Faculty of Economics and Business

DETERMINANTS OF GOLD RESERVES IN EMERGING MARKETS

WONG SII LI

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WONG SII LI

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Statement of Originality

The work described in this Final Year Project, entitled

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the author except where due reference is made.

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(Date Submitted)   WONG SII LI

                                                                                        62939

ABSTRACT

DETERMINANTS OF GOLD RESERVES IN EMERGING MARKETS

BY

WONG SII LI

The main purpose of this paper is to examine the relationship between selected macroeconomic factors and gold reserves in emerging markets. The macroeconomic factors that would be used in this study included real GDP growth rate, exchange rate, Volatility index, and gold price. Short panel data econometric techniques will be applied in this study. The frequency data collected is yearly data, which is from 2014 to 2018. The total observation is 50. The research methods used in this study are LM test and Hausman Test. LM test is used to compare between POLS model and random model while Hausman test is a test used to distinguish between random effect model and fixed effect model. Besides that, this study also have conducted diagnostic test to check whether regression model fulfil the assumptions of CLRM. All tests will be performed by the software Stata 14. The empirical results show that fixed effect model is the most suitable model to explain the relationship between dependent and independent variables. Besides that, the result also shows that real GDP growth, Volatility index and exchange rate have significant and positive relationship with gold reserves while only gold price is insignificant with gold reserves. Diagnostic test also shows that regression model has fulfilled all the assumptions of CLRM.

ABSTRACT

DETERMINANT RIZAB GOLD DI PAGAR PENGESAHAN

BY

WONG SII LI

Tujuan kertas ini adalah untuk mengkaji hubungan antara faktor makroekonomi terpilih dan rizab emas di pagar pengesahan. Faktor makroeconomic yang akan digunakan dalam kajian ini termasuk kadar pertumbuhan KDNK, kadar pertukaran, indeks volatility, dan harga emas. Teknik ekonometri data panel pendenk akan digunakan dalam kajian ini. Data frekuensi yang dikumpulkan adalah data tahunan, iaitu dari tahun 2014 hingga 2018. Jumalah permerhation adalah 50. Kaedah penyelidikan yang digunakan dalam kajian ini adalah ujian LM dan ujian Hausman. Unjian LM digunakan untuk membandingkan antara model POLS and random effect model sementara ujian Hausman adalah penggunaan ujian untuk membezakan antara random effect model dan fixed effect model. Selain itu, kajian ini juga ada menjalankan ujian diagnostic untuk memeriksa sama ada model regresi memenuhi andaian Best Linear Unbiased Estimator (BLUE). Semua ujian akan dilakukan oleh perisian Stata 14.Hasil empirical menunjukkan bahawa fixed effect model adalah model yang paling sesuai untuk menjelaskan hubungan antara dependent variable and independent variables. Selain itu, hasilny juga menunjukkan bahawa pertumbuham KDNK, indeks volatility dan nilai tukar mempunyai hubungan yang signifikan dan positif dengan rizab emas sementara hanya harga emas tidak signifikan dengan rizab emas. Untuk ujian diagnostic, keputusan telah menunjukkan bahawa model regresi ada memenuhi andaian CLRM.

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Besides that, I would like sincere to thank all the lecturers who taught me in the past three year, for their guidance and knowledge, and let us become a learned student. Apart from that, I also would like to thank all my course mates and friends, for their valuable guidance, teaching, suggestion, and knowledge, especially Jenifer Lim. She always helps and teaches me the procedure to run the software Stata. Without the help, I think I could not finish this paper on time.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

Gold reserve refers to the gold held by a country's monetary authority as a financial asset to balance the balance of payments, maintain or influence the level of the exchange rate. It plays a special role in stabilizing the national economy, restraining inflation and improving international credit. This role is quite significant in both developed and developing countries. In addition, the significance of the gold reserve management is to achieve the maximum possible liquidity and profitability of gold reserve. As one of the main forms of the international reserve, the gold reserve has its own limitations in terms of liquidity, so its appropriate scale should be considered. According to Western economist Keynes, gold is an infinitely authoritative reserve asset for a country, In other words, gold reserves can be considered as a country's economic security. It plays a very important role in the economic development of a country and has an important positive role in stabilizing the state-owned economy and maintaining currency stability. That is to say, if a country does not have sufficient gold reserves, the country will inevitably lack an important tool to reduce systemic financial risks because sufficient gold can resist any systemic financial risks. Moreover, gold is a unique asset that is not directly affected by any country's monetary policy and finances.

Besides that, Ghost (2016) also stated that gold is not easy to depreciate and is not as prone to deterioration as paper money and other metals. If a government holds a lot of gold, it won't lose popular feelings so easily. Some countries also have

clearly recognized that gold has a strong supporting effect on their currencies because it is highly solvent and can be used as a reserve for international payments. The amount of a country's gold reserves is closely related to its external debt solvency. So if there is gold in a country's reserves, the rating agencies will also give it a green light. Therefore, gold reserves are conducive to raising the creditworthiness of a country.

According to the World Gold Council (WGC), due to gold is a safe haven and decentralized assets, central banks around the world have been accumulating gold reserves, especially in emerging markets, from net seller to net buyers. So far in 2019, nine (emerging markets) central bank have increased their gold reserves by one tons or more. According to Karunagaran ((2011), since the outbreak of the financial crisis in 2008, depreciation of the US dollar and global stock market crash, one of the emerging markets which is Russian central bank has been buying a large amount of gold, and it gold reserves increased from 457 tons in the first quarter of 2008 to 1880.5 tons in April 2018, quadrupling in 10 years. In addition, the proportion of gold in the country's foreign exchange reserves jumped from 2.7% to 17.6%. The reasons for Russian has such large increase in gold reserves are maintain the Ruble's exchange rate, prevent political risk, and get rid of its dependence on the US dollar. In addition to Russia, many emerging markets are also buying gold. For example, after China stopped buying gold in 2015, it started buying gold in large quantities for 10 consecutive moths in December of the same year. Although China's gold reserve is in a phased growth model, its total gold reserve recorded 1,948.3 tons, ranking the fifth in the world's official gold reserves.

Apart from that, Turkey has been accumulating gold since 2014 due to economic sanctions and sharp depreciation of its currency. In 2018, the total amount of gold that holding by Turkish reached 64.6 billion lira, an increase of an increase of 67.3% year-on-year. Ghost (2016) said that it is the highest number ever.

1.1 Background of the Study

1.1.1 Overview of International Reserves
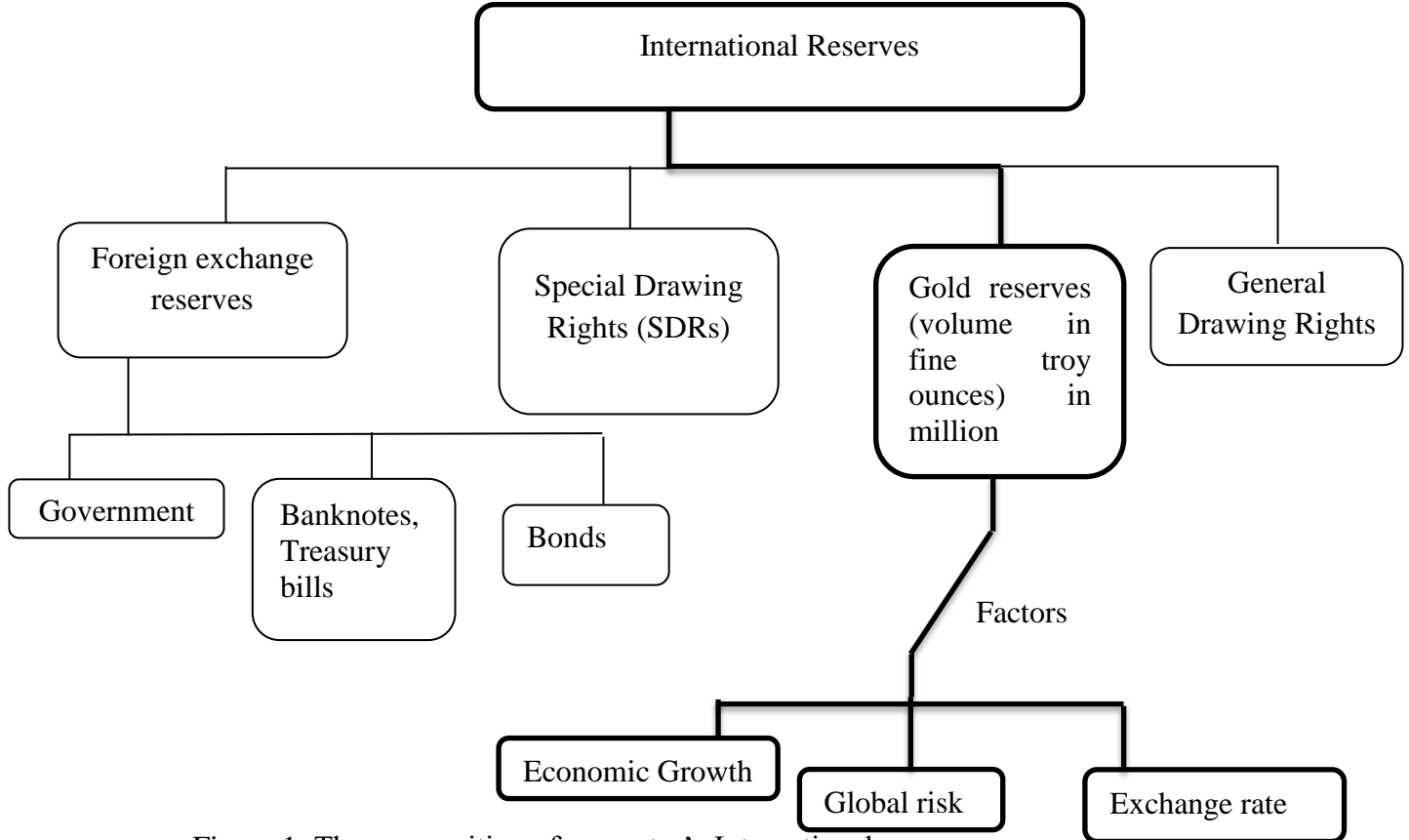
Figure 1: The composition of a country's International reserves

Figure 1 shows the composition of a country's international reserves. International reserves, also known as "official reserves" are all internationally acceptable assets held by the monetary authorities of a country for international payments, balance of payments, and maintaining its currency exchange rate. According to the International Monetary fund, a country's international reserves divided into four categories. The first category is foreign exchange reserve, which is an external asset held by the central bank in foreign currencies and plays an important role in balancing international payment and stabilizing the exchange rate. Foreign exchange reserve includes government securities, banknotes, bond and

treasury bills. The second and third categories of International reserves are SDRs[1] (Special Drawing Rights) and General Drawing Rights[2]. The last category is Gold reserves. Gold reserves Gold reserves are a safe asset held by a monetary authority to balance the balance of payments and to maintain or influence the level of the exchange rate. It plays a special role in the stabilizing national economy, controlling inflation and improving international credit. According to the World Gold Council (2019), gold reserves held by countries are growing substantially, especially in emerging markets. Emerging market central banks have purchased more than 4300 tonnes (net) of gold since 2003. According to the World Gold Council (WGC) released the 2019 official gold reserve rankings, the top ten countries is the United States, Germany, IMF, Italy, France, Russian, China, Switzerland , Japan and India. In term of the percentage of gold reserves accounting for reserves, the top four countries, namely Unites State, Germany, Italy and France all exceeded 60%. The United State gold reserves reached 8133.5 tons, accounting for 76.9% of the foreign exchange reserves.

According to figure 4, central bank demand for gold is influenced by three factors: economic growth, global risk and currency exchange rate. The central bank's demand for gold is linked to economic growth because gold can defend a country's competitiveness and protect its currency from devaluation. On the other hand, global risk can affect gold demand as well because gold is safe and liquid, which can resist any potential financial crisis and geopolitical uncertainty. In addition, the central bank's demand for gold will be affected by the exchange rate because gold can affect

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[1] SDRs refer reserve assets created by the International Monetary Fund for payments between Member States and the IMF.
[2] General Drawing Rights refers to the 25% of the gold and convertible currency subscribed by the IMF member states to the Fund, the net currency of the member states used by the IMF to pay loans to other member states; the IMF borrows from member states.

the exchange rate level of a country, and this also will indirectly affects market competitiveness.

1.2 Background of the Dependent and Independent Variables

1.2.1 Gold Reserves

Figure 2: Gold Reserves (Tones), (2014 -2018)
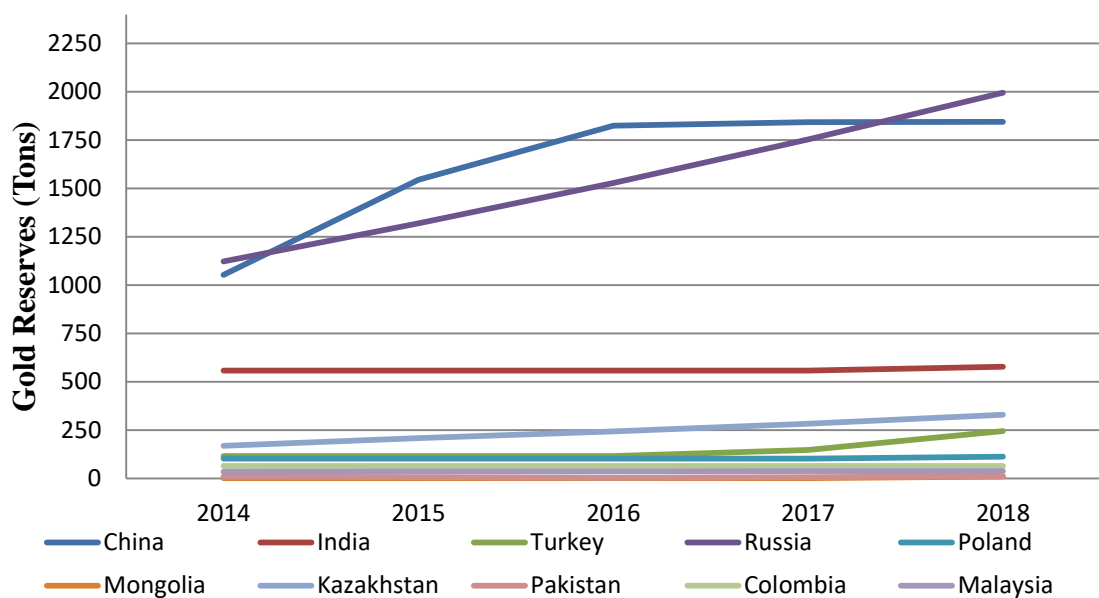
Source: World Gold Council, 2019

Figure 2 above shows the total gold reserves held by central banks of China, India, Turkey, Russia, Poland, Mongolia, Kazakhstan, and Pakistan, Colombia,and Malaysia from 2014 to 2018. According to the above statistics, the gold reserves held by the central banks are gradually increasing every year. Gold reserves held by all the central banks have increased sharply after 2018 due to China-US trade war. Russian is the highest gold reserves among the countries, which is recorded 2222.08 tons ($1.0 billion), and it is the only country with more than 2000 tons of gold reserves. The second-highest gold reserves is China, whose official gold reserve is stood at 1927.15 tons ($ 88 million), which is more than three times India's third-

largest gold reserves. As show in the table, China has stopped buying gold after 2015, but it started buying gold again in 2018. The reason behind rise in gold is due to economic slowdown and China-US trade war. Kazakhstan (374.99 tons), Turkey (351.47 tons), and Poland (203.53 tons) have the fourth, fifth, and sixth gold reserves, respectively. Lastly, the total gold reserves of Colombia, Malaysia, Mongolia, and Pakistan recorded 64.60 tons, 38.90 tons, 19.38 tons, and 17.66 tons respectively.

1.2.2 Economic Growth

Figure 3 : Economic growth, (2014 -2018)
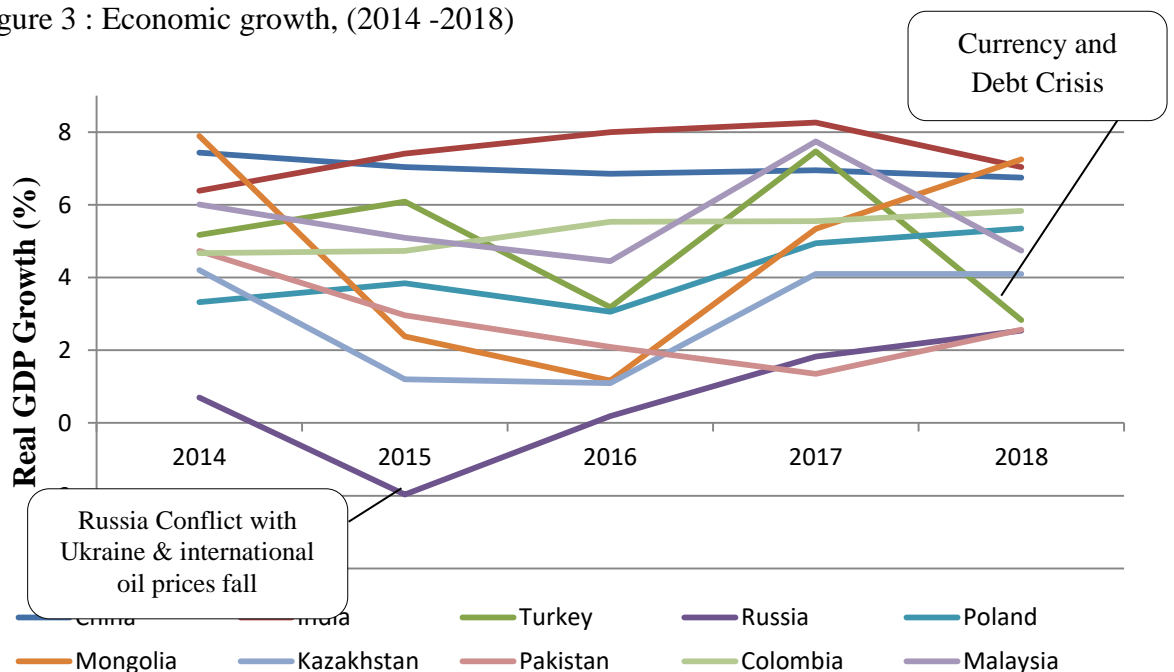
Source: International Monetary Fund (CEIC), 2019

Figure 3 above shows the economic growth of China, India, Turkey, Russia, Poland, Mongolia, Kazakhstan, and Pakistan, Colombia, and Malaysia from 2014 to 2018. According to the above statistics, India has the highest economic growth among the countries and its economic growth even surpassed China and become the fastest-growing economy in 2015. However, after 2017, India's economic growth is gradually declined and reached 7.17% in 2018. The reason behind of decrease is due

to the international economic environment unstable. Although India's economic growth is gradually declined, its economic growth is still higher and stable than in other countries. Besides India, China also is one of the highest economic growth among the countries. From 2014 to 2018, China's economic growth was 7.30%, 6.91%, 6.74%, 6.76% and 6.57% respectively. On the other hand, the country with the lowest economic growth was Russia. In 2015, Russian's economic growth has reached the lowest point (-2.31), and it is the only country with negative economic growth. Russia had such low economic growth is because of the conflict between Russia and Ukraine, and the decline in international oil prices. After that, Russia's economic growth has increase gradually from 2015 to 2018. Besides that, all the country's economic growth has increased from 2017 to 2018 except India, Malaysia, and Turkey. Turkey's economic growth fell most sharply, which is from 7.74% to 2.4%. This situation happens because of Turkey's currency and debt crisis.

1.2.3 Global Risk

Figure 4: Global Risk, (2005-2018)
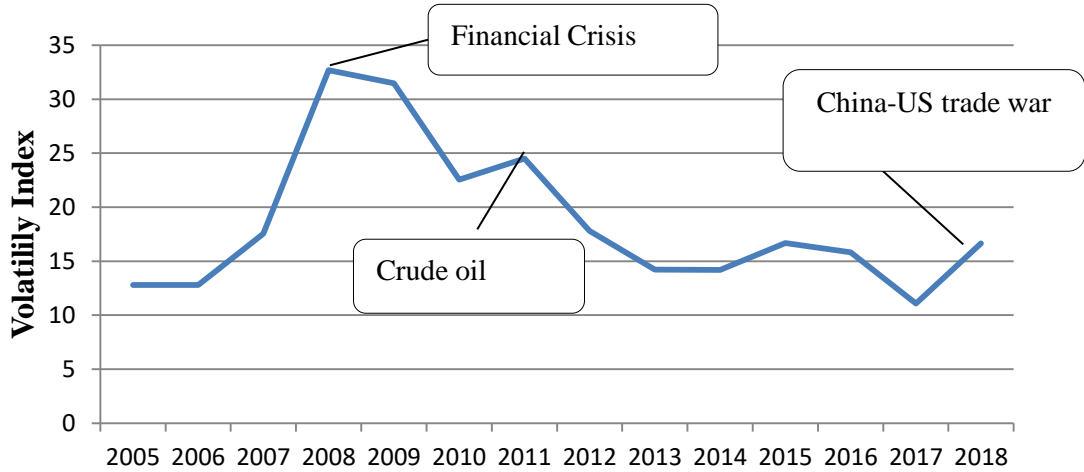
Source: CBOE, (2019)

Figure 4 depicts the VIX[3] index from 2005 to 2018, which collected from FRED. Global risk is measure by VIX index. VIX index is a real-time market index that represents the level of volatility in the market and investors' sentiments. From the graph, the VIX index was fluctuated from 2005 to 2018. In 2008, VIX index surged to 32.69% due to financial crisis and reached its highest point ever. The high VIX index reflects that the level panic of market at that time is very high. After 2008, the VIX index declines to 22.25% but rose again to 24.5% in 2011. The rise of VIX index was caused by the crude oil price decrease. After that, due to the China-US trade war, the VIX Index rise again to 16.64% in 2017.

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[3]VIX, also known as the volatility index, introduced by CBOE (Chicago Options Exchange) in 1993

1.2.4 Currency Exchange Rate

Figure 5: Currency Exchange Rate, (2014 -2018)
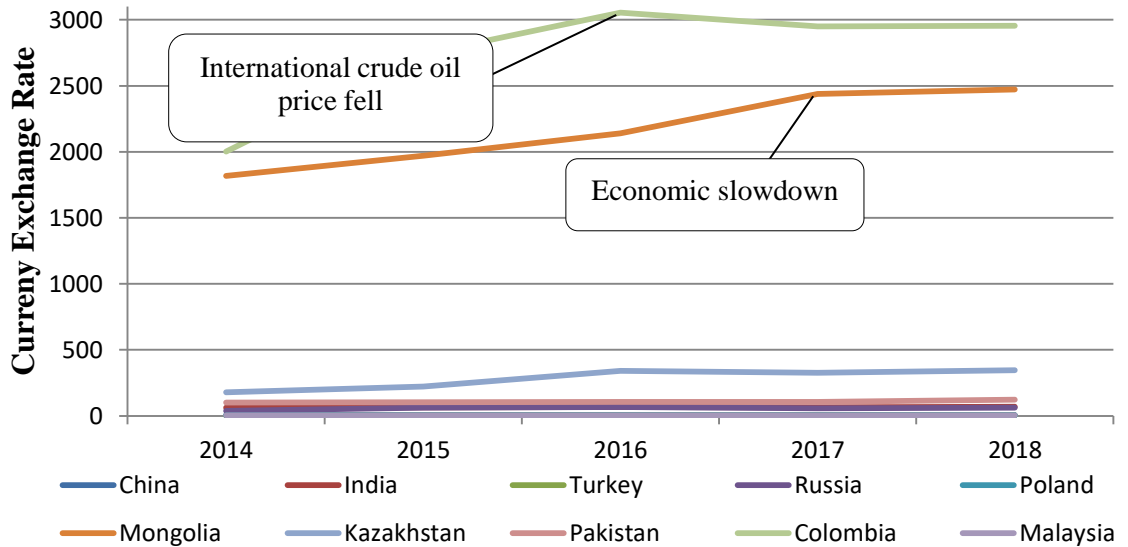
Source: International Monetary Fund (CEIC), 2019

Figure 5 shows the currency exchange rate of China, India, Turkey, Russia, Poland, Mongolia, Kazakhstan, and Pakistan, Colombia, and Malaysia from 2014 to 2019, which collected from the International Monetary Fund (CEIC). From the graph, the currency exchange rates of all countries are on the upward trend. In other words, the currency of countries is gradually depreciated from 2014 to 2018. In 2016, Colombia's currency has been recorded the lowest against the US Dollar, which is $1= 2001.78 Peso. The reason behind of depreciate of Peso is the international price of crude oil fell sharply. After 2016, Colombia's currency having a slightly appreciate again and recorded $1= 2955.7 peso in 2018. Besides that, Mongolia's currency has also depreciated sharply from 2014 to 2017, hitting a high record which is 2439.78 against US Dollar. The reason for the depreciation is Mongolia's economic slowdown.

1.3 Problem Statement

Slowing economic growth, trade, geopolitical tension and increased risk of uncertainty in trade policies have led to a sharp surge in demand for gold reserves by central banks in recent year, especially in emerging markets. The surge in central bank demand for gold has led to a rise in the price of gold and hitting six-year high. According to the World Gold Council (2019), the central banks around the world demand for gold has soared in 2018. The total net purchase of central banks around the world reached 651.5 tons, an increase of 74% over the previous year. This is the highest record increase in gold holding by central banks in the past 50 years, the second-highest annual increase in gold holding in history and also the highest net annual purchase in gold reserves since the end of the Bretton Woods system. In addition, the central bank's net purchases of gold in the first six months of 2019 also rose to 374.1 tons, up 57% from the previous years. This is also the highest level (on an annual basis) since central banks became net buyer in2010. World Gold Council said nine Central banks around the world had increased their gold reserves by at least a tonne in the first half of 2019 (World Gold Council, 2019). Central bank has such a high demand for gold is because gold is a liquid counter-cyclical asset and a long term value storage tool. It can guarantee the financial of a country.

In addition, the high demand for gold in emerging markets is due to the surge in the value of the US dollar and the continued depreciation of their currencies, especially the Indian Rupee, Turkish Lira and Argentine Peso. The Indian rupee hit a record high of 74.95 per dollar and was rated as one of the worst-performing currencies in Asia, down about 10% against the dollar. On the other hand, due to the rise of US dollar index and US economic sanctions, Turkey's currency has

depreciated sharply by more than 40%. Therefore, Turkey has been piling up gold to stabilize its economy and protect the currency depreciation. According to the World Gold Council (WCG), the total amount of gold that held by Turkey's central bank reached 64.6 billion Turkish Lira, an increase of 67.3% year-on-year. Besides that, in order to de-dollarize[4], the Russian central bank keeps purchasing the gold in recent years. Replace US dollar by gold in foreign reserves. According to the latest data, Russia purchased 274.3 tons of gold in 2018, accounting for one fifth (20.7%) of Russia's foreign exchange reserves. This is also the first time that the gold reserves in Russia have exceeded 20%.

Moreover, China increased its gold holding for 10 consecutive months starting in December 2018 due to on-going trade disputes and low GDP growth in China. In 2019, People's Bank of China's gold reserves reached 62.64 million ounces (approximately 1948.32 tons), ranking sixth in global gold reserves. The People's Bank of China increased its gold holding for 10 consecutive months has attracted high market attention because the last time the people's bank of China increased its holding of gold was in 2015 but gold reserves have remained stable at 1842.56 tons since then. The move by the people's bank of China to increase its holding of gold has raised concerns about the prospects for global economic growth and the credibility of the dollar is collapsing in the eyes of all countries.

There are some research question needs to know when conducting this research. The research questions of this study:

1. To study the various determinants that influence gold reserves

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[4] Non dollarization refers to assets and liabilities denominated in foreign currency held by residents, not in terms of US Dollar.

2. To investigate the impact of economic growth, global risk and currency exchange rate on gold reserves

1.4 Objective of the Study

1.4.1 General Objective

The general objective of this study is to analyze the potential determinants of gold reserves in emerging markets.

1.4.2 Specific Objectives

The specific objectives include:

I.   To investigate the relationship between economic growth on gold reserves;

II.   To examine the impact of global risk on gold reserves;

III.   To identity the influence of exchange rate on gold reserves;

1.5 Significance of the Study

The aim of this study is to investigate the various determinants that affect gold reserves in emerging market. The countries that selected are China, India, Turkey, Russia, Poland, Mongolia, Kazakhstan, and Pakistan, Colombia, and Malaysia. This study also will examine the significant relationship between these factors and gold reserves. Through this research, the economists and government authorities can better understand the role of gold. After knowing the role of gold, they will know how to take action or adopt appropriate measures to manage the gold reserves efficiency. Besides that, this research may also assist the investors, speculators and customer know factors affecting gold investment decisions because

by understanding the gold market, they can evaluate gold price more accurately and then decide the best time to buy or invest in the gold market.

1.6 Scope of the Study

This paper will consist of five chapters where the first chapter is describes the introduction, background, problem statement, objectives of the study as well as significance of study. Chapter two reviews the related previous studies which have been done by researches. This chapter includes empirical findings, testing procedures and theoretical issues. Chapter three will discuss the empirical model, data description methodology and concluding remarks. Chapter 4 presents the data analysis and discussion the findings. Lastly, chapter 5 is the conclusion and recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter intends to present the theoretical framework and literature review of past researches that are related to this study. The purpose of this study is to investigate and assess the determinants of gold reserves in emerging markets. This study investigates whether the economic growth, global risk, and exchange rate will influence the gold reserves in emerging markets. There are two sections in this chapter. The first section briefly explains the theoretical framework of the research while the second section discusses and summarized the related empirical finding from the previous study.

2.1 Theoretical Framework
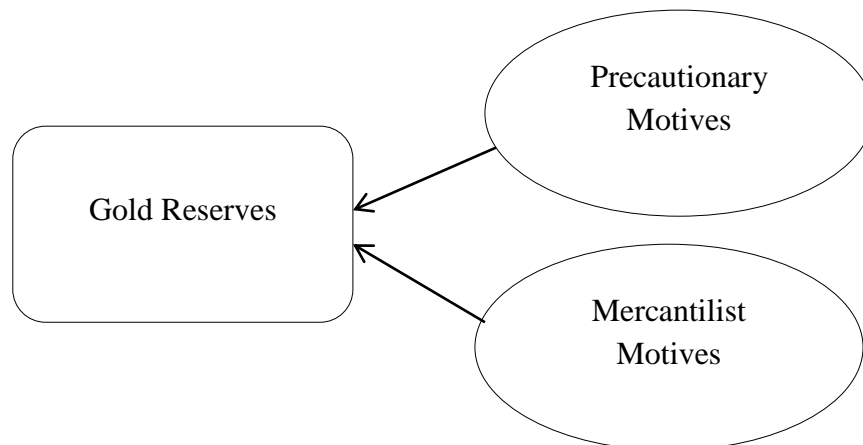
Figure 6: Theoretical Framework

Figure 6 above shows the theoretical framework of this study. According to the figure, there are two theories that are related to the variable of the study, namely precautionary motives and mercantilist motives.

1. **Precautionary motive**

Precautionary motive was developed by Keynesian. It is for people and central banks to hold a portion of foreign currency or gold reserves in order to prevent the economic problems, economic risk and some other emergencies. In other words, people or central banks hold foreign exchange reserves to meet unexpected needs. The motivation for people to hold foreign exchange reserves is because market conditions are changing rapidly and it is difficult for people to make accurate estimates of future economic problems. So, once people predict or assume that there is something happen in the market or economic uncertainty risks, people and central banks will start to buy foreign exchange reserves in order to stabilize the state-owned economy. This is because reserves such as gold can stabilize the national economy, curbing inflation and improving international credit standing. This effect is quite significant both in developed and developing countries. Dominguez (2010) stated after the financial crisis, the demand of many central banks for foreign exchange reserves is increasing, especially for gold. This is because many central banks realize that gold is different from the US dollar, it is stable and does not depreciate easily. Gold is a classic reserve asset free of political or credit risk, not devalued by excess currencies or unconventional monetary policy measures. According to Stiglitz (2006), the recent accumulation of foreign exchange reserves in developing countries is largely explained as a form of precautionary motive and self-insurance due to the high level of global economic and financial instability and the lack of an appropriate international crisis management system.

2 Mercantilist Motives

According to Chitu, Gomes & Pauli (2014), mercantilist motives lead many countries to accumulate reserves in order to improve trade value and international competitiveness. This is because reserves, especially gold reserves, can affect the exchange rate level and make a country's currency devalue or appreciate. For example, some country tends low gold share in reserves and to make their currency to become depreciated. When the currency depreciates, the export price will be decreased. As a result, the trade value increase because the export product to foreign countries increases and import products from abroad decrease. On the other hand, Carvalho & Renee (2016) and Winjbhold & Kapteyn (2001) point out that some countries tend to accumulate and hoarding reserves to maintain or prevent the appreciation of their own currencies, so as to maintain a competitiveness real exchange rate and promote import and export-oriented growth.

2.2 Empirical Finding

This section will present the empirical findings of some previous studies about the determinants of gold reserves in emerging markets. Since there is a limited number of a research paper about the determinants of gold reserves, I have also included some research on the determinants of international reserves because gold reserve also part of the International reserves.

2.2.1 Review of the Literature

Oktay, Serin & Oztunc (2015) used a panel regression model to analysis the determinant of gold reserves of G-7 countries from 1990 to 2018. According to Oktay, Serin & Oztunc (2015), GDP growth and exports of goods and services have positively affected with the gold reserves. An increase of 1% of GDP, the gold reserves will increase by 1.18%. It means that when the economy grow fast, the capacity of central bank to buy gold rise. They stated that that gold is an ideal weapon against inflation and accepted as a safe haven during the financial crises. There is a close relationship between gold reserves and state power. This result is consistent with Wei (2010), and Kashir & Sridharan(2014), which stated that GDP has a positive effect on gold reserves.

Olokoya, Osabuohien & Salami (2009) stated that GDP and trade openness have positively relationship with gold reserves. In their research, GDP was used as an indicator of economic size. A Positive relationship with gold reserves means that in the long run, the size of economy (GDP) and the trade openness would encourage central banks to increase and accumulative foreign exchange reserves. This result is consistent with the self-insurance theoretical base of foreign reserves. Central banks

intent to continue to accumulate foreign exchange reserves to self-insurance them and avoids the impact of economic recession. On the other hand, Olokoya et al. (2009) also found that inflation has a negative correlation with foreign exchange reserves. He stated that high inflation tend to reduce country's foreign exchange reserves. This is because inflation causes domestic good to become more expensive and demand for the country's exports falls. As a result, falling demand for national exports lead to a decline in net exports and ultimately to a reduction in the level of foreign exchange reserves.

Furthermore, in order to examine the relationship between economic growth and central bank demand for gold. Delatte, Laure & Julien (2009) used GDP growth as an indicator variable to measure the international reserves in the emerging countries during 1980-2004 period. According to the Delatte et al. (2009), GDP growth has an important impact on central bank demand for gold. When a country's economic falls into recession, it will accumulate more reserves because it can defend a countries' competitiveness and protect the currency form being devalued. This empirical result is same from the empirical study of Ghost (2016) who stated that economic growth was a negative effect on gold share in central bank's reserves portfolio. An increase 1% of economic growth, the share of gold in central bank will reduce 0.07-0.012%. This result is support with the precautionary motive, which central bank's share of gold in foreign exchange reserves is countercyclical in nature.

However, Khairul,Hazila &Saadah (2015) finding is slightly different with Delatte et al. (2009) and Ghost (2016) and revealed that economic growth is negative related with gold reserves, but it gave a significant impact on gold reserves. Khairul,Hazila &Saadah (2015) stated that gold is a good weapon to suppress

inflation and stabilize the national economy when the economy is in a downturn. This is because they point out that gold is an unique asset with relative intrinsic stability and will not depreciate easily. Therefore, it plays an important role in stabilizing the state-owned economy. The view of Khairul et al (2009) is same with the Charles (2012) who research also shows that reserves and economic have a positively relationship.

Kashif, Sridharan & Thiyagarajan (2017) argue that gold reserves have favourable exchange rate levels, especially to stabilize their exchange rate and to maintain the country's competitiveness. In this research, the empirical result shows that economic growth and reserves have positive short run and long run relationship. Kashif et al. (2017) stated that reserves have such relationship with economic growth is because gold reserves is a symbol of the country's credibility and determines its rating in the global competitive market. A high level of gold reserves can make the country appear financially responsible and creditworthy in the eyes of other countries, creditors and donors.

According to Ghost (2016) and Beckmann & Czudaj (2012), there is a significant relationship between the central bank's gold holding and gold price as well as inflation. Gold's US dollar and inflation-hedge properties as well as higher exchange rate risk to significantly increasing Central bank's gold holdings. He also said that gold was against financial shock and sudden interruption of access to the international capital market, and to enhance the credibility of monetary policy. This means that when the financial markets are at a high risk or uncertain economy, central bank will increase their gold holding. Besides that, the negative relationship between real GDP growth and gold of total reserves also proved by the study of

Ghost (2016). An increase 1% of economic growth, the central banks' demand for gold fell by 0.07%. Ghost (2016) pointed out that this result is consistent with the theoretical precautionary motive, especially when economic is in a downturn.

Gopalakrishnan & Mohapatra (2018) had conducted a study to examine the relationship between global risk and demand for gold by the central bank. In his research, he used VIX index to measure the global risk. VIX index is the trading code of the Chigo Board Options Exchange Market Volatility Index, which is commonly used to measure the implied volatility of S & P 500 index options. It is often referred to as the "panic index" or "panic indicator" because it broadly reflects the investor sentiment prevalent in the global economy (Bacchetta & Van Wincoop, 2013). Gopalakrishnan et al (2018) used baseline model to test the sensitivity of gold reserves to the global risk indicator for developing and developed countries. Through empirical test, there is a significant relationship between gold reserves and VIX index. This means central bank's gold holding increase as global risk increase. An increase of 1% of global risk, the gold reserves will increase by 6.7%.

Apart from that, Karunagaran (2011) also found that global risk was significant and positively correlated with gold. The global crisis and uncertainty economic led to rising demand gold by central banks. The central bank will either buy more gold or stopped selling its existing stock. According to Karunagaran (2011), gold is safety and liquidity. Country very highly relies on gold reserves to provide liquidity, and uses gold to fund temporary liquidity assistance. This is because gold can resist any potential financial crisis and geopolitical uncertainty. A country with sufficient gold reserves can reduce the chance of an external crisis and will undoubtedly help reduce the cost of managing such events. This result is

consistent with Marion (2003, 2004), Wong & Ito (2007), Ghazali, Lean & Bahari (2013) and Alfaro (2003). They argued that political uncertainty and financial turmoil can affect the bank's demand for gold. This is because gold is a good asset for diversified portfolio and safe haven, so it can reduce risk.

Tariq, Haq, Jan, Jehangir & Aamir (2014) argued that accumulation of foreign exchange reserves can increase the export competitiveness because the less foreign exchange reserves a country holds, the lower the value of its currency. The view of Tariq et al. (2014) is consistent with the mercantilist motive, some countries tend to sell their existing foreign exchange reserves to depreciate their exchange rate and improve their domestic competitiveness. Therefore, in the research of Tariq et al. (2014), the exchange rate has a positive relationship with foreign exchange reserves. However, this empirical finding is inconsistent with the Wei (2010) who studied the China's economy and stated that exchange rate is negative related with foreign exchange rate. Wei (2010) stated that the appreciation of RMB against the dollar will increase the demand for imported goods and thus drive the demand for foreign exchange reserves decrease.

In addition, Chowdhury, Uddin & Saiful (2014) also had carried out a study to examine the relationship of the exchange rate and demand of gold in Bangladesh from 1972 to 2011 by using the Augmented Dickey-Fuller (ADF) and Engle granger approach. Through empirical testing, there is a significant correlation between the exchange rate of Bangladesh and gold demand. Bangladesh uses gold reserves or so-called foreign exchange rate to maintain or affect its exchange rate level and avoid exchange rate fluctuations, especially during economic storms. Chowdhury et al.

(2014) stated that gold reserves are regards as a country's economic security, which plays an extremely important role in stabilizing the state-owned economy and maintaining the stability of the currency value. In addition, gold is a unique asset that is not directly affected by the monetary policy and fiscal policy of any country. Thus, gold does not easily get depreciate when the country experiences inflation. This result is same with the view of Gokhale & Raju (2013) who pointed that gold reserves are used to overcome the financial crisis, not as a tool to adjust the exchange rate.

Öztunç & Orhan (2019) studied the determinants of gold holdings in developed countries and emerging market economies based on annually data from 1990 to 2017. According to Öztunç & Orhan (2019), gold reserve often used as buffer stocks during crisis, and because of its properties of value, gold have become an important role in the global economy. Through empirical tests, they found that energy imports have a positive impact on developed countries but it is not significant for emerging markets. This result showed that developed countries' economies are healthier than emerging countries because they live on their own output. Öztunç & Orhan (2019) also argued that countries with high external debt would hold higher foreign exchange reserves because countries with excessive external debt are considered risk and are vulnerable to external shocks. Thus, according to the precautionary motive, such a country will tend to buy gold to reduce their risk. In addition, Öztunç & Orhan (2019) stated that there is a positive correlation between current account balance and gold reserves. Deficit current account causes them to use gold reserves.

Samaratunga & Perera (2015) categories the determinant of Sri Lanka's reserves holding into five categories, namely economic size (per capital GDP), current account vulnerability (trade openness), capital account vulnerability, exchange rate and opportunity cost. Through the unit root test, error correction models (ECM) and cointegration, the empirical result shows that exchange rate volatility and opportunity cost are not significant with the reserve demand. Samaratunga & Perera (2015) stated that exchange rate volatility has no significant impact on reserves because Sri Lanka very attaches great importance to stability of the domestic foreign exchange market and always uses it foreign exchange reserves to avoid excessive depreciation and appreciation of the exchange rate. This result is consistent with Aizenman and Lee (2007) show that exchange rate volatility is not significant with reserves. However, they found that the use of Asia-specific crisis models in the 53-country model only made sense. Cheung and Qian (2009) also emphasize that although reserve holdings are negatively affected by exchange rate volatility, the impact of exchange rate fluctuations may be zero.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter will describe the estimate models and methodology used to analysis in this study. There have 3 sections in this chapter. The first section discusses the estimate model, whereas the second section will explain the each of the variables and the sources of data. Section three is the methodology, which is mainly describes research methods that were used to identify the relation among the variables in this study.

3.1 Data Description

The variables used in this study are gold reserves, economic growth, global risk and the currency exchange rate in emerging markets between 2014 and 2018. The frequency data collected is yearly data, with a total of 50 observations. These data was collected from the World Gold Council (WGC), CEIC Data, International Monetary Fund, Chicago Board Options Exchange (CBOE). The dependent variable of this study is the gold reserves of central banks, while the independent variables are economic growth, global risk (VIX), and currency exchange rate.

The following table shows the sources of the data for each variable.

No	Variables	Symbols	Data Sources
1	Gold reserves	GR	World Gold Council (WGC)

2	Economic growth	EG	CEIC
3	Global risk	VIX	CBOE
4	Currency exchange rate	EX	International Monetary Fund

3.1.1 Gold reserves

Gold reserve is gold held as a financial asset by the central banks to balance the balance of payments, maintain or influence the level of the exchange rate. It plays a special role in stabilizing the national economy, controlling inflation, and improving international credit. According to Ghost (2016), gold is not directly affected by any country's monetary policy and fiscal policy. Therefore, gold would not easily get depreciate when the country experiences any crisis or inflation. Instead, gold can against inflation and consider as a safe haven.

3.1.2 Economic Growth

Economic growth is the increase in the inflation-adjusted market value of goods and services produced by an economy over a period of time (Djapou & Ndedi, 2017). It is usually measured in terms of the growth rate of real gross domestic product (real GDP growth).

3.1.3 Global Risk

Global risk is measure by VIX index. VIX index, also known as volatility index. VIX index was developed by CBOE (Chicago Options Exchange) in 1993. It is a real-time market index that represents the level of volatility in the market over

the next 30 days. It is usually used to evaluate the future market risk and reflects the degree of panic of investors in the market. Usually, investors, research analysts, and portfolio managers use VIX value to measure market risk, fear, and stress before making investment decisions (Kuepper, 2019). According to Kuepper (2019), a high VIX index means the stock market is not optimistic and has a high degree of volatility. The high degree of market volatility causes the investor to lose confidence and anxiety in the market. On the other hand, the lower VIX index, the slower the stock index changes in the market.

3.1.4 Currency exchange rate

Exchange rate represents the value of one currency in terms of another currency in this study

3.2 Methodology

3.2.1 Panel Data

In this study, we applied the short panel data to analyze the relation among the variables. Panel data, also known as longitudinal data, refers to the observation or measurement of multiple entities within a certain period of time. Kunst (2010) defined panel data is a data which combined time series and cross-section data. Since the panel data is a combination of cross-section data and time series, it has the characteristics of time series data (data collected from one variable at different times) and cross section data (data collected from one or more variables at the same time point). Besides that, the number sample of panel data is relatively big compare to time series and cross section data. There are several advantages for using panel data, such as it contains more information, more variability, less collinearity, more degrees of freedom and more efficiency than time series and cross section. Moreover, panel data can also able to detect and measure the statistical effects that pure time series or cross-sectional data cannot achieve.

There have three types of models in the short panel data, which are Pooled Ordinary Least Square Model (POLS), fixed effects model (FE), and random effects model (RE).

The estimate model of our research is shown below:

$$LGR_{it} = \beta_0 + \beta_1 LEG_{it} + \beta_2 LVIX_{it} + \beta_3 LEX_{it} + \varepsilon_{it} \tag{3.1}$$

Where:

$\beta_0 = Constant\ value$

$B_1, \beta_2, \beta_3 = Coefficient\ of\ the\ Explanationary\ Variables$

$LGR_{it} = Natural\ Logarithm\ of\ Gold\ Reserves$

$LEG_{it} = Natural\ Logarithm\ of\ Economic\ Growth$

$LVIX_{it} = Natural\ Logarithm\ of\ VIX\ Index$

$LREER_{it} = Natural\ Logarithm\ of\ Exchange\ Rate$

$t = Time\ periods$

$i = Countries$

$\varepsilon = Error\ Term$

3.2.2 Pooled Ordinary Least Square Model (POLS)

Pooled ordinary least squares model (POLS) is a type of statistical model that contain both random effects and fixed effects. Pooled OLS has a constant intercept and slope coefficients over the times and states. There have three assumptions of POLS; the first one is no difference among the data matrices of the cross-sectional dimension (N). Second is allowing each variable to have its own intercept and the third assumption is time-invariant which means that the intercept cannot vary over times. One limitation of the POLS model is that heterogeneity may exist among the observations across the period. This is because existing heterogeneity in the model can cause the result to become biases and inconsistent.

The equation of Pooled Ordinary Least Square is provided below:

$$y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} + \beta_3 X_{it} + \mu_{it} \qquad (3.2)$$

$$\mu_{it} = \alpha_i + \varepsilon_{it}$$

Where y_{it} denotes the value of dependent variables over the cross section (*i*) and times series (*t*). β_0 is the intercept and $\beta_1, \beta_2, \beta_3$ are coefficients of the explanatory variables while μ_{it} refers to random error term in cross section and time series.

3.2.3 Fixed Effect Model (FEM)

When omitted variables in the regression model have any correlation with one or more related observed variable, we should use fixed effect. This is because fixed effect model can control the omitted variable bias. This is in contrast to random effect in which allows unobserved variable correlated with other explanatory variables. In the fixed effect model, each variable has its own intercept, and each intercept cannot vary over time, it is, that is time-invariant. However, in order to allow each variable has its own intercept and can vary across state and over time, each variable is create a set of dummy variable. Dummy variable technique, particularly the differential intercept dummy technique will be used to overcome the differing intercepts and slope. There are two limitations of FEM. The first one is cannot control too many the dummy variables, because the more dummy variables are introduced, the more controllable the "noise" in the model. This may lead to excessive suppression of the model, reducing useful and useless information. Another limitation is FEM cannot control variables that vary over time (time variant). Fixed Effect Model equation stands as follow:

$$y_{it} = B_{1i} + B_2 X_{it} + \beta_3 X_{it} + \beta_4 X_{it} + \epsilon_{it} \tag{3.3}$$

Where i is ith subject and t is the time period. B_{1i} is the mean of the intercept term, B_2 and β_3 are coefficients of the each country. μ_{it} is the combination of time series and cross-section error components.

Dummy variables equation is provided below:

$$GS_{it} = \propto_{1i} + \propto_2 D_{2i} + \propto_3 D_{3i} + \propto_4 D_4 + \propto_5 D_5 + \beta_2 EG_{it} + \beta_3 GBR_{it} + B_4 REER_{it} +$$

$$\mu_{it} \tag{3.4}$$

Where $\propto_2 = 1$ for second country, 0 otherwise, $\propto_3 1$ for third country, 0 otherwise and so on. Note that to avoid getting caught in the dummy variable trap, we have only introduced four dummy variables for each country, although we have 5 countries. Here we are treating first country as the base, or references.

3.2.4 Random Effect Model (FEM)

The random effect, also known as error component model (ECM), is a generalization of the classical linear models, which treat the regression coefficients of the original (fixed effects models) as random variables, which are generally assumed to come from the normal distribution. According to Hiestand (2005), the fixed effect is contrast to the random effect in which individual effect is randomly distributed across the cross-section units. Besides that, the omitted variables in the regression model cannot be correlated with the explanatory variables because it can lead to result biased. In order to capture each effect, an intercept term will be representing the overall constant term is specified in the regression model. The equation of random effect is,

$$GS_{it} = \beta_1 + \beta_2 EG_{it} + \beta_3 GBR_{it} + \beta_4 REER_{it} + w_{it} \tag{3.5}$$

Where, β_1 is the mean value of intercept term, w_{it} is a random error term with a mean value of zero and a variance of σ^2. The composite error term w_{it} consists of two components, which are ε_i and μ_{it}. ε_i is the cross-section, or individual-specific error component while μ_{it} is the combination of combination of time series and cross-section error components.

3.3 Model Comparison

Before selecting the best estimator used in this study, we need to compare Pooles OLS, FEM and REM. The methods that used to compare these models are Breusch-Pagan Lagrange Multiplier (LM) Test, and Hausman test.

3.3.1 Breusch-Pagan, Lagrange Multiplier (LM) Test

Lagrange Multiplier (LM) is a test developed by Breusch-pagan in 1980 to compare the Pooled OLS with the random effects, to estimate whether country specific effects exist in the regression model. Compare with Hausman tets, LM test is easier to test because it only needs the pooled OLS residuals given.

$$\text{LM} = \frac{NT}{2(T-1)} \left[\frac{\sum_{i=1}^{N}(\sum_{t=1}^{T}\epsilon_{it})^2}{\sum_{t-1}^{N}\sum_{i=1}^{T}\epsilon_{it}^2} \right] \tag{3.6}$$

The hypotheses of Lagrangian Multiplier test (LM) are:

$H_0: \sigma_\lambda^2 = 0$

$H_a: \sigma_\lambda^2 > 0$

Under the null hypothesis, Lagrangian Multiplier (LM) is distributed in Chi square of one degree of freedom.

Rejection Rule:

Reject H_0 if p-value is less than the significant level of 1%, 5%, and 10%. Reject null hypothesis means that random effect model is more preferred than the Pool OLS and there is country specific effects exist in regression model. In contrast, if the p-

value is greater than the significant level of 1%, 5%, and 10%, the null hypothesis will failed to reject. Hence, Pool OLS is more appropriate than random effect model.

3.3.2 Hausman Test

Hausman test is a test that developed by Hausam (1978) to distinguish between random effect model and fixed effect model. According to Theme Horse, (2017), the Hausman test detects the endogenous regressions in a regression model. If the endogenous variables appear in the regression model, the OLS estimators will biased and inconsistent. This is because the endogenous variables are correlated with one or more regression in the model. According to Theme Horse, (2017), the endogenous variable is a variable that is determined by other variables in the system.

The hypotheses of Hausman test are:

$H_0 = \text{co}(\lambda_i, X_{it}) = 0$ (Random effects is the preferred estimator)

$H_a = \text{cov}(\lambda_{i,} X_{it}) \neq 0$ (Fixed effects is the preferred model)

Rejection Rule:

Reject H_0 if p-value is less than the significant level of 1%, 5%, and 10%. Reject null hypothesis means that fixed effect model is more preferred than the random effect model. In contrast, if the p-value is greater than the significant level of 1%, 5%, and 10%, the null hypothesis will failed to reject. Hence, Pool OLS is more appropriate than random effect model.

3.4 Diagnostic Test

To check whether the regression model has fulfilled the assumption of CLRM, this study will applied several additional tests such as multicollinearity, heteroskedasticity, and serial autocorrelation.

3.4.1 Multicollinearity

Multicollinearity is a situation where at least two independent variables in the model are highly correlated with each other. The multicollinearity problem in the model can be detected by using variance inflation factor (VIF). Multicollinearity's hypothesis is shown below:

H_0 = There is no multicollinearity among independent variables

H_a = There is multicollinearity among independent variables

Rejection Rule:

Reject null hypothesis when p-value is less than the significant level of 1%, 5%, and 10%. Reject null hypothesis means that multicollinearity problem have exist among independent variables. In contrast, if the p-value is greater than the significant level of 1%, 5%, and 10%, the null hypothesis will be fail to reject and means that there is no multicollinearity among independent variables.

3.4.2 Heteroskedasticity

Heteroskedasticity refers to a problem that occurs when the variance of error term in regression model is not constant. The existence of homoscedastic is one of the required assumptions in CLRM. Breusch-Pagan method will be carried out to detect the heteroskedasticity problem in the model.

The hypotheses of autocorrelation are:

H_0 = no heteroskedasticity problem in model (error term's variance constant)

H_a = heteroskedasticity problem in model (error term's variance not constant)

Rejection Rule:

If p-value is greater than the significant level of 1%, 5%, or 10%, H_0 will not be rejected. Fail to reject the null hypothesis means that there is no heteroskedasticity problem in the model. In contrast, if the p-value is less than the significant level of 1%, 5%, or 10%, the null hypothesis will be rejected and means that error term's variance no constant. If heteroskedasticity exists in the model, standard error method can be carried to solve this problem (Fall 2008).

3.4.3 Autocorrelation

Autocorrelation refer to a problem that occurs when the value of error term in the regression model is correlated with each other. Autocorrelation presence in the model means that the model is misspecified. The absence of autocorrelation is also one of the require assumptions in CLRM. Breusch-Godfrey test will be applied to detect the problem of Autocorrelation.

The hypotheses of Autocorrelation are:

H_0 = there is no autoorrelation between the eror term

H_a = there is autoorrelation between the eror term

Rejection Rule:

Null hypothesis cannot be rejected if p-value is greater than the significant level of 1%, 5%, and 10%. Cannot reject null hypothesis means that there is no first-order correlation in the model. In contrast, if the p-value is less than the significant level of 1%, 5%, and 10%, the null hypothesis will be rejected and means that there is autocorrelation in the model. If autocorrelation exists in the model, fixed effects and robust methods or autocorrelation AR (1) method can be used to solve this problem (Fall 2008).

CHAPTER FOUR

EMPIRICAL RESULT AND DISCSSIONS

4.0 Introduction

This chapter will present, analysis, and interpret the empirical results of this study. The empirical results are obtained by running test from Stata 14 software. In this chapter, we will use Lagrange Multiplier (LM) test and Hausman test to compare Pooled Ordinary Least Model (POLS), Random Effect Model (FEM) and Fixed Effect model (REM) to select the best efficient model. The Lagrange Multiplier (LM) test is used to compare POLS and REM, while Hausman test is applied to compare REM and FEM. Second section will present and interpret the diagnostic test result of regression model which are multicollinearity test, heteroskedasticity test, and autocorrelation test.

4.1 Result of Descriptive Analysis

Table 1: Summary descriptive statistics of dependent and independent variables.

	MEAN	STD. DEV	MINIMUM	MAXIMUM
LGR	4.7044	2.0107	0.3576	7.5989
LEG	1.3615	0.7011	-1.1086	2.1004
LEX	3.9749	2.4536	0.7839	8.0242
LVIX	2.7003	0.16544	2.4024	2.8656

Note: Data run between year 2014 to 2018, N=50 from 10 developing countries. LGR = natural logarithm of gold reserves, LEG = natural logarithm of economic growth, LEX = natural logarithm of exchange rate, VIX = natural logarithm of Volatility Index.

Table 1 show the summary of descriptive statistics of the dependent variable and independent variables. The variables for this study included gold reserves, economic growth, exchange rate, and VIX index. Gold reserve is dependent variable

in this study while exchange rate, economic growth, and VIX are independent variables. Based on the result above, the mean and standard deviation of gold reserves is the highest among the variables, which is 4.7044 and 2.0107 respectively. While the minimum and maximum value is between 0.3576 and 7.5989. The mean value of LEG is the lowest among the variable which is 1.3616, while the standard deviation is recorded at 0.7011. The minimum value and maximum value for LEG are -2.1086 and 2.1004, which is also the smallest among the variables and the one variable with a negative value. For LEX, the average mean is stood at 3.9749, the third highest among the variables with a 2.4536. The maximum value and minimum value are 0.7839 and 8.0242. Lastly, the average mean of LVIX is the second highest among the variables which recorded at 2.7003. On the other hand, the standard deviation is the lowest (0.03390), while minimum and maximum value is recorded at 2.4024 and 2.8656 respectively.

In conclusion, all the data are valid as the mean of each variable is within the minimum and maximum range. Therefore, there would have not outlier in data. Besides that, the standard deviation of all variable is relatively low and this indicates that the data value is close to the mean.

4.2 Model Comparison

To choose the most appropriate estimator among the POLS model, random effect model, and fixed effect model to explain the relationship between the dependent variable and independent variables, several additional test will be implemented in this study, such as Breusch-Pagan, Lagrange Multiplier (LM) test, and Hausman test.

4.2.1 Breusch–Pagan Lagrange Multiplier Test (LM Test)

Lagrange Multiplier (LM) is a test that uses to compare the Pooled OLS model with the random effect model, and estimate whether country specific effect exists in the regression model. The null hypothesis of this model is POLS model is more appropriate while alternative hypothesis is random effect model more appropriate. Breusch-Pagan LM test results is shown figure below.

Table 2: The result of Breusch-Pagan (LM test)

Breusch-Pagan (LM test)	
Prob. Chi-Square	0.0000^{***}
Decision Making	Reject null hypothesis
Conclusion	Random effect model is more preferable compare with POLS mode

Note: Asterisks (***) denoted null hypothesis rejected at 5% significance level.

Based on the table above, Breusch-Pagan LM test shows that random effect model is more preferable compare with POLS model. This is because p-value of statistics is 0.0000, which is smaller than significant level of 5%. Since p-value is smaller than 5% significance level, we have sufficient evidence to reject the null

hypothesis and conclude that random effect model is more appropriate than pooled OLS model.

4.2.2 Hausman Test

Since the Breusch-Pagan (LM) test shows that the random effect model is more preferable, then we will further use Hausman test to compare the random effect model and fixed effect model to select the most appropriate model for this study. The null hypothesis of this model is random effect model more appropriate while alternative hypothesis is fixed effect model more suitable. Hausman test results is shown figure below.

Table 3: The result of Hausman Test

Hausman Test	
Prob. Chi-Square	0.0003^{***}
Decision Making	Reject null hypothesis
Conclusion	Fixed effect model is more preferable than the random effect mode

Note: Asterisks (***) denoted the rejection of null hypothesis at 5% significance level.

Based on the result above, it shows that the p-value is 0.003, which is smaller than the 5% significance level. Thus, we have sufficient evidence to reject the null hypothesis and conclude that the fixed effect model is more appropriate than random effect model to be used in this study. Reject random effect model also proved that the omitted variables in the regression model are correlated with the other explanatory variables.

After conducted the Breusch-Pagan LM test and Hausman test, we can conclude that fixed effect model is the most suitable model that can be applied in this

research. The result of the Breusch-Pagan LM test and Hausman test is shown the table below.

Table 4: Summary result of POLS model, random effect model and fixed effect model

	POLS Model	Random Effect Model	Fixed Effect Model
LEG	-0.4002	0.3059***	0.3409***
	[0.289]	[0.003]	[0.000]
LEX	-0.4683***	0.2023	0.8777***
	[0.000]	[0.292]	[0.001]
LVIX	0.1623	0.28487	0.3449
	[0.923]	[0.291]	[0.145]
C	-38.01677	-12.9704	-0.2273
	[0.541]	[0.035]	[0.852]
Breusch-Pagan LM Test		78.21***	
		[0.0000]	
Hausman Test			23.10***
			[0.0003]
Observation	50	50	50

Note: Asterisks (*) denoted the significant at 10% significance level; (**) significant at 5% significance level, and (***) significant at 1% significance level. The parentheses [ ] indicate p-value.

4.3 Diagnostic Checking

4.3.1 Multicollinearity

Multicollinearity is a situation where at least two independent variables in the model are highly correlated with each other. The null hypothesis is there is no multicollinearity among independent variables while alternative hypothesis is there is multicollinearity among independent variables. The multicollinearity problem in

the model can be detected by using variance inflation factor (VIF).The result of multicollinearity is shown in table 5 below.

Table 5: Multicollinearity result

Variables	VIF	1/VIF
LRGDPG	1.10	0.907779
LEX	1.10	0.912935
LVIX	1.01	0.993582
Mean VIF	1.07	

Based on the result in table above, there is no multicollinearity problem among the independent variables as VIF value of the all independent variables are less than 10. According to the result above, economic growth and exchange rate has the highest value of VIF, which recorded by 1.10 and 1.10 respectively. It is followed by the VIX index (1.01). The mean VIF of all independent variables is recorded at 1.07, which is less than 10. The mean VIF values less than 10 represent that the null hypothesis has been rejected, and concluded that there is no correlation between the independent variables.

4.3.2 Heteroscedasticity

Heteroskedasticity refers to a problem that occurs when the variance of error term in regression model is not constant. The H_0 for heteroskedasticity is there is no heteroskedasticity problem (error term's variance constant) while H_1 is there is heteroskedasticity problem among independent variables (error term's variance not constant). In this study, Breusch-Pagan method will be applied to detect the heteroskedasticity problem in the model. The result of heteroskedasticity is shown in table 6 below.

Table 6: Result of heteroskedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Igr
chi2(1)   =   0.07
Prob > chi2   =   0.7894

According to the result above, there is no heteroskedasticity problem among the error term because the p-value (0.7894) is largest than 5% significance level. Therefore, we have sufficient evidence not to reject the null hypothesis and conclude that error term in the model is constant or equal variance.

4.3.3 Autocorrelation

Table 7: Autocorrelation result

Wooldridge test for autocorrelation in panel data
Ho: no first-order autocorrelation
F(1,9)   = 0.070
Prob > chi2   = 0.0063

Table 7 above shows the result of autocorrelation by using Stata 14. Based on the result above, the p-value of 0.0063 is less than the 5% significance level. Thus, we have sufficient evidence to reject the null hypothesis in which no first-order autocorrelation among the error term. In order words, reject null hypothesis indicates that the error terms in the model is correlated and autocorrelation problem. Due to the first-order autocorrelation problem, this model needs to be modified.

4.3.3.1 Remedy for Autocorrelation problem

If there is presence first-order autocorrelation in the regression model, we can use fixed effects and robust methods or Autocorrelation AR (1) method to solve this problem. The result of autocorrelation AR (1) is shown table below.

Table 8: Result of Autocorrelation AR (1)

Prob F (3,26)	7.94
Prob Chi-Square	0.0006

After using Autocorrelation AR (1) methods to solve the problem of autocorrelation, the result shows that p-value is 0.0006, which is less than 5% significance level. It means that, we have sufficient evidence to reject the null hypothesis and conclude that error term in the model has become constant or equal variance.

4.3 Empirical Model and Discussion

Since results in section 4.2 shows that fixed effect model is the best model compare to the other two models, thus the equation based on the fixed effect model as shown below:

$$LGR_{it} = B_0 + B_1 LEG_{it} + \beta_2 LEX_{it} + \beta_3 LVIX_{it} + \epsilon_{it} \qquad (3.7)$$

$$LGR_{it} = -0.2273 + 0.3409 LEG_{it} + 0.8777 LEX_{it} + 0.3449 LVIX_{it} ++\varepsilon_{it}$$

Where i = 1, 2, 3…., 50

t = 2014, 2015…, 2018

From the equation of fixed effect model (3.7), all independent variables are positively correlated with the gold reserves. Based on the model, an increase of 1% in real GDP growth, exchange rate, and volatility index will lead to 0.34%, 0.87%, and 0.34%, increase in gold reserves demand by a country respectively.

As the result shows in table 4 and equation 3.7, there is a significant and positive correlation between economic growth and gold reserves with a p-value of 0.000 significant at 5%. A positive correlation means that when economic growth increase, the demand for gold reserves will increase as well. This result is consistent with the study of Oktay, Serin & Oztunc (2015), Charles (2012),Kashif & Sridharan (2014), and Khairul, et al (2015). In the study, they also used GDP growth as an indicator variable to measure the international reserves. When economic growth increase, the central bank demand for gold increase as well because their purchasing power increase and tend to accumulate more gold as precaution. Central bank had such attitude maybe is because of gold is a good safe haven and hedge tool as during the financial crisis. Gold is a liquid counter-cyclical asset and a long term value

storage tool. Therefore, it can guarantee the financial of a country. However, positive relationship between economic growth and gold demand by the central bank is inconsistent with the study of Ghost (2016) and Delatte, Laure & Julien (2009). This is because when a country's economy falls into recession, it will accumulate more reserves to defend a countries' competitiveness and protect the currency from being devalued. Therefore, it can draw a conclusion that economic growth and gold reserve have both positive and negative correlation.

Besides that, the result from table 4 also shows the exchange rate has a significant relationship with the gold reserves as the p-value less than 5% significance level. This result is compatible with the mercantilist motives which stated in chapter 2 and indicates that gold can stabilize their exchange rate and to maintain the country's competitiveness. Many countries tend to either accumulate or sell gold to influence their own currency exchange rate to maintain competitiveness. For example, some countries tends to sell gold is want to make their currency become depreciated and improve the trade value. This result is consistent with Chitu et al (2014), and Carvalho (2016), who found that exchange rate has positively and significant with the gold reserves. On the other hand, Wei (2010), Khairul et al (2015), and Kashif et al. (2017) also stated that exchange rate has significant and negative relationship with the gold. This is because when currencies depreciate, countries need tend to buy or import gold in order to strengthen their currency. To sum up, there are positive and negative correlations between the currency exchange rate and the central bank's demand for gold.

The results above also indicate that there is a positive correlation between the volatility index and gold reserves. This means that the higher the volatility index, the

higher the country's demand for gold. High volatility index means economy's uncertainty and people's fear in the market very high. The positive relationship between gold demand and VIX is also have shown in the study of Gopalakrishnan et al. (2017), Karunagaran (2011), and Hood, M., & Malik, F. (2013), which also used the volatility index as an indicator variable to measure global risk. This result indicates that gold is an asset and hedging tool with excellent hedging function, which can reduce any loss risk or resist economic crisis or inflation. In addition, gold is also very valuable asset and also would not be depreciated in any time as compare to US Dollar. For example, in the face of economic crisis or inflation, gold's value has remained constant or even risen steadily. Therefore, many countries prefer to buy and hoarding gold as financial security.

4.4 Conclusion

Through the Breusch-Pagan LM test and Hausman test, it shows that fixed effect model is the most appropriate model that can be applied in this study and explain the relationship between gold reserves, economic growth, exchange rate and VIX index. Through the equation based on the fixed effect model, all the independent variables have shown a positive relationship with gold reserve. It means that when an increase in economic growth, exchange rate and VIX index, the gold reserves increase as well. Also, economic growth, exchange rate has found to be significant with gold reserves except VIX index. For the diagnostic test, the model is free from multicollinearity and heteroskedasticity, and autocorrelation problem as all the p-value is significant ay 5% significance level. So, it can be said this model is consider good because it have fulfil the assumptions of CLRM.

CHAPTER FIVE

CONCLUSION

5.0 Introduction

This chapter will summaries and conclude all the results that that been done in previous chapter. This chapter has divided into 3 sections. The first section is summary of the research, while the second section is to provide suggestions and policy recommendations for relevant parties. The last section is about the limitation of this study.

5.1 Summary of study

The main purpose of this study is to analyze the potential determinants of gold reserves in emerging markets. The countries that selected to be used in this study are China, India, Turkey, Russia, Poland, Mongolia, Kazakhstan, and Pakistan, Colombia, and Malaysia. The reason for choosing these 10 countries is that their gold reserves have been increasing in recent year. The independent variables of this study are real GDP growth rate, currency exchange rate, and VIX volatility. Frequency data collected is yearly annually from 2014 to 2018. The objective of this study is to examine the relationship between gold reserves with real GDP growth rate, currency exchange rate, and VIX volatility. All tests will be performed by the software Stata 14.

The result of descriptive analysis show that all the data in this study are valid as the mean of each variable is within the minimum and maximum range. Therefore, it can indicate that there would have not outlier in data. Besides that, the standard

deviation of all variable is relatively low and this indicates that the data value is close to the mean. Secondly, through the LM test and Hausman test, the result shows that fixed effect model is the most suitable model use to explain the relationship between dependent variable and independent variables. The empirical result based on the fixed effect model shows that economic growth has positively relationship with gold reserves because p-value is less that 5% significance level. A positive relationship between gold reserve and economic growth means that when a country's economic growth increases, it will tend to buy and accumulate gold for future use. For example, central banks use gold to maintain currency exchange rate or use for curbing inflation. This behavior can be called self-insurance or a precautionary motive. This finding is also match with the study of Khairul, et al (2015), Oktay et al (2015), Charles (2012), and Kashif et al (2014), who stated that there is a significant and positive relationship between gold reserves and economic growth.

In addition, empirical results also show that exchange rate has statistically significant and positive correlation with gold reserves within the period of 2014 until 2018. An increase of 1% currency exchange rate, gold reserves increase 1.41% as well. A positive relationship between gold reserve and exchange rate means that when the currency exchange rate appreciated, the demand for gold will increase. This is because the values of gold price denominated in dollar are cheaper for them. Therefore central bank will tend to import and accumulate the gold for future use.

Furthermore, result also indicates that there is no significant relationship between VIX index and gold reserve as the p-value is greater than the 5% significance level. This result is inconsistent with study of Karunagaran (2011), and

Gopalakrishnan & Mohapatra (2018), who stated that VIX index has a significant and positive relationship with gold reserves.

From the result of diagnostic checking, it shows that regression model is free from multicollinearity, heteroskedasticity and autocorrelation problem. Therefore, this model have fulfil the assumption of CLRM and declared that model is BLUE (Best Linear Unbiased Estimator).

To sum up, there is only economic growth, and exchange rate has a statistically significant and positive correlation with gold reserve. In other words, all the variables have a relationship with gold reserve except VIX index.

5.2 Policy Recommendation

This study is very meaningful and useful for some central banks. This is because through this study, central banks can better understand the role of gold reserves. After understanding the role of gold reserves, they will know how to take action or take appropriate measures to manage gold reserves. After understanding the role of gold, they can immediately take appropriate policies to adjust the size of gold reserves. In addition, central banks should also strengthen the policy framework of gold reserve management. Adjust the scale, structure and reserve assets of gold reserves at all times to help enhance their countries' resilience to shocks that may come from global financial markets or domestic financial systems. In addition, due to gold reserves have their own limitations in terms of liquidity, central banks also need to make great improvements in liquidity management to ensure the liquidity and profitability of gold reserves at all times.

5.3 Limitation of Study

There is no doubt that every researcher has encountered some limitations in the preparation of research papers. First and foremost, there is very limited research paper related to the topic research. In this study, there is very few research papers related to the determinants of gold reserves in emerging markets. Although there have some research papers have related with the gold reserves but its finding is not very detail. Therefore, I have also included some of the research that related to international reserves in literature because gold reserves also part of the International reserves.

The second limitation of this study is the issue of data collection. Since there have 10 countries in this study, researcher needs to spend a lot of time collecting data from different sources. Not only that, due to the frequency of some independent variables is in monthly data, researchers also need to spend time converting monthly data into annual data. It's very time-consuming.

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