
9	0.028423	0.015793
10	0.027156	0.017015
11	0.026115	0.018019
12	0.025259	0.018843
Response of LNPLATINUM:		
Period	LNKLCI	LNPLATINUM
1	0.009439	0.046917
2	0.007963	0.047410
3	0.010451	0.045129
4	0.013224	0.042476
5	0.015677	0.040116
6	0.017733	0.038135
7	0.019431	0.036498
8	0.020829	0.035151
9	0.021978	0.034044
10	0.022922	0.033134
11	0.023697	0.032387
12	0.024334	0.031773
Cholesky Ordering: LNKLCI LNPLATINUM		

Impulse Responsive Analysis during Post-Crisis

KLCI and Gold

Response of D(LNKLCI): Period	D(LNKLCI)	D(LNGOLD)
1	0.042899	0.000000
	(0.00398)	(0.00000)
2	0.011305	-0.007996
	(0.00576)	(0.00549)
3	0.001165	0.000332
	(0.00323)	(0.00145)
4	0.000382	-0.000318
	(0.00078)	(0.00045)
5	2.85E-05	2.59E-05
	(0.00020)	(0.00012)
6	1.34E-05	-1.32E-05
	(4.6E-05)	(3.8E-05)
7	5.30E-07	1.53E-06
	(8.9E-06)	(8.3E-06)
8	4.88E-07	-5.67E-07
	(2.3E-06)	(2.5E-06)
9	-6.09E-11	8.20E-08
	(3.8E-07)	(5.4E-07)
10	1.86E-08	-2.50E-08
	(1.1E-07)	(1.5E-07)
11	-7.74E-10	4.16E-09
	(1.7E-08)	(3.3E-08)
12	7.40E-10	-1.13E-09
	(5.4E-09)	(8.8E-09)

Response of D(LNGOLD): Period	D(LNKLCI)	D(LNGOLD)
1	-0.003324	0.052742
	(0.00693)	(0.00490)
2	0.011091	-0.015469
	(0.00722)	(0.00686)
3	-0.000587	0.002652
	(0.00208)	(0.00435)
4	0.000447	-0.000699
	(0.00066)	(0.00142)
5	-4.09E-05	0.000130
	(0.00018)	(0.00042)
6	1.87E-05	-3.20E-05
	(5.6E-05)	(0.00012)
7	-2.34E-06	6.29E-06
	(1.2E-05)	(3.0E-05)
8	8.10E-07	-1.48E-06
	(3.7E-06)	(7.9E-06)
9	-1.23E-07	3.01E-07
	(8.1E-07)	(1.9E-06)
10	3.60E-08	-6.90E-08
	(2.3E-07)	(4.8E-07)
11	-6.17E-09	1.43E-08
	(4.9E-08)	(1.2E-07)
12	1.63E-09	-3.22E-09
	(1.3E-08)	(2.8E-08)

Cholesky Ordering: D(LNKLCI) D(LNGOLD)
Standard Errors: Analytic

KLCI and Silver

Response of D(LNKLCI):

Period	D(LNKLCI)	D(LNSILVER)
1	0.042203	0.000000
	(0.00395)	(0.00000)
2	0.008540	-0.002105
	(0.00566)	(0.00589)
3	0.006834	0.007482
	(0.00560)	(0.00570)
4	0.004597	0.000360
	(0.00323)	(0.00160)
5	0.002167	0.000135
	(0.00247)	(0.00149)
6	0.001108	0.000662
	(0.00169)	(0.00091)
7	0.000708	0.000226
	(0.00108)	(0.00040)
8	0.000376	6.00E-05
	(0.00069)	(0.00027)
9	0.000195	7.57E-05
	(0.00044)	(0.00016)
10	0.000113	4.07E-05
	(0.00027)	(8.9E-05)
11	6.30E-05	1.55E-05
	(0.00017)	(5.3E-05)
12	3.36E-05	1.07E-05
	(0.00010)	(3.3E-05)

Response of D(LNSILVER):

Period	D(LNKLCI)	D(LNSILVER)
1	0.018377	0.106313
	(0.01419)	(0.00996)
2	0.033842	-0.016096
	(0.01481)	(0.01512)
3	0.007771	-0.007668
	(0.01489)	(0.01520)
4	0.003518	0.008562
	(0.00651)	(0.00692)
5	0.003971	0.000839
	(0.00352)	(0.00409)
6	0.001758	-0.000617
	(0.00284)	(0.00280)
7	0.000741	0.000625
	(0.00170)	(0.00101)
8	0.000547	0.000258
	(0.00098)	(0.00067)
9	0.000302	1.33E-06
	(0.00064)	(0.00033)
10	0.000143	5.53E-05
	(0.00040)	(0.00017)
11	8.53E-05	3.92E-05
	(0.00024)	(9.5E-05)
12	4.92E-05	9.83E-06
	(0.00014)	(4.9E-05)

Cholesky Ordering: D(LNKLCI) D(LNSILVER)
Standard Errors: Analytic

KLCI and Palladium

Response of LNKLCI:		
Period	LNKLCI	LNPALLADIUM
1	0.043331	0.000000
2	0.053344	0.007264
3	0.057414	0.010268
4	0.058624	0.012103
5	0.058877	0.013263
6	0.058810	0.014054
7	0.058662	0.014614
8	0.058515	0.015021
9	0.058390	0.015320
10	0.058292	0.015541
11	0.058216	0.015706
12	0.058159	0.015828
Response of LNPALLADIUM:		
Period	LNKLCI	LNPALLADIUM
1	0.027276	0.082126
2	0.077268	0.070204
3	0.095458	0.063825
4	0.104741	0.056958
5	0.109710	0.051334
6	0.112696	0.046915
7	0.114643	0.043535
8	0.115987	0.040982
9	0.116949	0.039065
10	0.117651	0.037630
11	0.118168	0.036558
12	0.118551	0.035758
Cholesky Ordering: LNKLCI LNPALLADIUM		

Impulse Responsive Analysis during Post-Crisis

KLCI and Gold

Response of LNKLCI:		
Period	LNKLCI	LNGOLD
1	0.044896	0.000000
2	0.042343	-0.000477
3	0.037459	0.003841
4	0.033201	0.007161
5	0.029343	0.010236
6	0.025874	0.012990
7	0.022751	0.015471
8	0.019941	0.017703
9	0.017411	0.019712
10	0.015135	0.021520
11	0.013086	0.023148
12	0.011243	0.024612
Response of LNGOLD:		
Period	LNKLCI	LNGOLD
1	0.001969	0.038798
2	0.003488	0.032496
3	0.002304	0.034200
4	0.001541	0.034696
5	0.000808	0.035295
6	0.000155	0.035811
7	-0.000434	0.036279
8	-0.000964	0.036700
9	-0.001441	0.037079
10	-0.001870	0.037420
11	-0.002256	0.037727
12	-0.002604	0.038003
Cholesky Ordering: LNKLCI LNGOLD		

KLCI and Platinum

Response of LNKLCI: Period	LNKLCI	LNPLATINUM
1	0.046609	0.000000
2	0.047205	-0.002185
3	0.043903	0.000908
4	0.040179	0.004470
5	0.036886	0.007638
6	0.034124	0.010298
7	0.031843	0.012497
8	0.029966	0.014306
9	0.028423	0.015793
10	0.027156	0.017015
11	0.026115	0.018019
12	0.025259	0.018843

Response of LNPLATINUM: Period	LNKLCI	LNPLATINUM
1	0.009439	0.046917
2	0.007963	0.047410
3	0.010451	0.045129
4	0.013224	0.042476
5	0.015677	0.040116
6	0.017733	0.038135
7	0.019431	0.036498
8	0.020829	0.035151
9	0.021978	0.034044
10	0.022922	0.033134
11	0.023697	0.032387
12	0.024334	0.031773

Cholesky Ordering: LNKLCI LNPLATINUM

Variance Decomposition Analysis during Pre-Crisis

KLCI and Gold

Variance Decomposition of LNKLCI: Period	S.E.	LNKLCI	LNGOLD
1	0.044896	100.0000	0.000000
2	0.061716	99.99403	0.005966
3	0.072296	99.71339	0.286614
4	0.079877	98.96141	1.038591
5	0.085710	97.67181	2.328195
6	0.090467	95.84854	4.151459
7	0.094558	93.52322	6.476780
8	0.098246	90.75351	9.246487
9	0.101706	87.61544	12.38456
10	0.105053	84.19584	15.80416
11	0.108366	80.58471	19.41529
12	0.111694	76.86852	23.13148

Variance Decomposition of LNGOLD: Period	S.E.	LNKLCI	LNGOLD
1	0.038848	0.256979	99.74302
2	0.050767	0.622629	99.37737
3	0.061256	0.569191	99.43081
4	0.070417	0.478614	99.52139
5	0.078771	0.392991	99.60701
6	0.086529	0.325997	99.67400
7	0.093828	0.279394	99.72061
8	0.100755	0.251453	99.74855
9	0.107371	0.239429	99.76057
10	0.113720	0.240480	99.75952
11	0.119836	0.252008	99.74799
12	0.125744	0.271762	99.72824

Cholesky Ordering: LNKLCI LNGOLD

KLCI and Platinum

Variance Decomposition of LNKLCI: Period	S.E.	LNKLCI	LNPLATINUM
1	0.046609	100.0000	0.000000
2	0.066373	99.89163	0.108369
3	0.079585	99.91160	0.088403
4	0.089264	99.67898	0.321018
5	0.096887	99.10594	0.894060
6	0.103235	98.21738	1.782624
7	0.108755	97.07332	2.926683
8	0.113712	95.74003	4.259970
9	0.118269	94.27884	5.721161
10	0.122534	92.74195	7.258049
11	0.126575	91.17146	8.828537
12	0.130439	89.59989	10.40011

Variance Decomposition of LNPLATINUM: Period	S.E.	LNKLCI	LNPLATINUM
1	0.047857	3.889843	96.11016
2	0.067834	3.314305	96.68569
3	0.082142	3.878915	96.12108
4	0.093415	5.003116	94.99688
5	0.102866	6.448542	93.55146
6	0.111131	8.071108	91.92889
7	0.118574	9.775150	90.22485
8	0.125416	11.49588	88.50412
9	0.131800	13.18983	86.81017
10	0.137820	14.82869	85.17131
11	0.143544	16.39501	83.60499
12	0.149018	17.87902	82.12098

Cholesky Ordering: LNKLCI LNPLATINUM

Variance Decomposition Analysis during Post-Crisis

KLCI and Gold

Variance Decomposition of D(LNKLCI): Period	S.E.	D(LNKLCI)	D(LNGOLD)
1	0.042899	100.0000	0.000000
2	0.045078	96.85343	3.146568
3	0.045095	96.85028	3.149721
4	0.045097	96.84568	3.154322
5	0.045097	96.84565	3.154353
6	0.045097	96.84564	3.154361
7	0.045097	96.84564	3.154361
8	0.045097	96.84564	3.154361
9	0.045097	96.84564	3.154361
10	0.045097	96.84564	3.154361
11	0.045097	96.84564	3.154361
12	0.045097	96.84564	3.154361

Variance Decomposition of D(LNGOLD): Period	S.E.	D(LNKLCI)	D(LNGOLD)
1	0.052846	0.395562	99.60444
2	0.056170	4.248689	95.75131
3	0.056235	4.249682	95.75032
4	0.056241	4.255070	95.74493
5	0.056241	4.255098	95.74490
6	0.056242	4.255107	95.74489
7	0.056242	4.255107	95.74489
8	0.056242	4.255107	95.74489
9	0.056242	4.255107	95.74489
10	0.056242	4.255107	95.74489
11	0.056242	4.255107	95.74489
12	0.056242	4.255107	95.74489

Cholesky Ordering: D(LNKLCI) D(LNGOLD)

KLCI and Silver

Variance Decomposition of D(LNKLCI): Period	S.E.	D(LNKLCI)	D(LNSILVER)
1	0.042203	100.0000	0.000000
2	0.043110	99.76152	0.238481
3	0.044285	96.91951	3.080491
4	0.044525	96.94602	3.053978
5	0.044577	96.95234	3.047658
6	0.044596	96.93286	3.067143
7	0.044602	96.93114	3.068858
8	0.044604	96.93118	3.068815
9	0.044604	96.93096	3.069036
10	0.044605	96.93090	3.069097
11	0.044605	96.93090	3.069102
12	0.044605	96.93089	3.069106

Variance Decomposition of D(LNSILVER): Period	S.E.	D(LNKLCI)	D(LNSILVER)
1	0.107890	2.901393	97.09861
2	0.114213	11.36875	88.63125
3	0.114734	11.72461	88.27539
4	0.115106	11.74218	88.25782
5	0.115178	11.84649	88.15351
6	0.115193	11.86669	88.13331
7	0.115197	11.86999	88.13001
8	0.115199	11.87192	88.12808
9	0.115199	11.87252	88.12748
10	0.115199	11.87265	88.12735
11	0.115199	11.87270	88.12730
12	0.115199	11.87271	88.12729

Cholesky Ordering: D(LNKLCI) D(LNSILVER)

KLCI and Palladium

Variance Decomposition of LNKLCI: Period	S.E.	LNKLCI	LNPALLADIUM
1	0.043331	100.0000	0.000000
2	0.069108	98.89512	1.104878
3	0.090431	98.06536	1.934643
4	0.108448	97.40923	2.590767
5	0.124110	96.87978	3.120220
6	0.138056	96.44203	3.557973
7	0.150713	96.07426	3.925741
8	0.162370	95.76189	4.238113
9	0.173228	95.49443	4.505573
10	0.183433	95.26393	4.736069
11	0.193089	95.06416	4.935843
12	0.202278	94.89010	5.109904

Variance Decomposition of LNPALLADIUM: Period	S.E.	LNKLCI	LNPALLADIUM
1	0.086537	9.934824	90.06518
2	0.135601	36.51522	63.48478
3	0.177689	50.12617	49.87383
4	0.213982	58.52411	41.47589
5	0.245886	64.23030	35.76970
6	0.274520	68.38253	31.61747
7	0.300665	71.54561	28.45439
8	0.324857	74.03430	25.96570
9	0.347470	76.03996	23.96004
10	0.368772	77.68689	22.31311
11	0.388964	79.06001	20.93999
12	0.408199	80.21956	19.78044

Cholesky Ordering:
LNKLCI LNPALLADIUM