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DOCTORAL THESIS
Doctor of Philosophy (PhD)

OIL PRICES, GOLD PRICES AND STOCK MARKETS: EVIDENCE FROM BRICS AND MINT ECONOMIES

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THESIS APPROVAL PAGE

DECLARATION

I hereby declare that this doctoral thesis titled as “Oil Prices, Gold Prices and Stock Markets: Evidence from BRICS and MINT Economies” has been written by myself in accordance with the academic rules and ethical conduct. I also declare that all materials benefited in this thesis consist of the mentioned resources in the reference list. I verify all these with my honour.

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ABSTRACT

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This study investigates the relationship between oil prices, gold prices and stock markets from emerging markets' perspective during a 16-year period that covers before and after the financial crisis that emerged in late 2007. Focusing on BRICS and MINT economies, the study first tries to capture the dynamic connections between these variables for each individual country in a VAR setting by using monthly data from 2000:01 to 2015:12. Second, these economies are examined in a panel setting in order to test for Granger Causality. Output from the VAR estimations give hints about connections between national macroeconomic indicators and some of the financial variables: Negative link between interest rates and currency depreciation on stock prices and positive link between inflation and gold prices, which can support the idea that gold can be used protection against inflation. However, VAR analyses fail to detect consistent ties between stocks markets, gold prices and oil prices of these economies. The study then proceeds with a panel setting which provides clearer results: Stock market prices Granger Cause Brent oil prices, although the connection is lost for BRICS during pre-financial crisis period. This finding indicates that stock market prices of these economies can be used as a predictor of oil prices. There is no causality between gold prices and stock market prices, which can be interpreted as an independence factor to support the safe-haven arguments. This

view is also justified by the relatively steady trend of gold prices during the examination period, where stock prices fluctuate drastically.

Keywords: BRICS, MINT, Emerging Markets, Stock Markets, Gold Prices, Oil Prices, VAR, Panel Granger Causality

ÖZET

Doktora Tezi

Petrol Fiyatları, Altın Fiyatları ve Hisse Senedi Piyasaları: BRICS ve MINT Ekonomilerinden Bulgular

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Bu çalışmada petrol fiyatları, altın fiyatları ve hisse senedi fiyatları arasındaki ilişki, gelişmekte olan ülkelerin perspektifinden, 2007 sonlarında ortaya çıkan finansal kriz öncesi ve sonrasını kapsayan 16 yıllık bir dönemde ele alınmıştır. BRICS ve MINT ülkelerine ağırlık veren çalışma, ilk olarak her ülke için 2000:01 ve 2015:12 dönemleri arası aylık veri kullanarak, söz konusu değişkenler arasındaki dinamik bağlantıları öncelikle VAR kurgusu ile ortaya çıkarmayı hedeflemiştir. VAR analiz sonuçları makroekonomik göstergeler ve finansal değişkenler arasındaki bağlantılar için bazı ipuçları vermektedir. Bu doğrultuda, faiz oranları ve para biriminde değer kaybı ile hisse senedi fiyatları arasında negatif ilişki ve enflasyondan korunma aracı olarak altına yönelmeyi destekleyecek şekilde enflasyon ile altın fiyatları arasında pozitif ilişki bulunmuştur. Bununla birlikte VAR analizleri sonucunda bu ülkeler için hisse senetleri, petrol ve altın fiyatları arasında istikrarlı bir ilişki saptanmamıştır. Çalışmanın ikinci kısmında başvurulan panel nedensellik kurgusu ise daha net bulgular sağlamaktadır: Hisse senedi fiyatlarından petrol fiyatlarına Granger Nedensellik bağlantısı bulunmakla beraber, bu bağlantıya BRICS ülkeleri için kriz öncesi dönemde rastlanmamıştır. Bu bulguya göre, söz konusu ülkelerin hisse senedi fiyatları, petrol fiyatlarının tahminlenmesi için bir gösterge olarak kullanılabilir. Altın fiyatları ve hisse senedi fiyatları arasında bağlantıya rastlanmamıştır. Altına ilişkin güvenli liman argümanlarını destekleyecek bir bağımsızlık faktörü olarak yorumlanabilecek olan bu bulgu, aynı zamanda

analize konu olan dönem itibariyle şiddetle dalgalanan hisse senedi fiyatları ile kıyaslandığında altın fiyatlarının göreceli olarak daha dengeli bir seyir izlediği gerçeği ile doğrulanabilir.

Anahtar Kelimeler: BRICS, MINT, Gelişmekte olan Ülkeler, Hisse Senedi Piyasaları, Altın Fiyatları, Petrol Fiyatları, VAR, Panel Granger Nedensellik

OIL PRICES, GOLD PRICES AND STOCK MARKETS: EVIDENCE FROM BRICS AND MINT ECONOMIES

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ABBREVIATONS

ADCC:	Asymmetric Dynamic Conditional Correlation
ADF:	Augmented Dickey-Fuller
AIC:	Akaike Information Criterion
AR:	Auto Regression
ARCH:	Auto Regressive Conditional Heteroskedasticity
AVG:	Average
BRICS:	Brazil, Russia, India, China, South Africa
BSE:	Bombay Stock Exchange
CPI:	Consumer Price Index
DCC:	Dynamic Conditional Correlation
EIA:	The U.S. Energy Information Administration
EM:	Emerging Markets
FTSE:	The Financial Times Stock Exchange
GARCH:	Generalized Auto Regressive Conditional Heteroskedasticity
GDP:	Gross Domestic Product
IRF:	Impulse Response Function
KSE:	Karachi Stock Exchange
MGARCH:	Multivariate GARCH
MINT:	Mexico, Indonesia, Nigeria, Turkey
OECD:	The Organisation for Economic Co-operation and Development
SIC:	Schwarz Information Criterion
S&P:	The Standard & Poor's Index
TECM:	Threshold Error Correction Model
UK:	The United Kingdom
US:	United States of America
VAR:	Vector Autoregression
VECM:	Vector Error Correction Model
WTI:	West Texas Intermediate

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INTRODUCTION

Although having no direct connection with each other through a strict causality relationship, some economic indicators are long-respected members of portfolios, and their development is a point of attraction for financial investors and economists. Most popular financial indicators are stock market indices, commodity prices (more specifically, gold and oil prices) and exchange rates. Investors all over the world in every organization keep these figures in track, while attempting to get a sense of how the economic system is moving.

The attention given to these figures comes from a perspective that they are, at some level, linked to real economic movements. A well-developed stock market is arguably a sound indicator of how a country's economy is perceived at the time. It reflects an investor's evaluation on companies and the economy both in terms of recent and future states. In diversified portfolios, how well the stocks play with other instruments is a critical factor for investor decisions. Bosworth et al (1975) argue that the stock market's link to the real economy can exhibit three characteristics: First, stock market movements may be a source of variation in aggregate demand; second, the causation may be in opposite direction; or there may be no direct causation at all. The third view here reveals that stock markets reflect investors' efforts to foresee where the economy is heading: Since, the argument adds, stock market movements are useful at predicting major business cycles, investors' forecasts are considered to be better than random guesses. Morck et al (1990) add that stock markets act in two ways: As a passive informant that captures information people already know, thus not leading investment decisions; and as a key figure coordinating the decisions of managers who invest, eventually triggering the economic activity upwards (or downwards), and ultimately justifying its own signal.

"Being in general demand, cognizable and portable" are three properties that Marshall (1920) mentions while explaining the importance of stock markets and valuable metals. These instruments are requested in every part of the world, which make them "international". In the world of commodities, these properties (easily describable, portable, and generally demanded) are possessed in the highest degree by gold and silver. As in any realized investment opportunity, the demand for storage of

gold comes from the expectation of appreciation in its price, tells Abken (1980). Besides, being not directly linked to other investment properties gives gold the opportunity of being a portfolio diversification instrument. Gold bears significant attraction particularly during financial crises with increased risk aversion. Being not directly linked to other factors, gold demand tends to raise when investors try to avoid uncertainty. Volatile trends in alternative investment opportunities (example: stock market) may result in demand shifts towards gold market. Baur and Lucey (2010) indicate while there is no strict theoretical model that explains why gold is a safe-haven asset, the fact that it was one of the first forms of money and it was used as an inflation hedge gives it importance. On the other hand, there is also empirical evidence that raise questions over the safe-haven argument: Baur and McDermott (2010) find that, during the peak of recent financial crisis, gold does not seem to keep its hedging stance in BRIC countries[1]. Choudhry et al (2015) argue the same for UK, US and Japan economies. Hence, there is lack of consensus in the literature on the risk aversion mission of gold market.

Among the above-mentioned financial indicators, oil prices have the ability to directly trigger real macroeconomic movements. As Olomola and Adejumo (2006) simply put, there is a two-sided transmission mechanism that gives movements of oil prices the power to have an impact on the real economy. On the supply side, oil prices are a cost factor which would directly influence the output; on the demand side, oil prices are a wealth adjustment factor through their impact on disposable income. Oil prices may also affect the investments of the firms: Increasing energy prices may force firms to move towards less energy-intensive production elements. The literature also acknowledges the negative correlation of oil prices and GDP, while the relationship may change in the case of oil exporters like Norway (Morck et al, 1994). Oil price shocks were held responsible for recessions, inflation, slow-paced productivity and thus for changes in monetary policy, labour market adjustments and shifts in energy technologies (Kilian, 2014). Understanding the movements in the oil prices requires an interpretation of the actions of all these participants. Although the demand side of oil consists of a large group that includes countries, companies, households and alike, the supply side is much smaller: OPEC countries and large European and US oil

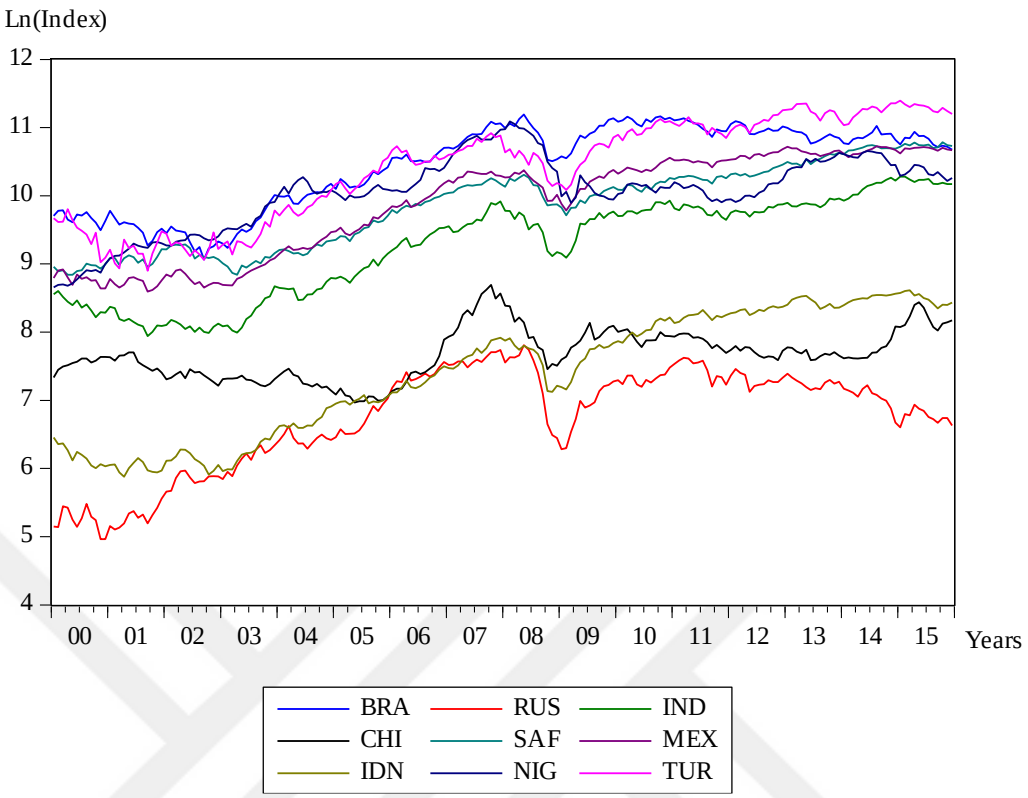
[1] BRIC: Brazil, Russia, India, China.

companies are the main oil suppliers. Moreover, the rising trend in oil market towards 2007 can be explained by an increasing oil demand coming from emerging markets (Möbert, 2007).

Basher et al (2012) suggest that understanding the interactions between financial variables in the context of emerging markets is crucial since these markets exhibit growing influence in global economy. These economies gain importance as they develop and sound louder in the world stage. PwC (2017) predicts that by 2050 six of the seven largest economies in the world would be emerging economies, China and India having the first two seats and Indonesia being the fourth. If these expectations become the reality, these markets might become the major playground for investors. For risk managers, as Zhang and Wei (2010) also state, investigating these topics is of great importance for the sake of both managing commodity market risk and forecasting future market movements.

While investigating the financial variables mentioned above, one should also consider the global financial crisis which emerged through late 2007 and soared onwards. As Claessens et al (2014) have put, the event was the worse since the Great Depression, contracting World GDP by 1.8 percent annually in 2009. Markets were disrupted while also suffering wealth losses and bankruptcies. Today, in the prolonging aftermath, authorities are still struggling to achieve sustainable growth dynamics that are supported by strong investment and job creation. The EU and the USA have implied expansionary policies to support investment and to foster aggregate demand; but this era is also coming to an end as the global demand is slowly picking up, thus bringing the inflation figures to a desired level. It seems that eventually the world will experience a period where external financing is harder for emerging economies while the advanced players are busy tightening up their monetary policies.

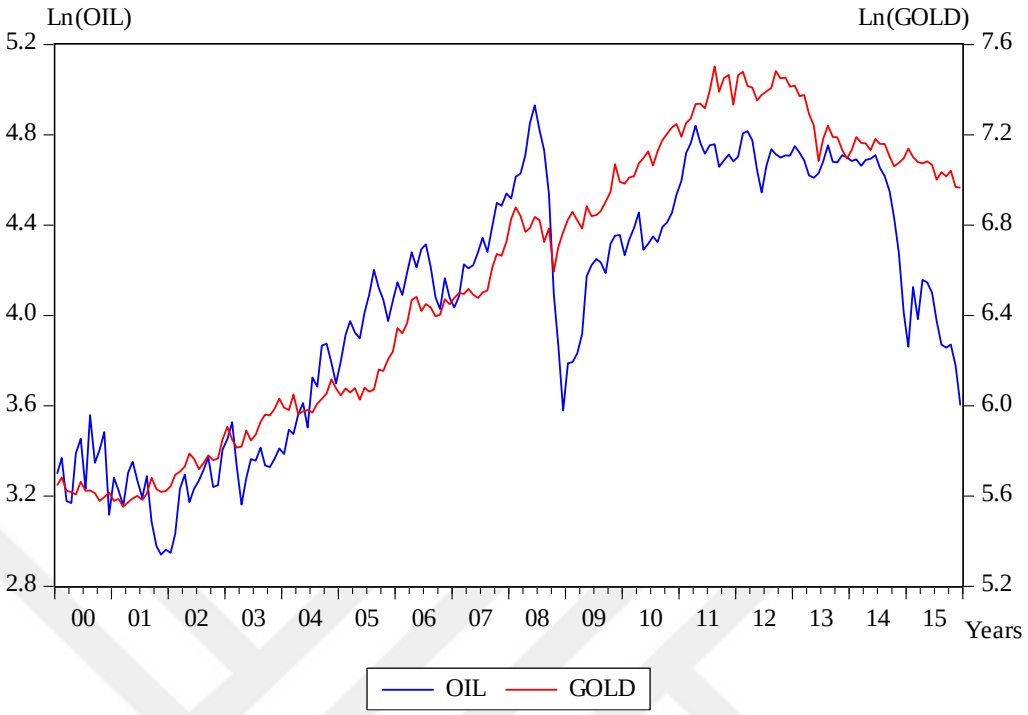
Figure 1: Stock Prices of BRICS and MINT



Sources: Investing, Thomson Reuters, Yahoo Finance

Stock market movements, Brent oil price and gold prices are summarized in Figure 1 and Figure 2. Looking at the movements of stock markets, Brent oil price and gold price in a timescale that captures pre-crisis and post-crisis periods reveal interesting dynamics. Clearly all the stock markets react with sharp drops that start around late 2007; and although a return to previous levels seem to be in the process, the aggregate emerging market trend is less clear than the pre-crisis period.

Figure 2: Prices of Brent Oil and Gold



Sources: U.S. Energy Information Administration, World Gold Council

Commodity figures of the same period reveal a diversion: We observe a sharp decline in the Brent petrol price in 2008 while this deviation was corrected upwards until around mid-2014. However, gold price movements seem to have kept their upward momentum more consistently until late 2012, with a slight jump during the crisis period. While without doubt these graphs are for initial comprehension only, it is interesting to see the price of gold moving slightly more independent from the movements in the stock market and Brent oil. This may approve the safe-haven hypothesis of gold as an investment opportunity as it moves relatively unhurt by the crisis by moving unrelated to the other financial variables, but of course the data needs to be critically tested.

CHAPTER ONE
MOTIVATION OF THE STUDY

Following the introduction, this chapter explains the motivation of the study. First, the problem is defined; then the aim and methodology are briefly discussed, accompanied by a breakdown of structure and discussion of study's limitations.

1.1. PROBLEM DEFINITION

Although the literature has widely explored the nature of interactions between financial variables in various setups, the area is still open for research considering indecisive results, fragmented contexts, and growing data. The fragmentation is understandable as uniform empirical evidence is not likely to emerge from varying countries with different characteristics in varying time periods. Additionally, new data makes further examination possible. Studies concerning this area of research mostly focus on developed markets (Sadorsky 1999; Kilian and Park, 2009; Malik and Ewing, 2009; Choi and Hammoudeh, 2010; Chan et al, 2011; Le and Chang, 2011; Sumner et al, 2011; Samanta and Zadeh, 2012; Mollick and Assefa, 2013; Barunik et al, 2013; Ciner et al, 2013; Creti et al, 2013; Mensi et al, 2013; Miyazaki and Hamori, 2013; Choudhry et al, 2015), while studies related to emerging economies are relatively lower in volume, or they are mostly focused on single-country analyses. There exists a body of literature that explores the characteristics of emerging markets in terms of investment opportunities among stocks, gold prices, and oil prices (Papapetrou, 2001; Maghyereh, 2004; Cong et al, 2008; Soytas et al, 2009; Hsing, 2011; Basher et al, 2012; Patel, 2012; Bhunia, 2013; Bhunia and Mukhuti, 2013; Ayaydın and Barut, 2016; Huang et al, 2016; Jain and Biswal, 2016; Shahzadi and Chohan, 2016); but a wide-ranged analysis that includes both the specific groups of BRICS and MINT is hard to find. Therefore, one of the main points of this study is filling this gap[2].

[2] BRICS: Brazil, Russia, India, China, South Africa. MINT: Mexico, Indonesia, Nigeria, Turkey. Both abbreviations were introduced by Jim O'Neill, a former Goldman Sachs economist, due to their similarities in potential to procedurally influence the world economy in larger scale in the future.

1.2. AIM OF THE STUDY

Following this context, this study aims to explore the relationship between stock markets, gold and oil prices with focus on BRICS and MINT economies. To this end, this study aims to contribute to the literature by:

- Evaluating both BRICS and MINT developing country groups. To the writer's best knowledge, a study with this specific scale does not exist to date.
- Working with 16-year timeframe (2000:01-2015:12) while dividing into two periods as pre-crisis (2000:01-2007:12) and post-crisis (2008:01-2015:12) to see whether there is any change in dynamics.
- Using VAR (Vector Autoregression), and Panel Granger Causality models to (1) capture dynamic responses and (2) to see whether any variable hold any value in predicting the other.

1.3. METHODOLOGY

This study applies two methods to investigate the relationship between oil prices, gold prices and stock markets in BRICS and MINT economies. (1) Unrestricted individual VAR estimations with each country having its own regression, followed by analyses of impulse response functions and lead-lag properties to understand how the variables act dynamically within each countries' environment; (2) Panel Granger Causality analysis to understand if these variables possess any predictive value for each other.

First, in VAR section, Unit Root tests are run with natural logarithms of variables (except interest rates) using Augmented Dickey Fuller (ADF) Test based on Schwarz Information Criterion (SIC). An unrestricted VAR is applied for all nine countries using stock prices, gold prices, and oil prices, with addition of interest rates, consumer price indexes and exchange rates as complementary variables, using monthly data from 2000:01 to 2015:12. VAR analysis is accompanied by impulse response functions and lead-lag properties. All estimations are run with three time sets: (1) Full Set: 2000:01-2015:12, (2) Pre-Crisis Set: 2000:01-2007:12, (3) and Post-Crisis

Set: 2008:01-2015:12. Application of these divided sets serves the investigation of differences in dynamics before and after crisis scenarios.

Second, stock market data for BRICS and MINT are used for constructing five different panels: BRICS, MINT, oil exporters, oil importers, and all countries. Panel Unit Root tests are run for all groups in both log levels and first differences, lag specification being based on SIC. The study than proceeds to applying a Panel Granger Causality method introduced by Hurlin and Dumitrescu (2012), using log differences with same time frequency, this time using only stock prices, gold prices, and oil prices. Panel Granger Causality tests are based on interactions between stock markets-gold prices and stock markets-oil prices since the data for gold and oil prices consist of world prices and are same for every case. Application of pre-crisis and post-crisis time sets also exists in this section.

1.4. STRUCTURE OF THE STUDY

This thesis consists of five chapters. This chapter, the introduction, is followed by a broad examination which is aimed at building a grasp of these economies by comparing various indicators such as: Gross domestic product, sector composition, population and employment figures, net crude oil position, and stock market capitalization.

The third chapter forms the literature review section that precedes the VAR analysis. The survey does not discriminate between specific conditions and tries to capture a wide spectrum of existing studies that examine the connections between commodities and stock markets. The section is complemented by a review table which summarizes the key factors of studies including authors, year, method, data frequency and time period, variables, and key findings.

The fourth chapter includes empirical analysis that employs VAR method. The chapter begins with information on data sources, and then presents the method of estimation being used, finally unravelling by the presentation and discussion of Unit Root Tests, VAR results (with specific focus on each economy), impulse responses and lead-lag properties. Striking elements of the findings are discussed at the final stage of this chapter.

The fifth chapter opens with an additional literature survey that precedes the Panel Granger Causality analysis. This time, however, an additional summary table is not created, but the details are rather included in the Table 1 in the third section. Then the chapter demonstrates the empirical analysis that uses Panel Granger Causality. Following the description of data and discussion of the model, the chapter presents the Unit Root Tests and results for the causality analysis. The results are then accompanied by an extensive discussion of the findings.

The final section concludes of the paper. This includes a general summary of the motivation, related literature, and empirical findings. The chapter also includes comments on the study's integrity, while adding suggestions for improvement in further studies.

Remaining sections include the reference list and the appendix.

1.5. LIMITATIONS OF THE STUDY

First and most important limitation of this study is data selection and availability. This issue has several sides: (1) In this study, the "emerging market" definition includes only BRICS and MINT and leaves aside other economies that may or may not enrich the results if included. (2) Some of these economies have issues with data availability, which converted to shrinkages in common data sample. (3) Inclusion of factors such as CPI and interest rates made the use of monthly data frequency inevitable, which may translate into loss of information especially for highly dynamic series such as stock market indexes. (4) The study uses world prices of gold and oil, which neglects the situation in domestic markets. (5) Stock market indices are used as all-share indices; however, use of oil-related sub sectors could yield more subtle results in the presence of moving oil prices.

CHAPTER TWO

BRIEF LOOK AT BRICS AND MINT ECONOMIES

Before delving into data description and further analysis, it is important to visualize and review the recent economic trends of the countries of interest, within the context of the study. Not only it would help to get a grasp of the countries' recent performances, but also it would provide a level of intuition that may help forming expectations on their future performances. In this section, a brief presentation and discussion are made for the indicators such as GDP, sector composition, population, unemployment, oil exports and imports, and total market capitalization, using the latest annual data that is available for the last decade. The data for GDP, employment, total market capitalization, population, and sector composition are gathered from the World Bank; while oil indicators are gathered from the U.S. Energy Information Administration.

2.1.GDP

Country specific and group accumulated figures for BRICs and MINT countries for annual GDP (current US Dollars) are presented in Table 1.

Table 1: GDP Comparison (Current USD, billions)

GDP	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Brazil	892	1.108	1.397	1.696	1.667	2.209	2.616	2.465	2.473	2.456	1.804
Russia	764	990	1.300	1.661	1.223	1.525	2.032	2.170	2.231	2.064	1.366
India	834	949	1.201	1.187	1.324	1.657	1.823	1.828	1.857	2.034	2.089
China	2.286	2.752	3.552	4.598	5.110	6.101	7.573	8.561	9.607	10.482	11.065
South Africa	258	272	299	287	296	375	416	396	368	351	315
Mexico	866	965	1.043	1.101	895	1.051	1.171	1.187	1.262	1.298	1.144
Indonesia	286	365	432	510	540	755	893	918	913	890	862
Nigeria	112	145	166	208	169	367	409	457	509	547	487
Turkey	483	531	647	730	615	731	775	789	823	799	718
BRICS	5.034	6.070	7.749	9.429	9.619	11.866	14.460	15.420	16.535	17.387	16.638
Avg.	1.007	1.214	1.550	1.886	1.924	2.373	2.892	3.084	3.307	3.477	3.328
MINT	1.747	2.006	2.289	2.550	2.219	2.904	3.248	3.350	3.506	3.534	3.210
Avg.	437	502	572	637	555	726	812	838	877	884	803

Source: The World Bank. Writer's own arrangement.
Avg is the abbreviation for average.

Over the last decade, BRICS and MINT groups cumulatively improved their GDP values in current US Dollars. However, some emerging economies (example: Brazil and Russia) experienced slowdown during 2015. By the end of this period, China has the biggest improvement as its figures are quadrupling, followed by Nigeria. A period of stuttering can be seen while moving between 2008 and 2009, as the global financial crisis hindering economic performances. Overall, BRICS group nearly tripled their GDP, reaching 16.638 billion US Dollars at the end of 2015; while MINT group went 1,6-fold, reaching 3.210 billion US Dollars. As a result, the ratio of BRICS/MINT by GDP increased from 2.9 in 2005 to 5.2 in 2015.

2.2.SECTOR COMPOSITION

Country specific and group accumulated sector composition for these economies are presented in Table 2.

Table 2: Sector Composition (Value added % of GDP)

Industry	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Brazil	28,5	27,7	27,1	27,3	25,6	27,4	27,2	26,0	24,9	23,8	22,3
Russia	38,1	37,2	36,4	36,1	33,6	34,7	33,8	33,5	32,9	32,1	32,8
India	28,1	28,8	34,7	33,8	33,1	32,4	32,5	31,7	30,8	30,1	29,6
China	47,0	47,6	46,9	46,9	45,9	46,4	46,4	45,3	44,0	43,1	40,9
South Africa	30,3	29,4	29,7	31,4	30,4	30,2	29,9	29,6	29,6	29,5	29,4
Mexico	35,2	36,4	36,1	36,6	34,3	35,1	36,3	36,4	34,4	34,3	32,8
Indonesia	46,5	46,9	46,8	48,1	47,7	42,8	43,9	43,6	42,6	41,9	40,0
Nigeria	43,5	41,9	40,7	41,5	34,2	25,3	28,3	27,3	26,0	24,9	20,4
Turkey	28,5	28,2	27,7	27,2	25,3	26,4	27,5	26,7	26,6	27,1	26,5
BRICS (Weighted Avg.)	38,4	38,5	39,0	39,4	38,6	38,9	38,9	38,5	37,8	37,3	36,6
MINT (Weighted Avg.)	35,7	36,6	36,1	36,6	35,0	33,7	35,3	34,8	33,5	33,1	31,4

Services	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Brazil	66,0	67,2	67,7	67,3	69,2	67,8	67,7	69,1	69,9	71,2	72,7
Russia	57,0	58,2	59,1	59,5	61,7	61,4	62,2	62,9	63,3	63,9	62,7
India	53,1	52,9	46,4	47,8	48,5	48,7	49,0	50,0	50,6	51,8	53,0
China	41,3	41,8	42,9	42,8	44,3	44,1	44,2	45,3	46,7	47,8	50,2
South Africa	67,1	68,0	67,4	65,5	66,6	67,2	67,6	68,0	67,8	67,8	68,7
Mexico	61,5	60,4	60,6	60,2	62,2	61,5	60,3	60,1	62,1	62,1	63,6
Indonesia	40,3	40,1	39,5	37,5	37,1	43,3	42,6	43,0	44,0	44,8	46,5
Nigeria	23,7	26,1	26,6	25,7	28,7	50,8	49,4	50,6	53,0	54,8	58,8
Turkey	60,7	62,4	63,7	64,4	65,6	64,2	63,5	64,5	65,1	64,9	65,0
BRICS (Weighted Avg.)	51,3	52,0	51,6	51,5	52,1	52,1	52,2	52,7	53,3	53,9	54,4
MINT (Weighted Avg.)	55,4	54,7	55,0	54,0	54,5	56,1	54,8	55,2	56,8	57,2	58,6

Agriculture	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Brazil	5,5	5,1	5,2	5,4	5,2	4,8	5,1	4,9	5,3	5,0	5,0
Russia	5,0	4,5	4,4	4,4	4,7	3,9	4,0	3,7	3,8	4,1	4,6
India	18,8	18,3	18,9	18,4	18,4	18,9	18,5	18,3	18,6	18,0	17,5
China	11,6	10,6	10,3	10,3	9,8	9,5	9,4	9,4	9,3	9,1	8,8
South Africa	2,7	2,6	3,0	3,2	3,0	2,6	2,5	2,4	2,3	2,4	2,4
Mexico	3,4	3,2	3,3	3,3	3,5	3,5	3,4	3,5	3,5	3,5	3,6
Indonesia	13,1	13,0	13,7	14,5	15,3	13,9	13,5	13,4	13,4	13,3	13,5
Nigeria	32,8	32,0	32,7	32,9	37,1	23,9	22,3	22,1	21,0	20,2	20,9
Turkey	10,8	9,4	8,5	8,5	9,1	9,5	9,0	8,8	8,3	8,0	8,5
BRICS (Weighted Avg.)	10,3	9,5	9,4	9,2	9,3	9,0	8,8	8,8	8,9	8,3	8,6
MINT (Weighted Avg.)	8,9	8,7	8,9	9,4	10,5	10,3	9,9	10,0	9,7	9,6	10,0

Source: The World Bank. Writer's own arrangement.

An interesting fact, upon considering sector composition of GDP values, is that none of the countries in the two groups had a considerable change during the last decade. As of 2015, industry, services, and agriculture composition for BRICS is 36.6 %, 54.4 %, and 8.6 %; while for MINT the values are 31.4 %, 58.6 %, and 10 %, in weighted averages. Overall, the two groups have a similar composition, while China and Indonesia have relatively higher industry sector values (40.9 % and 40 %); Brazil, South Africa, and Turkey have relatively higher services sector values (72.7 %, 68.7 %, 65 %); and Nigeria, India and Indonesia have relatively higher agriculture sector values (20.9 %, 17.5 %, 13.5 %).

2.3.POPULATION, LABOUR FORCE, UNEMPLOYMENT

Country specific and group accumulated statistics for population and labour market are presented in Table 3.

Table 3: Population, Labour force, unemployment

Population (Millions)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Brazil	188	191	193	195	197	199	201	202	204	206	208
Russia	144	143	143	143	143	143	143	143	144	144	144
India	1.144	1.162	1.180	1.197	1.214	1.231	1.247	1.264	1.279	1.295	1.311
China	1.304	1.311	1.318	1.325	1.331	1.338	1.344	1.351	1.357	1.364	1.371
South Africa	48	48	49	50	50	51	52	53	53	54	55
Mexico	110	111	113	115	117	119	120	122	124	125	127
Indonesia	226	229	232	235	238	242	245	248	251	254	258
Nigeria	140	143	147	151	155	159	164	168	173	177	182
Turkey	68	69	70	70	71	72	74	75	76	78	79
BRICS	2.828	2.855	2.882	2.909	2.935	2.961	2.987	3.012	3.038	3.064	3.089
Avg.	566	571	576	582	587	592	597	602	608	613	618
MINT	543	553	562	572	582	592	602	613	624	635	645
Avg.	136	138	141	143	145	148	151	153	156	159	161

Labor Force (Millions)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Brazil	96	97	99	100	102	102	102	103	104	106	107
Russia	75	76	77	77	77	77	77	77	77	76	76
India	466	467	468	469	470	471	474	477	485	492	502
China	766	770	774	779	782	783	789	794	798	802	805
South Africa	17	18	18	19	18	18	18	19	20	20	21
Mexico	45	47	48	49	50	51	52	54	55	56	57
Indonesia	107	109	111	113	115	117	119	120	122	123	125
Nigeria	43	44	46	47	48	50	51	53	54	56	57
Turkey	22	23	23	24	25	26	27	27	28	29	29
BRICS	1.421	1.428	1.436	1.444	1.449	1.450	1.460	1.470	1.483	1.496	1.511
BRICS (W.Avg.)	552	554	556	558	560	560	564	567	572	576	581
MINT	218	223	228	233	238	244	249	254	259	264	270
MINT (W.Avg.)	68	69	70	72	73	75	76	77	78	80	81

Unemployment (% of Labor Force)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Brazil	11,4	11,5	10,9	9,6	9,7	8,5	7,8	7,4	7,1	6,8	8,5
Russia	7,1	7,1	6,0	6,2	8,3	7,3	6,5	5,5	5,5	5,2	5,6
India	4,4	4,3	3,7	4,2	3,9	3,5	3,5	3,6	3,6	3,5	3,5
China	4,1	4,0	3,8	4,4	4,3	4,2	4,3	4,5	4,5	4,6	4,6
South Africa	23,8	22,6	22,5	22,4	23,5	24,7	24,6	24,7	24,6	24,9	25,1
Mexico	3,6	3,6	3,6	3,9	5,4	5,3	5,2	4,9	4,9	4,8	4,3
Indonesia	11,2	10,3	9,1	8,4	7,9	7,1	7,5	6,1	6,2	5,9	6,0
Nigeria	7,1	7,1	7,1	7,2	7,2	7,3	7,3	7,6	7,1	4,8	4,3
Turkey	10,6	8,7	8,9	9,7	12,6	10,7	8,8	8,1	8,7	9,9	10,2
BRICS	5,1	5,0	4,6	5,0	5,0	4,7	4,7	4,7	4,7	4,7	4,8
MINT	8,7	8,1	7,5	7,3	7,7	7,2	7,1	6,4	6,4	5,9	5,7

Source: The World Bank. Writer's own arrangement.
W.Avg. is the abbreviation for Weighted Average.

A slight increase in overall population can be noticed from 2.828 million people in 2005 to 3.038 million people in 2015 in BRICS; while MINT have increased from 566 million to 618 million. Nigeria had the highest population increase with 31 percent; whereas Russia remained stable. While labour force figures have not changed drastically, unemployment figures draw a different picture as MINT have significantly improved from 8.7 percent to 5.7 percent. On the contrary BRICS had too little of an improvement. However, it should be noted that the recurring unemployment in BRICS overall is largely due to China and South Africa, as their numbers seem to worsen. In a similar fashion, the seemingly positive change in MINT overall can be attributed to Indonesia and Nigeria as they both have larger populations and have improved their employment statistics.

2.4.CRUDE OIL IMPORTS/EXPORTS AND NET OIL POSITION

Net flows of crude oil for these economies are presented in Table 4.

Table 4: Net Crude Oil Flows

Crude Oil Imports (000. Barrels Per Day)	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Brazil	351	450	379	360	437	425	375	339	332	345
Russia	115	84	73	46	54	48	36	31	13	24
India	1,789	1,912	1,938	2,156	2,412	2,557	3,185	3,267	3,355	3,696
China	1,806	2,449	2,599	2,905	3,264	3,578	4,082	4,754	5,052	5,421
South Africa	465	471	538	443	452	468	501	399	420	426
Mexico	8	6	8	10	12	9	11	8	8	10
Indonesia	371	406	416	308	298	258	374	395	384	392
Nigeria	0	0	0	0	0	0	0	0	0	0
Turkey	486	482	472	485	470	435	286	341	364	395
BRICS	4,525	5,365	5,526	5,910	6,619	7,075	8,179	8,790	9,172	9,912
MINT	864	894	896	802	780	701	670	744	757	797

Crude Oil Exports (000. Barrels Per Day)	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Brazil	242	230	270	362	428	440	526	631	604	533
Russia	4,520	5,211	5,222	5,106	5,172	5,120	4,891	4,888	4,892	4,807
India	0	0	0	0	0	0	0	0	0	0
China	163	110	161	127	78	85	104	61	50	49
South Africa	0	0	0	10	61	0	10	0	0	0
Mexico	2,107	2,095	2,038	1,977	1,793	1,499	1,303	1,403	1,365	1,280
Indonesia	0	0	366	259	317	273	401	355	303	296
Nigeria	2,164	2,176	2,260	2,190	2,120	1,932	2,115	2,341	2,402	2,411
Turkey	0	0	0	0	0	0	0	0	0	7
BRICS	4,925	5,551	5,653	5,605	5,738	5,645	5,530	5,580	5,547	5,389
MINT	4,271	4,271	4,664	4,426	4,230	3,704	3,820	4,098	4,071	3,994

Net Crude Oil Position (000. Barrels Per Day)	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Brazil	-109	-219	-109	2	-9	15	151	293	273	188
Russia	4,406	5,127	5,150	5,060	5,118	5,072	4,855	4,856	4,879	4,783
India	-1,789	-1,912	-1,938	-2,156	-2,412	-2,557	-3,185	-3,267	-3,355	-3,696
China	-1,643	-2,339	-2,438	-2,777	-3,186	-3,493	-3,978	-4,693	-5,001	-5,372
South Africa	-465	-470	-537	-433	-391	-468	-491	-399	-420	-426
Mexico	2,100	2,088	2,030	1,968	1,781	1,490	1,293	1,394	1,357	1,270
Indonesia	-371	-406	-51	-49	18	15	27	-41	-81	-96
Nigeria	2,164	2,176	2,260	2,190	2,120	1,932	2,115	2,341	2,402	2,411
Turkey	-486	-482	-472	-485	-470	-435	-286	-341	-364	-388
BRICS	399	186	128	-305	-881	-1,430	-2,648	-3,210	-3,625	-4,522
MINT	3,407	3,377	3,768	3,624	3,450	3,002	3,149	3,354	3,314	3,197

Source: The U.S. Energy Information Administration. Writer's own arrangement.

As of 2012, BRICS are net oil importers, and this is the case since 2006, while the change may be attributed to increasing oil imports by India and China over the period from 2003 to 2012. Russia and Brazil are the sole net exporters in the group, while effectively Russia is the only one that deserves attention with 4.783 thousand barrels of crude oil exports per day as of 2012, which have only slightly changed from 4.406 barrels per day in 2003. Thanks to Nigeria and Mexico, MINT are net oil exporters, with a slight decrease from 3.407 barrels per day in 2003 to 3.197 bpd in 2012. Mexico have shrunk the exports from 2.107 bpd in 2003 to 1.280 bpd in 2012;

while Nigeria had a slight increase from 2.164 bpd to 2.411 bpd. Turkey and Indonesia remained net importers, while Indonesia remained an exporter only from 2007 to 2009.

2.5.MARKET CAPITALIZATION

Market capitalization ratio of stock markets of BRICS and MINT are presented in Table 5.

Table 5: Market Capitalization

Current USD, Billions	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Brazil	475	710	1.370	592	1.337	1.546	1.229	1.227	1.020	844	491
Russia	549	1.057	1.503	397	762	951	784	825	771	386	393
India	553	819	1.819	647	1.307	1.632	1.007	1.263	1.139	1.558	1.516
China	402	1.145	4.479	1.779	3.573	4.028	3.412	3.697	3.949	6.005	8.188
South Africa	549	711	828	483	799	925	789	908	943	934	736
Mexico	239	348	398	234	352	454	409	525	526	480	402
Indonesia	81	139	212	99	215	360	390	428	347	422	353
Nigeria	22	33	85	48	32	51	39	56	81	63	50
Turkey	160	161	285	118	232	302	197	315	196	220	189
BRICS	2.527	4.443	9.999	3.898	7.778	9.082	7.221	7.921	7.822	9.727	11.324
BRICS (Weighted Avg.)	470	981	2.866	1.140	2.431	2.738	2.269	2.538	2.700	3.986	5.735
MINT	503	681	979	498	831	1.168	1.035	1.325	1.149	1.185	994
MINT (Weighted Avg.)	178	238	308	158	261	341	307	385	337	342	288

Market CAP / GDP	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Brazil	0,53	0,64	0,98	0,35	0,80	0,70	0,47	0,50	0,41	0,34	0,27
Russia	0,72	1,07	1,16	0,24	0,62	0,62	0,39	0,38	0,35	0,19	0,29
India	0,66	0,86	1,51	0,55	0,99	0,99	0,55	0,69	0,61	0,77	0,73
China	0,18	0,42	1,26	0,39	0,70	0,66	0,45	0,43	0,41	0,57	0,74
South Africa	2,13	2,62	2,77	1,68	2,70	2,46	1,89	2,29	2,56	2,66	2,34
Mexico	0,28	0,36	0,38	0,21	0,39	0,43	0,35	0,44	0,42	0,37	0,35
Indonesia	0,28	0,38	0,49	0,19	0,40	0,48	0,44	0,47	0,38	0,47	0,41
Nigeria	0,20	0,23	0,51	0,23	0,19	0,14	0,10	0,12	0,16	0,11	0,10
Turkey	0,33	0,30	0,44	0,16	0,38	0,41	0,25	0,40	0,24	0,28	0,26
BRICS	0,50	0,73	1,29	0,41	0,81	0,77	0,50	0,51	0,47	0,56	0,68
MINT	0,29	0,34	0,43	0,20	0,37	0,40	0,32	0,40	0,33	0,34	0,31

Source: The World Bank. Writer's own arrangement.
CAP is the abbreviation for capitalization.

All stock markets have shrunk in value from 2007 to 2008 -an immediate result of the financial meltdown, emerging during 2007 and still being recovered from to the recent date. By 2015 both groups have surpassed their market capitalization numbers; although there are interesting changes when looked upon closely. Specifically, Russia and China have lost their momentum after the year 2012. At the end of 2015 Mexico is levelled with its 2007 performance, while China and Indonesia are the flag carriers and have improved the most, 83 percent and 67 percent respectively. All other

economies are behind their pre-crisis market capitalization. Compared to their pre-crisis levels in 2007, all the nine emerging economies have lower ratios of market capitalization to GDP as of 2015.

2.6.GOLD RESERVES AND GOLD DEMAND

Official reserves of gold and consumer demand of BRICS and MINT are presented in Table 6 and 7.

Table 6: Official Gold Reserves

Gold Reserves (Tonnes)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Brazil	34	34	34	34	34	34	34	67	67	67	67
Russia	387	401	450	520	649	789	883	958	1,035	1,208	1,415
India	358	358	358	358	558	558	558	558	558	558	558
China	600	600	600	600	1,054	1,054	1,054	1,054	1,054	1,054	1,762
South Africa	124	124	124	125	125	125	125	125	125	125	125
Mexico	3	3	4	6	9	7	106	125	123	123	121
Indonesia	96	73	73	73	73	73	73	74	78	78	78
Nigeria	21	21	21	21	21	21	21	21	21	21	21
Turkey	116	116	116	116	116	116	195	360	520	529	516
BRICS	1,502	1,517	1,566	1,636	2,419	2,559	2,653	2,762	2,839	3,012	3,927
MINT	237	213	214	217	219	218	396	580	742	751	736

Source: World Gold Council

Table 7: Consumer Gold Demand in Selected Countries

Gold Demand (Tonnes)	2010	2011	2012	2013	2014	2015
Brazil	29	26	28	26	24	21
Russia	60	64	68	80	75	48
India	1002	974	914	959	833	857
China	646	816	856	1346	1005	982
Mexico	27	22	18	18	18	19
Indonesia	51	61	62	88	63	59
Turkey	109	146	114	184	117	72
EM Selected	1924	2109	2060	2700	2136	2058
World total	3258	3597	3449	4430	3566	3507

Source: World Gold Council
EM stands for Emerging Markets

Table 6 shows that China and Russia have the largest gold reserves among BRICS and overall. Indonesia and South Africa are the only two countries with steady values of gold reserves. In total, BRICS and MINT economies had around 6% of the total reserves in the world in 2005. This figure has grown up to 14% by 2015. The data

for consumer gold demand (table 7) is unfortunately limited and do not include Nigeria and South Africa. In total, EM selected countries create a big portion (59%) of the consumer demand for gold in the world. Another visible property is the slight drop in demand in most countries after 2013. Whether this trend signals a shift in consumer preference towards other investment opportunities is open to question, along with its underlying cause.

CHAPTER THREE
LITERATURE REVIEW: STUDIES ON THE RELATIONSHIP BETWEEN STOCK MARKETS, GOLD PRICE AND OIL PRICES

Huang et al (1996) examine the information transmission between oil shocks and stock prices by a VAR method using daily return series of oil futures (NYMEX, closing prices), S&P 500 index, and one-month Treasury bill from 09-10-1979 to 16-03-1990. The study finds that oil futures returns lead stock returns, but the process is not affected by interest rates. This result is consistent with stock returns of oil companies but not with all the other stock returns -even the stock returns of transportation companies do not exhibit such relationship.

Sadorsky (1999) investigates the impact of oil price shocks on stock market returns. Using monthly data from 1947:1 to 1996:4, US industrial production, interest rates, real oil prices, real stock returns (S&P500), and CPI inflation rate were employed in an unrestricted VAR model. Findings imply that oil prices and oil price volatility affect economic activity. The effect seems to be strong when channelled from oil to economic activity but gets weaker when reversed. Oil price movements are able to explain movements in stock returns according to impulse response functions. The author also finds that positive shocks to oil prices affect real stock returns negatively, while interest rates and industrial production gets positively affected from the shocks to real stock returns.

Papapetrou (2001) examines the Greek economy, while considering the connections between oil price shocks, stock market returns, economic activity and employment. Using monthly data from 01/1989 to 06/1999 in a VAR model, Papapetrou discovers that oil price shocks explain a significant proportion of fluctuations in both economic growth and employment growth, while the same connection cannot be traced when the shock is coming from stock returns. On the other hand, oil prices are found to be an explanatory factor of stock market movements. An oil price shock has immediate negative effects on industrial production and stock returns (cost and financial performance factor in firm level), while it raises interest rates (through inflationary pressures).

Maghyereh (2004) uses VAR approach with daily data of stock market indices and Brent oil from 1998 to 2004 for 22 emerging countries and examines dynamic linkages between oil price shocks and stock market returns. The study assumes that the oil price might directly or indirectly affect the economy as it is being a cost factor; and the effect's appearance in stock market depends on how efficient the market is. Findings indicate that crude oil price shocks do not create any significant deviation on emerging stock markets, implying that the importance of oil price for aggregate economy in the emerging countries might be overestimated. Detailed examination shows that crude oil shocks were able to explain no more than 2 percent of the forecast error's variances; and for most of the countries under investigation this explanatory power seems less than 1 percent. However, the impact of oil shocks in stock markets was largest in economies with higher energy-intensive consumption. The stock markets in emerging economies seem not to rationally reflect changes in the oil prices, as the response time to oil shocks are roughly 2 days and they seem to taper-off around day 4.

Cong et al (2008) investigate the effects of oil price shocks on Chinese stock market, using multivariate VAR model with monthly data for the period from 1996:1 to 2007:12. Authors use Brent crude oil price, short term interest rates, various Shanghai and Shenzhen stock market indices, CPI of China, and industrial production data –all adjusted to cancel out seasonal fluctuations. Findings indicate that, for Chinese stock markets, oil price shocks do not create a significant impact, except when the analysis is tailored to account for manufacturing index and some oil companies where oil price shocks prove to be associated with stock prices. The study also indicates that oil price shocks (both for world and Chinese prices) seem to explain differences in the manufacturing index more than interest rates.

There is a common belief regarding commodity market, as if commodity prices rise and fall together. While this may be true regarding the fact that all the variables considered get affected from common macro indicators, the common movement may not exist due to these commodities having diversified economic uses. In this framework, Hammoudeh et al (2008) examine the co-movements among silver, gold, copper, and oil, using daily data from 2.1.1990 to 1.5.2006 in an ARDL approach, while also adding macro financial variables such as interest and exchange rates.

Results suggest that the oil price, although commonly believed, do not lead the movements of other commodities. Another keynote is that increases in prices of gold and silver depreciates the US dollar (flight to precious metal safety), while increases in interest rate results in other direction. For commodity exporters, the relationship is on the positive side as it adds to the currency appreciation against US dollar; while gold appears to be the strongest commodity that creates this impact.

Park and Ratti (2008) investigate the effects of oil market shocks on stock market prices while focusing on the US, Germany, Belgium, Spain, Greece, Sweden, UK, Finland, Italy, Denmark, Norway, Netherlands and France. Using monthly data of oil prices, real stock returns, CPI, interest rates, and industrial production from 01/1986 to 12/2005 in a VAR model, the study detects oil prices having significant effects on real stock returns, which are especially in a positive direction when an oil exporter (Norway) is on scope, and in opposite direction for most of the remaining countries. The study also finds that oil price shocks contribute to the variability in real stock returns much more than the remaining variables.

Apergis and Miller (2009) use monthly data of stock market indices, oil prices, global oil production, CPI, and global real economic activity for Australia, Canada, France, Germany, Italy, Japan, the UK, and the US, ranging from 1981 to 2007. While using a VAR model, the study finds that oil market shocks do not appear to cause large reactions in international stock markets, as their responses are depicted as significant but small.

Soytas et al (2009) examine the transmission of information between Turkish economy's specific indicators (interest rate, TRY-USD exchange rate, domestic spot gold and silver prices) and the world oil price, using daily data from 2003 to 2007 in a VAR model. The paper admits that Turkey is considerably a small player in the world arena and its oil consumption shares the same fate in relative volume; its markets are emerging and have their own long run properties. On the other hand, the relative importance of natural gas, coal and oil in aggregate energy is evolving due to the increase in the first two; and this may have rendered the Turkish markets less sensitive to world oil price changes. The study finds that the oil price cannot be taken as an explanatory indicator of metals, interest rate, and exchange rate in the long run, and the result is the same when reversed. This indicates that the world oil prices seem not

to affect Turkish markets in short run or long run. However, interest rate in Turkey seems to granger-cause some of the metal prices and macro indicators (exchange rate, gold and silver prices), suggesting that interest rate in the Turkish economy is a powerful policy tool as it can create deviations in precious metal markets and exchange rates. However, the existence of imported inflation somehow hurts the effectiveness of monetary policy while rising interest rates cannot offset the lira depreciation as much as desired. The IRF's of the study suggests that in the short run oil price movements affect metal spot prices negatively, while the response was positive for the interest rates. Another finding suggests that devaluation in the Turkish lira leads to a rising interest in the gold market, stating that gold is considered a safe haven during times of devaluation.

Malik and Ewing (2009) examine the volatility transmission between oil prices and equity sector returns, using weekly returns of WTI oil price and Dow Jones index from 01/1992 to 04/2008 in a bivariate GARCH model. The study investigates 5 different US sector indices and assures the reader that it is important to understand the volatility transmission dynamics due to financial assets being traded according to these sectors' return performances. The dynamics may also include a type of information transfer as news in one sector may impact the others. The study finds that the oil return volatility is directly affected by its own news and volatility, and by the return volatility of consumer services sector; while it is indirectly affected by industrial and health-care sectors.

Kilian and Park (2009) investigate the impact of oil price shocks on the US stocks, using a VAR model with monthly of stocks prices, real economic activity, crude oil price, and change in oil production from 1973:1 to 2006:12. The study criticises the literature for holding oil price exogenous with respect to the global economy; due to global macroeconomic fluctuations influencing the oil price. Empirical results indicate that 22 percent. of the variation the aggregate stock returns are explained by shocks to crude oil market; among these shocks, the biggest portion is demand-sided. The study also finds that the underlying cause of oil price increase greatly changes its impact on the stocks, at the industry level: if the price increase is coming from positive movements in the global activity, share prices of retail, automobile, gas, and mining industries tend to increase. However, an oil-market

specific demand shock appears to result in varying responses: mining stocks rise, petroleum and natural gas does not respond, while retail and automobile stocks fall significantly.

Zhang and Wei (2010) investigate the causality and cointegration between oil and gold, using daily data of Brent crude oil and gold (London pm fix) from 04.01.2000 to 31.03.2008. The authors remind that crude oil and gold occupy a big proportion of the large commodity market; hence the interactive mechanism among them, as well as their own dynamics, is of great importance. Empirical results show that (1) the volatility of crude oil is much greater than of gold; (2) there is significant cointegration, thus a long-term equilibrium between the two markets; (3) the crude oil price return Granger causes the price return of gold; and (4) the role of crude oil is larger than gold in terms of affecting the larger commodity market price trend.

Choi and Hammoudeh (2010) examine the volatility behaviour of oil, commodity and stock markets. They use the method DCC-GARCH with weekly data of gold, silver, copper, and oil, along with S&P500 index from 1990:01 to 2006:05. The study indicates that the interconnectedness of variables may vary during different occasions of volatility behaviour. Especially after 2003, commodity correlations are found to be rising, and this is interpreted as a reduction in hedging opportunity, while on the other hand it is expected to get easier for the monetary authority to direct the commodity movements as a whole. Among commodities, gold is found to have the highest duration of volatility regime, implying that investors should consider long-term investments to cancel out high volatility. Similar advice is given for the stock market as it has the highest duration of volatility regime compared to all the other variables.

Throughout the history, gold received high demand during times of economic or political turbulences; when financial markets seemed short of providing prospect, investors move towards gold as an alternative safe instrument. There is a prevalent belief that gold preserves its purchasing power in the long run better than other valuables; it also has a high liquidity and can be exchanged for money at any time. For these reasons, gold is used as a hedge tool against inflation and currency depreciation –which implies that investment in gold reflects the fears of inflation and political risk. In this mechanism, gold is considered to be a safe haven which provides comfort

against the fear of uncertainty. For instance, an increase in the oil prices may lead to inflationary pressures, which in turn lead to hedging against uncertainty in the form of investment in gold (Sujit and Kumar, 2011).

Sujit and Kumar (2011) use daily time series data from 2nd Jan 1998 to 5th Jun 2011 to investigate the impact of interrelationship among gold price, stock market returns (S&P 500), crude oil price and exchange rates using vector autoregression and cointegration techniques. The paper suggests that the results of interrelations among relationship are mixed and this could be due to various techniques and time period used by varying studies. Thus, the absence of consensus is understandable, but it also increases the importance of verifying these relationships with sophisticated techniques. The study finds that the fluctuations of in the price of gold are largely influenced by gold itself rather than other commodities. But gold price in fact seems to influence the WTI index at around 4 to 5 percent. The study also finds that a shock in WTI (Brent oil) explains 3 percent (6-7 percent) of the fluctuations in the exchange rate; while the innovations in the gold index explains 10 percent. Innovations in WTI explain roughly 2 percent of S&P Index, while innovations in S&P explains around 1.5 percent of gold as the findings suggest.

Le and Chang (2011) investigate the relationship between the prices of gold and oil using monthly data from 1986:1 to 2011:4. The paper uses an unrestricted trivariate VAR model, and Granger causality analysis for variables such as WTI crude oil, gold (London PM Fix), the US CPI index, the US dollar index, with all data being seasonally adjusted. Theoretically, the relationship is considered from several points: (1) if oil exporters invest in gold in the wake of a rise in their oil revenues (as a risk diversification), the expansion in oil revenues may reflect itself as an expansion in the gold market, suggesting that the price volatilities of both markets may move in the same direction; (2) if oil price increases, its effect as a cost factor may disrupt companies' performances thus reducing their share prices, which in turn may result in a search for alternative assets such as gold, eventually causing a hike in their values; (3) a possible hike in oil price may also provide an inflationary pressure mechanism for the economy in a broad scale, which in turn may convert into instinct of hedging, raising both the demand and the price of gold, respectively. Paper reminds the reader that common factors also drive prices of gold and oil: (1) they are traded in US dollar

and are exposed to its fluctuations, (2) they are exposed to effects coming from geopolitical factors. The study finds long-run relationships between oil price-inflation, inflation-gold price, and prices of gold and oil. Granger causality analysis also supports the idea that in the long run rising oil price causes inflationary movements. This translates into a higher demand in gold and eventually raises the gold price. Trivariate relationship analysis among gold, oil, and US dollar index points to a co-integrating long-run relationship among the three. The study (1) supports the idea of gold being a hedge instrument against inflation, (2) and suggests that the oil price can be used as a predictor of the gold price as the former seems to cause the latter.

Masih et al (2011) use a Vector Error Correction model in order to assess the effects of oil price fluctuations and volatility on stock market performance, focusing on South Korea. The investigation is based on monthly data from 1988:05 to 2005:01 (which covers the Asian Crisis period in 1997) and consists of variables such as stock returns, real oil prices, oil price volatility, interest rates, and industrial production. The study indicates that oil price movements significantly affect the stock market; while oil price shocks (1) decrease the profitability of firms and (2) and this decrease is affecting the investor behaviour in advance because it is foreseen. Authors then suggest that, for countries where oil consumption is surging with economic activity, governments should utilize oil-saving measures in order to hold fast against extreme cases of oil price volatility which may harm the economy on a broad scale. These measures, as they suggest, may include cooperation with oil-exporters, improving energy efficiency, promoting energy conservation, and using alternative sources.

Le and Chang (2011) investigate Japan using monthly data from 2008:1 to 2011:02 in an Autoregressive Distributed Lag model that consists of WTI crude oil, exchange rate, stock price index, CPI, interest rate, and gold (London afternoon monthly average). Authors explain that since Japan is a major oil consuming –and gold holding- country, deviations in these two commodities carry the risk of delivering significant macroeconomic results. The paper suggests that in the long run, Japanese stock market and gold price seem to create positive deviations on the Japanese interest rate. The channelling mechanism is presented in such a way that the prices of gold and stocks form an expectation of increasing inflation, which in turn results in an increase

in interest rate. This relationship also hints that investors may hold gold or stock or both against the losses in Japanese currency, since the two assets fluctuate against it.

Filis et al (2011) use an ADCC-GARCH-GJR approach with monthly data from 1987:01 to 2009:09 and focuses on the dynamic relationship between stock market and oil prices, while dividing between oil-importing and oil-exporting countries. Along with stock market indices of Canada, Mexico, Brazil as oil exporters and the US, Germany and Netherlands as oil importers, the paper uses Brent crude oil index as it is proportionally larger in daily production. Interestingly, regardless of countries' position as an oil exporter or importer, time-varying correlation between oil and stocks does not show difference. Aggregate demand side oil price shocks seem to affect all stock markets in the same direction due to their origination lying in global business cycles. However, fluctuations of business cycles prove to have a stronger effect on correlations when compared to supply-side shocks. Authors also indicate that non-economic crises create a negative link between oil and stocks while economic crises create a positive link. Thus, during economic problems, the oil market does not seem to provide shelter as an alternative investment opportunity.

Sumner et al (2011) study the spillover effects among gold, US stocks and bonds during the period 1970-2009, using weekly data, along with the spillover index methodology introduced by Diebold and Yilmaz (2009). The paper finds no strong relationship between gold-stocks and gold-bonds; implying that gold cannot be considered as a predictor of stocks and bonds –contradicting the belief that investing in gold against stock markets is a proper counter measure. However, gold seem to have slight negative correlation with stocks and bonds, leaving space for portfolio diversification. Volatility spillovers are documented as being elevated during the recent crisis period (2008 financial crisis), while also peaking during early 80's and mid 90's, with no specific trend is being detected.

Chan et al (2011) explore the asset market linkages between commodities, real estate assets, and financial assets, using a Markow switching model with monthly returns of S&P500, WTI crude oil, and gold prices, covering the period between 01/1987 and 12/2008. The paper associates the tranquil (economic expansion) periods with lower volatility and positive stock returns, with slight tendency to flight from gold market to stocks; while associating crisis periods with higher volatility, negative stock

returns, and flight from stocks to treasury bonds (flight to quality) -accompanied by a trend of contagion between stocks, oil and real estate. The paper suggests that during crisis, portfolio allocations can logically be biased towards gold and treasury bonds, while during expansion periods the allocation could be bent towards stocks, real estate and oil. During economic decline, stocks and other assets share a level of contagion, while the spread does not seem to affect treasury bonds, implying that risk-averse investors may want to hold treasury bonds in terms of risk diversification.

Zhu et al (2011) use a panel threshold cointegration method to investigate the relationship between crude oil shocks and stock markets, with monthly data from 1995 to 1999, for 14 OECD and Non-OECD countries. The US price of WTI, and real stock prices of countries (both deflated) are used with additional regressors such as industrial production, and short-term interest rates. The study explains that many underlying variables affecting the stock and oil markets may have asymmetric adjustment processes; and ignoring these might lead to misleading conclusions. For example, a bearish or bullish market may have different reaction characteristics to reflect oil price movements. Financial markets may also react differently according to the availability of various instruments, let alone the willingness of investors to partake in such continuous adjustment considering the costs. Results of the study indicate a bidirectional long run Granger-causal relation between crude oil and stock markets; with crude oil prices and stock prices driving each other positively in circular motion, while the issue of high oil prices affecting stock prices positively seems a contradiction to the theory due to having only one oil exporter in the country group. The paper suggests that other domestic factors may have had a more dominant effect on the stock prices.

Hsing (2011) focuses on South Africa while investigating the movements of stock markets and macroeconomic variables, using quarterly data of South African stock market and various financial variables from 1980: Q2 to 2010:Q3 in an exponential GARCH model. The study finds that South African stock market index reacts positively to GDP growth, the ratio of money supply to GDP, and the US stock market index; while it reacts negatively to the ratio of government to GDP, domestic real interest rate, exchange rate, domestic inflation rate, and the US government bond yield. Paper also suggests that the authorities may want to achieve fiscal discipline,

economic growth, lower interest and inflation rates, and a higher M3/GDP in order to help the stock market performance.

Ray (2012) studies the impact of macro variables (CPI, gold prices, industrial production, oil price, interest rate, money supply, foreign exchange rate, gross fixed capital formation, FDI, GDP, wholesale price index, balance of trade, and foreign exchange reserve) on the stock prices (BSE) of India. Using annual data from 1990 to 2010, Ray conducts a multiple regression analysis and also applies Granger Causality tests to capture causal linkages among variables. Regression results indicate that gold and oil prices have negative effect on stock prices, implying that gold might be regarded as an alternative investment asset. On the other hand, GDP, BoT, interest rate, foreign exchange reserve, money supply, and industrial production appeared to have positive effects on stock prices. Granger causality tests find unidirectional causality between stocks and inflation (FDI, GDP, exchange rate, gross fixed capital formation); and bi-directional causality between stocks and foreign exchange reserve (money supply, oil price, wholesale price index).

Basher et al (2012) use VAR approach with monthly data of emerging countries between 1998:01 and 2008:12; and focuses on the dynamic relationship between oil prices, exchange rates, and stock markets; while stating that the relationship between these variables in emerging markets has to be understood due to the fact that the emerging economies are gaining louder voice in the world economy day by day. One result of this progress is that the demand for oil is increasing rapidly in these countries, opposed to the steady consumption in developed world, a situation which carries the possibility of affecting other dynamics in the economy in real terms. IRF's in the study conclude that the stock prices respond negatively to a shock in the oil prices (significant for 2-3 months period); while oil prices respond positively (significant for 2-8 months period) when the examination is reversed. The second result falls into the same direction with the argument that emerging market growth, as traced from the movements in stock market, is driving the demand and resulting in upward trend in the oil market. The study also tells us that in the short run, positive oil price shocks result in a drop in the trade-weighted exchange rate (significant for 5-6 months). When reversed, the study did not find any indication of oil prices getting affected by the exchange rates. Therefore, main plot of the findings indicate that oil

prices reflect positive shocks to the emerging stock markets in the same direction, which plays nicely with the theory of supply and demand dynamics for the oil market.

Samanta and Zadeh (2012) examine the co-movements between gold, stocks, real USD exchange rate and crude oil price, using daily data from 1989 to 2009. Like other studies (Sujit and Kumar, 2011; Baruník et al, 2013), the importance of increasing integration of financial markets, and the effect of financial indicators to affect other macroeconomic variables is being stated. The paper then employs a vector autoregressive moving average model that enables to understand the dynamic relationships among series over time. Findings suggest that stock price and gold price are largely influenced by themselves, while exchange rates and oil price can be influenced by other variables. Spillover indexes among all variables are calculated as 0.7 percent for one-step forecast; and as 6.7 percent for two-step forecast; implying that spillover effects become larger for longer horizons.

Lee et al (2012) examine the asymmetric long-run relationship between WTI crude oil and gold futures, using daily data from 1.5.1999 to 20.11.2008 in TECM-GARCH analysis, to assess whether oil futures affect the prices of gold futures; in other words, whether there is a long run relationship between the two markets. The analysis detects an asymmetric long run relationship between gold and oil. Especially when the price of oil deviates from the level of 40$ (+/-), WTI seems to act dominant in affecting the gold price.

Baruník et al (2013) emphasize the trend in global financial market in terms of becoming an interconnected ecosystem; in which co-movements in asset prices gain higher importance every day. The paper tries to test the hypothesis of homogeneity in dynamic correlations across various investment horizons among assets, by using wavelets. Importance of three commodities, according to the study, can be simplified as (1) gold being perceived as a store of wealth especially in during economic and political stability; (2) oil being vital to production from an industrial perspective and being highly traded on a daily basis, whose price is strongly determined by supply and demand; (3) stocks being a reflector of economic and financial development of firms, while they also represent perceptions of aggregate economic development and investment opportunities. The inflationary mechanism from rising oil prices to inflationary pressures and increasing investment in gold as in Sujit and Kumar (2011)

is also mentioned here. The study utilizes a time-frequency analysis with both daily and intra-day data from 1978 to 2012 to find that correlations between gold, oil and stocks become homogeneous after the 2008 crisis, and it also states that all three assets can be held together in a well-diversified portfolio for investment purposes. The paper states that investment horizons approach is critical due to (1) Investors' behaviour of risk being inversely related to time and varying investment horizons and this being already mentioned by Samuelson (1989) and Marshall (1994); (2) the existence of monthly, weekly, and speculative intra-day investors with changing strategies; (3) the heterogeneity of market behaviour, the interactions among assets, and the possible dynamic correlation among them being able to create patterns that are far from being generic.

Baruník et al (2013) indicate that during crisis periods, correlations between the assets become heterogeneous; while pre and post-crisis periods present homogeneous correlations. Findings include existence of low and negative relationship between gold and oil until 2005; between gold and stocks until 2001; and between oil and stocks until 2004. A structural break in the correlation between gold and oil is discovered, as their correlation increases significantly. Similar breaks were found for gold-stocks in 2009 and for oil-stocks in 2008. With intra-day frequency analyses, the study finds that during 1987-1991 and 2006-2009, there exists heterogeneity in correlations for all three pairs of gold, oil and stocks. It is also said that increased correlations in post-crisis period does not differ in varying investment horizons; however, during economic downturn heterogeneity emerges in linkages among these assets over time and across different investment horizons.

Using data from both the US and the UK, Ciner et al (2013) investigate the return relationships between major assets, based on their evaluation that dependencies across assets are: (1) important for portfolio managers due to their strategies depending on these correlations, (2) important for policy makers due to the possibility that their decisions may have wide spread influences with the help of information spillovers across asset classes. The study examines the time varying nature of correlations and focuses on the ability of gold and oil to provide shelter while other assets like stocks and bonds ill-perform. Using daily data from 1990:01 to 2010:06, the study employs S&P500 and FTSE indexes, 10-year government bonds, exchange rate indexes, gold

futures (NYMEX and London A.M. fix), crude and Brent oil futures. According to findings, both the US and the UK market data suggest that gold can be a hedge instrument against exchange rate fluctuations, while on average bond market seems provide hedge against equity market.

Creti et al (2013) use DCC GARCH with daily data from 2001 to 2011 for the examination of the links between commodity markets' volatility and stocks. Due to various commodities being used extensively in investment portfolios, the paper suggests that it is important to analyse their interconnections in order to build substitution strategies; thus, spot prices of 25 commodities are employed in the study (energy, food, metals, livestock, etc.) along with SP500 index. Study suggests that, in general, the volatility evolve over time and are highly volatile especially after 2007-08 financial crisis; while correlations between stocks and commodities rise during the crisis and. Among others, oil proves to be the most related to the stock market; as it is explained through the cost mechanism, where a price hike in oil converts to rising costs, reduced profits, and eventually to lower shareholder value. Correlations between the oil price and stocks tend to increase during times of rising stock prices; while they decrease and switch to negative during 2007-08 crisis; meaning that they do not provide diversification material. Gold acts with an adverse trend of evolution in times of declining stock prices, supporting the notion that gold is a safe haven during times of stock market discomfort. All results point to the fact that 2007-08 crisis acted as a disturbing phenomenon for the links between commodities and stocks; while high correlation during crisis can be regarded as the footprint of how commodity markets are financialized; and this phenomenon is traceable especially in the movements of oil as it is the most financialized commodity.

Mollick and Assefa (2013) employ GARCH and MGARCH-DCC models with daily data from 1999:01 to 2011:12 to examine the behaviour of oil prices and the US stock returns, while including other variables such as gold prices, interest rates, inflation expectation, and the USD/EUR exchange rate. The finds that, before the 2009 financial crisis, stock returns were negatively correlated with oil prices and the USD/EUR; however, this relationship changed after 2009 while the US stock returns now seem to be positively correlated with oil prices and weaker USD/EUR.

Using daily data from 1991:01 to 2012:10, Bhunia (2013) looks into the causal relationship and cointegration among oil price, gold price and financial variables (BSE and NSE). Paper finds that according to Johansen cointegration analysis there exists a long-term relationship between selected variables; and indicates that the variables are closely interlinked. As for India, the world's largest market for gold consumption, gold appears to act as a safe-haven; while the demand for gold as a financial instrument and jewellery did not see a decline although several financial crises (Asian crisis, Global financial crisis, European crisis) were present during the sample period. Paper also reminds that oil importers should study the effects of oil price changes for their economies, since the oil price is unpredictable and associated with exchange rates and stock prices. Bhunia and Mukhuti (2013) finds that domestic gold price and Indian stock market does not have any Granger Causality relationship between 1991 and 2012.

Ewing and Malik (2013) analyzes the transmission between gold and oil futures; using daily returns from 1993:01 to 2010:06 in a bivariate GARCH model. When structural breaks in variance are accounted for, the study finds evidence for direct transmission of volatility between gold and oil markets (which turns into indirect when structural breaks are neglected).

Another study by Mensi et al (2013) that examines correlations and spillovers among commodities and stock markets uses VAR–GARCH analysis with daily returns of S&P 500 index, Brent oil, wheat, gold and beverages from 2000:01 to 2011:12. The paper finds significant transmission of volatility among S&P500 and commodity markets; while deviations in S&P500 seem to influence the oil and gold markets the most.

These studies are summarized in Table 8 below:

Table 8: Literature Summary

Author(s), Year	Method	Frequency	Period	Variables	Results
Huang et al (1996)	VAR	Daily	1979-1990	Oil futures (NYMEX), S&P500 index (and individual companies), 1-month Treasury Bill	*Returns of oil futures lead stock returns of oil companies *No relationship with interest rates *No relationship with broad stock index
Sadorsky (1999)	Unrestricted VAR	Monthly	1947-1996	Us industrial production, Interest rates, Real oil prices, Real stock returns, CPI	*Impulse response functions: oil price movements are able to explain stock returns *(+) shocks to oil → (-) effect on stock returns *(+) shocks to stock returns → (+) effect on interest rates and industrial production
Papapetrou (2001)	VAR	Monthly	1989-1999	Industrial production, interest rate, real oil price, CPI (Greece), industrial employment, real stock returns	*Oil price shocks explain a significant proportion of fluctuations in both economic growth and employment growth *Oil price shocks have immediate (-) effects on industrial production and stock returns
Maghyereh (2004)	VAR	Daily	1998-2004	22 emerging stock market indices, Brent Oil	*Crude oil shocks don't have significant effects on emerging stock markets *However, the effects are relatively larger in economies with higher energy-intensive consumption
Hammoudeh et al (2008)	ARDL	Daily	1990-2006	Oil, Gold, Silver, Copper, US interest rates, US exchange rate	*Oil price does not lead the movements of other commodities *Increases in prices of gold and silver depreciates the USD *Increases in the interest rate appreciates the USD
Cong et al (2008)	Multivariate VAR	Monthly	1996-2007	Oil, interest rates, CPI, industrial production, Chinese stock market indices	*Oil price shocks are associated with stock prices only for manufacturing index and for some oil companies *Oil price shocks explain differences in the manufacturing index better than interest rates
Park and Ratti (2008)	VAR	Monthly	1986-2005	Oil prices, real stock returns, CPI, interest rates, and industrial production (multiple countries)	*Oil prices have significant effects on stock returns, especially (+) for oil exporters (Norway); (-) in other countries *Oil price shocks contributes to the variability in real stock returns more than other variables
Apergis and Miller (2009)	VAR	Monthly	1981-2007	Stocks (multiple countries), Oil prices, Global oil production, CPI, Global real economic activity	*Oil market shocks do not cause large reactions in stock markets
Kilian and Park (2009)	Structural VAR	Monthly	1993-2006	Oil Price, % change in oil production, Global real economic activity, US stocks	*%22 of the variation in stock returns comes from shocks to crude oil *The cause of the oil price hike affects its reflection on stocks
Malik and Ewing (2009)	Bivariate GARCH	Weekly	1992-2008	US Stocks (5 sector indices), and WTI oil price	*Oil return volatility is directly affected by its own news and volatility, and by the return volatility of consumer services sector *Oil return volatility is indirectly affected by industrial and health care sectors
Soytas et al (2009)	VAR	Daily	2003-2007	Interest rate, TRY/USD exchange rate, Domestic god and silver prices, Oil price	*Devaluation of Turkish Lira results in an increase in gold price (safe haven) *World oil price does not seem to affect Turkish markets.
Narayan et al (2010)	Structural Break Cointegration Test	Daily	1995-2009	Gold and oil spot and futures markets	*Gold and oil markets are cointegrated up to 10 months *Both can be used to predict the other: Jointly inefficient

Choi and Hammoudeh (2010)	DCC- GARCH	Weekly	1990-2006	Gold, Silver, Copper, Oil, S&P 500 index	*After 2003, correlations between commodities are rising *Hedging opportunity is reduced, but monetary authority has easier control over the movements *Gold has the longest volatility regime among commodities *Stocks have the longest volatility regime overall
Zhang and Wei (2010)	Granger Causality	Daily	2000-2008	Oil Price, London pm fix (Gold)	*Crude oil volatility is greater *Two markets are influenced from common factors
Hsing (2011)	Exponential GARCH	Daily	1980-2010	Stocks (US, SA), Real GDP, Govt deficit, Exchange rate, Inflation, US govt bond yield	*South African stocks reflect (+) to GDP growth, M3/GDP, and US Stocks *South African stocks reflect (-) to government deficit/GDP, inflation, interest rate, exchange rate, US bond yield
Sujit and Kumar (2011)	VAR, Cointegration	Daily	1998-2011	Gold, Stock returns, Cruide oil, Exchange rates	*Gold price influence WTI around 4-5%. *Shocks to WTI and Brent oil explains 3% and 6-7% of the innovations in the exchange rate. Gold explains 10% *Innovations in WTI explains 2% of S&P index *Innovations in S&P explains 1.5% of gold
Zhu et al (2011)	Panel Cointegration	Monthly	1995-2009	Stocks, Industrial production, Interest rate, Oil price	*Crude oil → stocks (+) *Stocks → crude oil (+)
Le and Chang (2011)	VAR, Granger Causality	Monthly	1986-2011	Oil, Gold, US CPI, US Dollar index	*Long run relationships between oil price-inflation, inflation-gold price, and prices of gold and oil *Granger causality: in the long run rising oil price eventually raises the gold price *Oil price can be used as a predictor of the gold price *Gold can be a hedge instrument against inflation
Masih et al (2011)	VECM	Monthly	1988-2005	Stock returns (SK), Oil (price and price volatility), Interest rates, Industrial production	*Oil price movements significantly affect the stock market by decreasing firm profits and investor behaviour. *Government should utilize oil saving measures to hold fast against extreme oil price volatility
Le and Chang (2011)	ARDL	Monthly	2008-2011	Oil, Exchange rate, Stocks (JP), Interest rate, Gold	*In the long run, Japanese stock market and gold price causes positive deviations on the Japanese interest rate *Gold and stocks can be held as a protection against Japanese currency fluctuations
Filis et al (2011)	ADCC-GARCH-GJR	Monthly	1987-2009	Various stock market indices, Brent Crude Oil index	*Time varying correlation between oil and stocks does not differ, regardless of the country *Business cycles have stronger effect on correlations than supply-side shocks *Economic crises create a (+) link between oil and stocks *Oil market cannot be considered as an alternative to stocks during crises.
Sumner et al (2011)	VAR	Weekly	1970-2009	Gold, US stocks, US bonds	*No strong relationship between gold-stocks and gold-bonds. *Gold have a slight negative correlation with stocks and bonds (allows for portfolio diversification)

Chan et al (2011)	Markow Switching IAS	Monthly	1987-2008	US stocks, WTI Crude Oil, Gold prices, US bonds, Real estate assets	*Economic expansion periods: lower volatility, (+) stock returns, movement from gold to stocks *Crisis periods: higher volatility, (-) stock returns, movement from stocks to bonds *During crisis, portfolio allocations are biased towards gold and bonds; while during boom, they shift towards stocks, real estate and oil
Ray (2012)	Granger Causality	Daily	1990-2010	Stocks, CPI, Gold, Industrial prod (oil), Interest rate, Exchange rate, FDI, GFCF, BoT, M3, GDP, Exchange reserve	*Gold and oil prices have negative effects on stock prices; gold can be an alternative investment asset *GDP, BoT, interest rate, foreign exchange reserve, money supply, and industrial production have (+) effects on the stock prices
Samanta and Zadeh (2012)	VARMA	Daily	1989-2009	Gold, Stocks, Real exchange rate, Crude oil price	*Stocks and gold are influenced by themselves *Exchange rates and oil price are influenced by others *Spillover effects become larger for long horizons
Patel (2012)	VECM	Monthly	1991-2011	Stocks (India), macroeconomic determinants	*There is causality from exchange rates to stocks, IP, and oil price.
Samanta and Zadeh (2012)	VARMA, Granger Causality	Daily	1989-2009	Dow Jones Industrial, gold, USD exchange rate	*Stocks and gold price Granger-cause USD exchange rate and oil price
Li and Fan (2012)	Bivariate GARCH	Daily	2006-2010	WTI crude oil, Non-energy commodity prices	*Crude oil has volatility spillovers on non-energy commodity prices *the effect weakens after financial crisis
Lee et al (2012)	TECM-GARCH	Daily	1999-2008	WTI crude oil, Gold futures	*Asymmetric long run relationship between gold and oil *When WTI is beyond -/+ 40$, it is dominant in affecting the gold price
Basher et al (2012)	VAR	Monthly	1998-2008	Oil price, Exchange rates, Stocks (Emerging countries)	*Impulse response functions: stock prices respond (-) to a shock in the oil prices. *Oil prices respond (+) to a shock in stock prices. *In SR, positive shock to oil prices decrease the trade-weighted exchange rate.
Mollick and Assefa (2013)	GARCH, MGARCH, DCC	Daily	1999-2011	US stocks, Oil price	*US stocks respond (+) to expectations of recovery worldwide *Correlation varies over time
Bhunia (2013)	Granger Causality, Johansen Cointegration	Daily	1991-2012	Oil, Gold, Stocks (BSE and NSE)	*Gold is a safe haven for India *Johansen Coint → Long term relationship between oil and stocks
Baruník et al (2013)	Time-Frequency Analysis	Daily and Intra-Day	1978-2012	Gold, Oil, US Stocks	*Correlations between gold, oil and stocks are heterogeneous (homogeneous) during (after) crisis periods. *All three assets can be held together in a well-diversified portfolio

Ciner et al (2013)	DCC GARCH	Daily	1990-2010	Stocks (US, UK), 10-year Govt bonds, Exchange rate indexes, Gold futures (US, UK), Oil futures	*Both the US and the UK market data suggest that gold can be a hedge instrument against exchange rate fluctuations *Bond market provides hedge against equity market
Ewing and Malik (2013)	Bivariate GARCH	Daily	1993-2010	Gold and Oil futures	*Evidence of direct transmission of volatility between gold and oil markets
Creti et al (2013)	DCC-GARCH	Daily	2001-2011	Spot prices of 25 commodities, S&P 500 index	*Oil is the most related commodity to stock market *Correlation between oil and stocks tend to increase during times of rising stock market; while they switch to negative during 2007-08 crisis. *Gold acts as a safe haven during times of stock market discomfort.
Miyazaki and Hamari (2013)	ADF, ARCH	Daily	2000-2011	S&P 500, Gold	*No volatility transmission in the long run *There is flight to quality during financial crisis
Reboredo (2013)	Copulas	Weekly	2000-2011	WTI crude oil, gold price	*Gold cannot be used as a hedge against oil unless there is extreme volatility
Bhunia and Mukhuti (2013)	Granger Causality, ADF	Daily	1991-2012	Stocks (India), gold	*Domestic gold price and Indian stock market do not cause each other
Mensi et al (2013)	VAR, GARCH	Daily	2000-2011	US stocks, Brent oil, Wheat, Gold, Beverages	*Significant transmission of volatility among S&P500 and commodity markets *Deviations in US stocks influence the oil and gold markets the most
Choundry et al (2015)	Nonlinear Granger Causality	Daily	2000-2014	Japan, UK, and US stocks; gold price	*Gold was a safe haven in pre-crisis period *Safe-haven status is lost after crisis
Shanzadi and Chohan (2016)	Johansen Cointegration, Granger Causality	Monthly	2006-2010	Karachi stock exchange, gold price	*Negative relationship between gold prices and KSE index *No long run relationship
Ayaydın and Barut (2016)	Johansen Cointergration, VAR, Impulse Responses,Granger Causality	Monthly	1997-2016	Stocks (Turkey), Brent oil, gold	*Positive correlation between gold and stocks *Negative correlation between oil and stocks
Jain and Biswal (2016)	DCC-GARCH	Daily	2006-2015	Brent oil price, Gold, USD/INR, Indian stocks	*Safe haven property of gold price is confirmed *Causality runs from gold to exchange rate to stocks
Huang et al (2016)	Granger Causality, Frequency-based approach	Daily	1991-2014	Stocks (China), Brent oil, gold	*Brent oil and stock prices cause each other *Gold and stock prices cause each other

CHAPTER FOUR
DYNAMICS OF RELATIONSHIP BETWEEN OIL PRICES, GOLD PRICES AND STOCK MARKETS: VECTOR AUTOREGRESSION AND IMPULSE RESPONSE ANALYSES

This section includes data and method description, unit root tests, and discussion of the results for the VAR analysis part of the thesis.

4.1.DATA, MODEL AND METHODOLOGY

This study covers a 16-year period and nine emerging countries that form BRICS and MINT country groups. To investigate the dynamic relationship between major investment assets, we use international gold prices, Brent oil prices, and all-share stock market index for each country. Moreover, to set forth the possible relationship between these assets and macroeconomics indicators, exchange rate (against USD), consumer price index (CPI), and policy interest rates of each country are also included in the analyses. We use monthly data to gather detailed information about the characteristic of the relationships. Monthly international prices of gold and Brent crude oil are obtained from World Gold Council and U.S. Energy Information Administration (EIA). Exchange rates of local currencies against USD are obtained from Investing's database; while interest rates and CPI figures are collected from OECD's database -except for Nigeria, whose figures were present on the Central Bank of Nigeria. Stock market data for all-share index values are gathered from a combination of sources, including databases of Thomson Reuters, Yahoo Finance, and Investing. Except for the interest rates, all figures used in the analyses are in logarithmic form. Tables 9, 10, 11 and 12 include the descriptive statistics for the variables mentioned above:

Table 9: Descriptive Statistics: Stock Prices, Oil Prices and Gold Prices

Sample: 2000M01 2015M12, Ln(Stock Market Index)

	BRA	RUS	IND	CHI	SAF	MEX	IDN	NIG	TUR	OIL	GOLD
Mean	10.4531	6.7432	9.2550	7.6732	9.8566	9.8778	7.3985	10.0428	10.4106	4.0506	6.5586
Median	10.7328	6.9935	9.5455	7.6491	10.0212	10.1977	7.5795	10.1059	10.6190	4.1459	6.6870
Maximum	11.1926	7.8079	10.2826	8.6919	10.7855	10.7283	8.6159	11.0921	11.3937	4.9301	7.5030
Minimum	9.0622	4.9649	7.9415	6.9667	8.8412	8.5948	5.8812	8.6575	8.8996	2.9402	5.5518
Std. Dev.	0.6170	0.7603	0.7252	0.3696	0.6084	0.7419	0.9022	0.5487	0.7477	0.5585	0.6310
Skewness	-0.6627	-0.7824	-0.4320	0.3388	-0.2028	-0.4968	-0.2834	-0.6043	-0.4883	-0.3037	-0.1850
Kurtosis	1.9621	2.4790	1.7325	2.7332	1.6663	1.6540	1.6188	2.9558	1.8434	1.7827	1.5659
Jarque-Bera	22.6731	21.7603	18.8247	4.2421	15.5449	22.3934	17.8318	11.7021	18.3321	14.8045	17.5492
Probability	0.0000	0.0000	0.0001	0.1199	0.0004	0.0000	0.0001	0.0029	0.0001	0.0006	0.0002
Sum	2006.9991	1294.6931	1776.9683	1473.2532	1892.464	1896.5408	1420.5122	1928.2207	1998.8331	777.7104	1259.2593
Sum Sq. Dev.	72.7148	110.415	100.4448	26.0864	70.6904	105.1381	155.4717	57.5094	106.7705	59.5775	76.041
Observations	192	192	192	192	192	192	192	192	192	192	192

Sources: Investing, Thomson Reuters, Yahoo Finance, EIA, World Gold Council

Table 10: Descriptive Statistics: CPI Figures

Sample: 2000M01 2015M12, Ln(CPI)

	BRA	RUS	IND	CHI	SAF	MEX	IDN	NIG	TUR
Mean	4.4697	4.3138	4.4303	4.5493	4.4749	4.4874	4.3985	4.3900	4.3118
Median	4.4767	4.3599	4.3330	4.5611	4.4416	4.4866	4.4560	4.3714	4.4072
Maximum	4.9717	5.0560	5.0336	4.7515	4.8880	4.7983	4.9062	5.1938	5.0179
Minimum	3.9381	3.3507	3.9700	4.3728	4.0587	4.1143	3.7559	3.3803	2.8825
Std. Dev.	0.2811	0.4639	0.3355	0.1254	0.2391	0.1951	0.3356	0.5130	0.5246
Skewness	-0.2134	-0.3241	0.3582	0.1773	0.1222	-0.1147	-0.3104	-0.1935	-0.9676
Kurtosis	2.1131	2.0187	1.7051	1.5655	1.7765	1.8233	1.8720	1.8971	3.3849
Jarque-Bera	7.7504	11.0659	17.5197	17.4682	12.4534	11.4971	13.2620	10.9297	31.1465
Probability	0.0208	0.0040	0.0002	0.0002	0.0020	0.0032	0.0013	0.0042	0.0000
Sum	858.1729	828.2499	850.6209	873.4584	859.1777	861.5752	844.5195	842.8739	827.8671
Sum Sq. Dev.	15.0897	41.0997	21.4992	3.0021	10.9168	7.272	21.5136	50.2696	52.5595
Observations	192	192	192	192	192	192	192	192	192

Sources: Central Bank of Nigeria, OECD

Table 11: Descriptive Statistics: Exchange Rates

Sample: 2000M01 2015M12, Ln(Exchange Rate)

	BRA	RUS	IND	CHI	SAF	MEX	IDN	NIG	TUR
Mean	0.8065	3.4364	3.8841	1.9822	2.0939	2.4561	9.1888	4.9341	0.4055
Median	0.7810	3.3923	3.8436	1.9800	2.0426	2.4277	9.1475	4.8877	0.4075
Maximum	1.3764	4.2905	4.1966	2.1138	2.7393	2.8437	9.5922	5.3110	1.1071
Minimum	0.4376	3.1543	3.6685	1.8007	1.7343	2.1983	9.0180	4.5986	-0.5804
Std. Dev.	0.2283	0.2118	0.1312	0.1208	0.2123	0.1490	0.1243	0.1606	0.3159
Skewness	0.5643	2.3143	0.9043	-0.1206	0.7333	0.3048	1.3001	0.3005	-0.8573
Kurtosis	2.5811	8.5432	2.9180	1.3054	2.7824	2.5424	3.9167	2.6958	5.1081
Jarque-Bera	11.5955	417.2028	26.2195	23.4392	17.5853	4.6470	60.8079	3.6304	59.0745
Probability	0.0030	0.0000	0.0000	0.0000	0.0002	0.0979	0.0000	0.1628	0.0000
Sum	154.8387	659.7929	745.7402	380.5849	402.0376	471.5754	1764.2532	947.3382	77.8561
Sum Sq. Dev.	9.9587	8.5716	3.29	2.7883	8.6109	4.2412	2.9507	4.9287	19.0545
Observations	192	192	192	192	192	192	192	192	192

Sources: Investing

Table 12: Descriptive Statistics: Interest Rates

Sample: 2000M01 2015M12

	R(BRA)	R(RUS)	R(IND)	R(CHI)	R(SAF)	R(MEX)	R(IDN)	R(NIG)*	R(TUR)
Mean	0.1413	0.1324	0.0689	0.0316	0.0826	0.0515	0.0920	0.1174	0.2261
Median	0.1325	0.1150	0.0600	0.0325	0.0750	0.0479	0.0775	0.1078	0.1452
Maximum	0.2650	0.4500	0.1025	0.0414	0.1350	0.1529	0.1767	0.3326	4.0027
Minimum	0.0725	0.0525	0.0600	0.0270	0.0500	0.0211	0.0575	0.0077	0.0150
Std. Dev.	0.0446	0.0755	0.0121	0.0034	0.0269	0.0303	0.0324	0.0603	0.3507
Skewness	0.6467	1.4517	0.9561	0.7545	0.4621	1.9258	1.1527	0.7039	7.2122
Kurtosis	3.0403	5.4427	2.3082	4.6247	1.8045	6.2479	3.2563	3.7529	73.3849
Jarque-Bera	13.3977	115.1766	33.0812	39.3332	18.2678	203.0738	43.0458	17.8429	41296.7777
Probability	0.0012	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0000
Sum	27.1289	25.425	13.2249	6.0624	15.8575	9.8833	17.6716	19.721	43.4091
Sum Sq. Dev.	0.3801	1.0875	0.0281	0.0022	0.1382	0.1758	0.2007	0.6062	23.4948
Observations	192	192	192	192	192	192	192	168	192

Sources: Central Bank of Nigeria, OECD

* Sample size is reduced due to data availability.

Initially an unrestricted VAR is constructed individually for all countries using stock prices, gold price, oil price, CPI, exchange rate, and interest rates:

$$S_t = \alpha_0 + \sum_{i=1}^{p=1} \alpha_{1i} S_{t-i} + \sum_{j=1}^{p=1} \alpha_{2j} G_{t-j} + \sum_{k=1}^{p=1} \alpha_{3k} O_{t-k} + \alpha_4 C + \alpha_5 X + \alpha_6 R + \varepsilon_{1t} \quad (1)$$

$$G_t = \beta_0 + \sum_{i=1}^{p=1} \beta_{1i} S_{t-i} + \sum_{j=1}^{P=1} \beta_{2j} G_{t-j} + \sum_{k=1}^{P=1} \beta_{3k} O_{t-k} + \beta_4 C + \beta_5 X + \beta_6 R + \varepsilon_{2t} \quad (2)$$

$$O_t = \gamma_0 + \sum_{i=1}^{p=1} \gamma_{1i} S_{t-i} + \sum_{j=1}^{p=1} \gamma_{2j} G_{t-j} + \sum_{k=1}^{p=1} \gamma_{3k} O_{t-k} + \gamma_4 C + \gamma_5 X + \gamma_6 R + \varepsilon_{3t} \quad (3)$$

S: Logarithm of the country's Stock Exchange

C: Logarithm of the country's Consumer Price Index

X: Logarithm of USD/Country's National Currency

G: Logarithm of International Gold Price

O: Logarithm of International Brent Crude Oil Price

R: Policy Interest Rate of the country

The system is built in way that allows the prices of gold, oil, and stocks to be endogenous, while country specific CPI, exchange rate and interest rate figures are held exogenous as control variables. Lag length for the models are selected using the lag order with the highest accumulation among various specification criteria; and by looking at the model with lower AIC and SIC criteria if any doubt arises.

Estimations are run in levels of logged variables for the sake of retaining the information within the series, thus stability of the VAR system is examined through AR roots table and graph. If any root lies outside the unit circle, a different lag order is chosen from the lag specification table, until a stable VAR is estimated. Then Impulse responses for 10 periods are examined for all nine countries' VAR systems, followed by an examination of lead-lag properties through variance decomposition in each country's estimation. The VAR system is estimated for three periods: (1) full sample from 2000:01 to 2015:12 for an overall point of view; (2) pre-crisis sample from 2000:01 to 2007:12; and then post-crisis sample from 2008:01 to 2015:12.

4.1.1. Unit Root Tests

Testing for the unit root is systematically run by using Augmented Dickey-Fuller test in levels, 1st and differences, by leaving exogenous the constant, constant and trend, and no constant/trend specifications. Lag Length is based on Schwarz Information Criterion, with maximum lags of 10. Considering the sample period 2000:01-2015:12, majority variables seem to present an I (1) process, except for the logged CPI of Turkey and the interest rates of Russia, Mexico, Nigeria, and Turkey, which seem to be stationary at levels. Following section will include the discussion VAR results, impulse responses, and variance decomposition for lead-lag relationship of gold, oil and stocks for each country in each time scale. Test results are shown below in Table 13:

Table 13: Unit Root tests, pre-VAR estimations

	Level						1st Difference						
	Intercept		Trend and Intercept		None		Intercept		Trend and Intercept		None		
	T-Stat	Lags	T-Stat	Lags	T-Stat	Lags	T-Stat	Lags	T-Stat	Lags	T-Stat	Lags	Order
Ln(BRA)	-1.1684	0	-0.8752	0	0.8575	0	-12.6965***	0	-12.6971***	0	-12.6851***	0	1
Ln(RUS)	-1.9522	1	-1.1496	1	0.5176	1	-11.8385***	0	-11.9855***	0	-11.8353***	0	1
Ln(IND)	-0.4355	0	-2.0790	0	1.6843	0	-12.6412***	0	-12.6148***	0	-12.4998***	0	1
Ln(CHI)	-1.4523	0	-2.4102	2	0.7825	0	-12.1190***	0	-12.0873***	0	-12.1093***	0	1
Ln(SAF)	-0.5665	0	-2.1665	0	2.3754	0	-14.8115***	0	-14.7708***	0	-14.3944***	0	1
Ln(MEX)	-0.8376	0	-1.2206	0	2.2894	0	-13.5474***	0	-13.5232***	0	-13.2267***	0	1
Ln(IDN)	-0.4599	1	-2.9008	1	1.5194	1	-11.2158***	0	-11.1891***	0	-11.0595***	0	1
Ln(NIG)	-2.6842*	0	-1.6845	0	1.4959	0	-11.5962***	0	-11.7862***	0	-11.4922***	0	1
Ln(TUR)	-0.9966	0	-2.6196	0	1.0675	0	-16.3792***	0	-16.3252***	0	-16.3053***	0	1
Ln(OIL)	-1.6464	0	-0.7766	0	0.0267	0	-13.1685***	0	-13.2789***	0	-13.1995***	0	1
Ln(GOLD)	-1.2460	0	-0.4293	0	1.7133	0	-15.9706***	0	-16.0618***	0	-15.6891***	0	1
Ln(EX_BRA)	-0.6723	0	-0.5660	0	0.8903	0	-7.9990***	1	-8.0176***	1	-7.9464***	1	1
Ln(EX_RUS)	0.7600	1	-0.2126	1	1.3464	1	-9.4372***	0	-9.6646***	0	-9.3303***	0	1
Ln(EX_IND)	-0.0415	0	-1.0731	0	1.4179	0	-12.1489***	0	-12.1939***	0	-12.0686***	0	1
Ln(EX_CHI)	-0.6610	1	-0.7086	1	-2.4104	1	-9.9020***	0	-9.8828***	0	-9.5016***	0	1
Ln(EX_SAF)	-0.3652	0	-0.9286	0	1.3365	0	-13.6242***	0	-13.6540***	0	-13.5262***	0	1
Ln(EX_MEX)	-0.3826	0	-2.9940	1	1.4754	0	-12.1256***	0	-12.1327***	0	-12.0296***	0	1
Ln(EX_IDN)	-1.3010	1	-2.1613	1	0.8001	0	-11.8161***	0	-11.8648***	0	-11.8129***	0	1
Ln(EX_NIG)	-0.8407	0	-2.2357	0	2.0083	0	-13.1989***	0	-13.1657***	0	-12.9695***	0	1
Ln(EX_TUR)	-2.4173	0	-2.8686	1	0.1172	1	-11.7265***	0	-11.7349***	0	-11.4466***	0	1
Ln(CPI_BRA)	-0.5386	1	-1.9375	1	4.9741	1	-6.1612***	0	-6.1506***	0	-3.2924***	0	1
Ln(CPI_RUS)	-2.6921*	1	-3.0038	1	4.8525	1	-6.7535***	0	-7.2025***	0	-1.7808*	10	1
Ln(CPI_IND)	2.8625	7	-1.9679	7	6.7092	7	-7.3100***	6	-8.1981***	6	-1.2449	10	1
Ln(CPI_CHI)	0.0734	1	-3.0246	1	3.0075	1	-10.5336***	0	-10.5361***	0	-9.8897***	0	1
Ln(CPI_SAF)	-0.4657	1	-1.6825	1	6.0197	1	-8.6953***	0	-8.6727***	0	-3.3305***	2	1
Ln(CPI_MEX)	-4.0473***	6	-4.1120***	6	5.7910	1	-8.3229***	0	-9.8286***	5	-1.9554**	10	1
Ln(CPI_IDN)	-1.9386	1	-1.5443	1	6.4923	1	-11.1856***	0	-11.3775***	0	-8.0317***	0	1
Ln(CPI_NIG)	-1.8348	0	-2.4967	0	8.5084	0	-12.0198***	0	-12.1320***	0	-9.1705***	0	1
Ln(CPI_TUR)	-4.6318***	1	-4.0466***	1	1.7962	5	-3.7996***	4	-7.4207***	0	-3.2231***	4	0
R(BRA)	-2.5891*	2	-3.6062**	2	-0.9718	2	-4.5231***	1	-4.5316***	1	-4.5292***	1	1
R(RUS)	-7.6036***	0	-7.4068***	0	-5.7477***	0	-7.3517***	1	-8.0130***	1	-7.1349***	1	0
R(IND)	-1.5839	2	-2.2661	2	-0.3358	2	-10.8681***	1	-10.9040***	1	-10.8965***	1	1
R(CHI)	-2.5274	0	-2.5322	0	-0.4602	0	-12.4713***	0	-12.4404***	0	-12.5018***	0	1
R(SAF)	-2.3130	3	-3.5243**	3	-1.0960	3	-4.0484***	2	-4.0479***	2	-4.0382***	2	1
R(MEX)	-3.1355**	6	-3.0065	6	-2.9227***	6	-5.6111***	5	-5.8055***	5	-5.4123***	5	0
R(IDN)	-1.5895	1	-2.3037	1	-0.8953	1	-6.5396***	0	-6.5185***	0	-6.5445***	0	1
R(NIG)	-3.8559***	1	-3.9506**	1	-2.0032**	3	-11.5699***	2	-11.5395***	2	-11.5454***	2	0
R(TUR)	-3.2537**	2	-4.2316***	2	-2.7483***	2	-16.8313***	1	-16.7938***	1	-16.8662***	1	0

Augmented Dickey Fuller Test. Automatic lag selection based on SIC with max lags 10.
Null Hypothesis: Series has a unit root.
*, **, and *** indicates significance at 10%, 5%, and 1%.
Critical Values (Based on MacKinon, 2010)
Trend: 1%: -3.4645, 5%: -2.8764, 10%: -2.5748
Trend & Intercept: 1%: -4.0066, 5%: -3.4334, 10%: -3.1406
None: 1%: -2.5771, 5%: -1.9425, 10%: -1.6156

4.2.RESULTS

In this section, output from VAR analyses for BRICS and MINT economies are discussed in depth.

4.2.1. Brazil

Below is the table of estimation results for Brazil:

Table 14: VAR Estimation Output for Brazil

	Sample: 2000M01 2015M12 Included observations: 192			Sample: 2000M01 2007M12 Included observations: 96			Sample: 2008M01 2015M12 Included observations: 96		
	LN(BRA)	LN(GOLD)	LN(OIL)	LN(BRA)	LN(GOLD)	LN(OIL)	LN(BRA)	LN(GOLD)	LN(OIL)
LN(BRA)(-1)	0.8957***	-0.0024	0.0554	0.5355***	-0.0384	0.2713**	0.7786***	-0.0835	-0.0372
LN(GOLD)(-1)	-0.0985**	0.9286***	0.0308	-0.0277	0.8771***	-0.031	-0.0862*	0.8723***	-0.0550
LN(OIL)	-0.0436*	-0.0159	0.8652***	-0.0527	0.0113	0.668***	-0.1518***	-0.0799***	0.7683***
C	0.1816	-0.1263	-0.2422	0.2823	-0.1165	-2.337***	1.4184**	0.4481	-0.6283
LN(CPI_BRA)	0.4376***	0.1710**	0.0192	1.2879***	0.3095**	0.2127	0.5832***	0.4243***	0.6396***
LN(EX_BRA)	-0.2596***	-0.1072**	-0.1183	-0.5966***	-0.0790	0.0307	-0.4868***	-0.3511***	-0.5791***
R(BRA)	-0.0802	0.0920	0.1317	-1.235	-0.2158	0.6407	-0.888***	-0.0364	-1.2289**
R-squared	0.9876	0.9939	0.9647	0.9869	0.9870	0.9494	0.8878	0.9407	0.9249

*, **, and *** indicates significance at 10%, 5%, and 1%.

During base period, stock market returns for period (t) are diminished by 0.09 % after 1 % gain in gold prices in period (t-1)[3]. This dynamic can be attributed to shifting demand towards gold market due to price increase in previous month. The effect is also significant in period 2, with slightly lower magnitude and significance. Stock market returns also diminish by 0.04% following 1 % gain in oil prices in previous month during base period (0.15% in period 2) -an effect which falls in line with the argument that regards oil prices as a cost factor. In all sub-periods, gains in exchange rate results in shrinking stock returns in the same period with rates varying from 0.3 % to 0.6 %: Clearly Brazilian economy do not favour a strengthening USD. 1-point increase in interest rates is affiliated with lower stock returns from 0.9 % to 1.2 %: Rising interest rates transform into stock market loss almost directly; the effect however is only significant in sub-periods. Inflationary pressures are reflected in stocks from 0.4 % to 1.3 %; the effect is tripled in period one compared to the rest. Gold returns in period (t) are driven by inflation and the effect is ranging from 0.17 % to 0.4 %, while being larger in sub-periods: movements of Brazilian CPI may support the idea of gold being an inflation-hedge instrument. Movements in USD/Brazilian Real are matched with 0.1 % to 0.4 % decreases in returns in gold prices. Oil price returns in previous month have a negligible impact on gold returns in current month, during post-crisis period. Returns in Brent oil prices do not have persistent connections to domestic macro indicators; however, the effects seem to become significant in post-

[3] Base period: 2000-2015; Period 1: 2000-2007; Period 2: 2008-2015; Period (t): Current month; Period (t-1): Previous month.

crisis period. Stock market returns in (t-1) are reflected with 0.3 % increase in oil price returns in pre-crisis period, while no significant effect is seen in other periods.

Impulse responses for the 00-15 period are in line with the comments on estimated coefficients. Response of stocks to changes in the oil and gold prices is negative and similar in magnitude. Response to the shocks from gold seems to enlarge over 10 periods, while effects of oil price max around 7th period. During 00-07 stock market is not responsive to gold and oil prices, while in 08-15 the responses are negative especially when the shocks are coming from oil price. Oil and gold prices present positive responses to stocks, and these effects tend to fade over time for gold price. These effects are similar in sub periods and turn negative for gold in 00-07. Gold and oil prices do not react to each other strongly.

4.2.2. Russia

Estimation results for Russian VAR is presented below:

Table 15: VAR Estimation Output for Russia

	Sample: 2000M01 2015M12			**Sample: 2000M01 2007M12**			**Sample: 2008M01 2015M12**		
	Included observations: 192			**Included observations: 96**			**Included observations: 96**		
	LN(RUS)	**LN(GOLD)**	**LN(OIL)**	**LN(RUS)**	**LN(GOLD)**	**LN(OIL)**	**LN(RUS)**	**LN(GOLD)**	**LN(OIL)**
LN(RUS)(-1)	0.9551***	0.0088	0.0453	0.7197***	0.0976***	0.1227	1.045***	0.0445	0.2290***
LN(GOLD)(-1)	-0.0007	0.9432**	0.0853	0.4900**	0.6249***	-0.3318	0.1356	0.9225***	0.1309*
LN(OIL)(-1)	-0.1733***	-0.0362	0.7275***	-0.0677	0.0239	0.7273***	-0.4760***	-0.1122**	0.4245***
C	1.0534***	0.2587*	0.5700**	-3.1119**	1.3365**	3.2777*	-0.8581	0.5056	-1.7033***
LN(CPI_RUS)	0.2675**	0.1441**	0.2280*	0.4583**	0.2125**	0.5188**	1.0458***	0.1532	1.0346***
LN(EX_RUS)	-0.3435***	-0.1272**	-0.3985***	0.1093	-0.2070	-0.9731***	-0.9483***	-0.1303	-0.9315***
R(RUS)	-0.0754	0.1758	0.4313	0.3049	0.4409**	0.9531*	1.0996	-0.3994	1.0582
R-squared	0.9829	0.994	0.9687	0.9887	0.9890	0.9486	0.9198	0.9344	0.9374

*, **, and *** indicates significance at 10%, 5%, and 1%.

Russian stock market benefits from inflation (ranging from 0.2 % to 1 %) and this effect is largest in the post crisis era. Oddly gains in oil prices in (t-1) are reflected as losses in stock returns in (t), with ranging weight from 0.2 % to 0.5 %. Russia is a net oil exporter, and one might expect opposite results out of gains from increases in the oil prices -focusing on stock market gains of energy sector firms may yield a different outcome. Similar to Brazil, Russian stock market movements do not favour gains in USD against national currency and losses range from 0.3 % to 0.9 %; the effect is strongest after the crisis, and not significant before crisis. 1 % increase in gold

price in period (t-1) results in 0.5 % increase in stock market. Although there is no direct causal mechanism to explain this behaviour, this may be an indication that gold and stock market cannot be used as hedge tools against each other in Brazil during pre-crisis years. This effect is also supported in the gold equation of the VAR system as 1 % increase in stock market in period (t-1) is affiliated with 0.09 % increase in gold prices in period (t) during pre-crisis era. The positive link between CPI and gold price is present for full period and pre-crisis estimations, and the effect is between 0.1 % and 0.2 %. The negative link between gold price and USD against domestic currency is present for the full period at 0.1 %. This effect shifts between periods and magnitude but stays in the same direction for all countries except Mexico, for whom the gold equation does not provide significant coefficients for CPI. Weakening of Brazilian Real by 1 % is affiliated with 0.1 % decrease in gold prices, and this effect is lost when divided into sub periods. Only during pre-crisis era, 1-point increase in interest rates is reflected with 0.4 % increase in gold prices; the two does not seem to act as competing investor tools for Brazilian economy. The influence of CPI and (t-1) stock market gains are similar for Brent oil prices; and these connections are pronounced louder in the post crisis period. 1 % strengthening of USD against Russian currency is accompanied by 0.6 % decrease in oil prices. Increase in gold prices during previous month are reflected with 0.13% increase in oil prices, only in post crisis era.

Impulse responses show that the effect of oil price on stocks maxes out during the 5th period and stays in the system. The seemingly negative effect of gold, as seen in the 00-15 VAR estimation, is negligible and tends to increase over time. The dynamics between oil and gold prices are rather flat, while the small negative effect of oil price on gold price seems to max out in 5th period and stay in the system. Sub periods do not produce extraordinary responses, although the negative response of stocks to oil price can be seen more clearly.

4.2.3. India

Below are the significant estimation results for India:

Table 16: VAR Estimation Output for India

	Sample: 2000M01 2015M12 Included observations: 192			Sample: 2000M01 2007M12 Included observations: 96			Sample: 2008M01 2015M12 Included observations: 96		
	LN(IND)	LN(GOLD)	LN(OIL)	LN(IND)	LN(GOLD)	LN(OIL)	LN(IND)	LN(GOLD)	LN(OIL)
LN(IND)(-1)	0.9380***	-0.0179	-0.0001	0.8808***	0.0659**	0.1536*	0.6525***	-0.1729***	0.0056
LN(GOLD)(-1)	-0.0449	0.9249***	0.1051*	0.0919	0.7232***	-0.0696	-0.2258***	0.7798***	0.1235
LN(OIL)(-1)	-0.0264	0.0032	0.8463***	-0.0439	0.0131	0.7347***	-0.0598**	-0.0236	0.8390***
C	1.0701***	0.7220***	1.6085***	0.1559	-1.1184	0.2986	4.4216***	3.3027***	1.8135
LN(CPI_IND)	0.3532***	0.2357***	0.0995	0.5528	0.5019**	0.2837	1.0750***	0.6896***	0.1007
LN(EX_IND)	-0.4273***	-0.2775***	-0.5781***	-0.4999**	0.0579	-0.2997	-1.1146***	-0.8361***	-0.7059**
R(IND)	0.1164	-0.5248	1.9294*	1.8695	-2.0327	-4.137	2.7333***	1.6626*	3.7576**
R-squared	0.9915	0.9941	0.9663	0.9881	0.9882	0.9466	0.9554	0.9424	0.9145

*, **, and *** indicates significance at 10%, 5%, and 1%.

Indian regression results for stock market equation gains significance in all indicators after financial crisis; signalling that these elements influence each other more in recent environment. Stock market gains narrow by 0.2 % and 0.06 % against 1 % (t-1) gains in gold and oil prices, respectively: From this aspect gold and oil markets seem to be suited for complimentary use with stocks in a portfolio. The two also do not seem to affect each other in a meaningful way (except for the base estimation where there is a positive link between t-1 gains in gold prices and current oil prices[4]). Gains from inflation are 0.4 % and 1.1 % in 00-15 and post-crisis periods. Weakening Rupee is harmful to stock market gains, and the effect is nearly three-fold after the crisis. Interest rate hikes and stock market gains (2.7 %) move in the same direction in period 2, and this effect is not present in base and period 1 estimations. The negative link between exchange rate and gold prices are present only for base and period 2 estimations. Another similarity with previous countries is the positive link between inflation and gold prices, and this is strongest in period 2, justifying the inflation hedge usage. 1-point increase in interest rates move the gold prices up by 1.6% in post-crisis period. During 08-15, oil price moves 3.7 % by 1-point increase in interest rates (1.9% in base estimation): These two are not investment alternatives to each other; however, this dynamic is not seen during 00-07. Stronger USD against

[4] Base estimation: 2000-2015; Period 1: 2000-2007; Period 2: 2008-2015.

Rupee is also paralleled with 0.6 % decrease in oil prices for base estimation (0.7% in post-crisis period).

Impulse response figures reveal that in 00-15 oil price and gold price have negligible but lasting negative effects on Indian stock exchange. The minuscule positive responses of gold and oil prices to shocks from stocks fade over time. Gold price shocks positively affect the oil price and the effect stays in the system. Sub periods do not produce surprises; except the negative response of gold price to shocks from stocks is presented better in 08-15.

4.2.4. China

Refined estimation table for China is presented below:

Table 17: VAR Estimation Output for China

	Sample: 2000M01 2015M12			Sample: 2000M01 2007M12			Sample: 2008M01 2015M12		
	Included observations: 192			Included observations: 96			Included observations: 96		
	LN(CHI)	**LN(GOLD)**	**LN(OIL)**	**LN(CHI)**	**LN(GOLD)**	**LN(OIL)**	**LN(CHI)**	**LN(GOLD)**	**LN(OIL)**
LN(CHI)(-1)	0.9818***	0.0151	0.0091	0.8860***	-0.0860***	-0.1268*	0.8852***	-0.0076	0.0831
LN(GOLD)(-1)	0.0216	0.9492***	0.2039***	-0.0073	0.8029***	0.0736	0.0043	0.9149***	0.1909**
LN(OIL)(-1)	-0.0132	0.0509**	0.8926***	-0.0841	0.0375	0.7101***	-0.0687	0.0584	0.9213***
C	-2.4240	-0.2481	-1.3118	6.2694*	3.5081*	-1.7311	-0.1959	-1.9990	3.6958
LN(CPI_CHI)	0.3916*	0.0674	-0.1763	0.0684	0.5263*	1.5924*	0.2819	0.3364	-0.8993
LN(EX_CHI)	0.4201	0.0499	0.5591	-2.5893***	-1.8950***	-1.8021	0.1138	0.5536	-0.6298
R(CHI)	-4.2640*	-4.4246***	1.1847	2.2626	-5.6465***	0.5804	-4.8315	-6.0765**	0.0263
R-squared	0.9553	0.9939	0.9645	0.971	0.9885	0.9467	0.8839	0.9344	0.9065

*, **, and *** indicates significance at 10%, 5%, and 1%.

Chinese stock market mostly reacts to itself in consistent manner, and this finding matches with Cong et al (2008) for the pre-crisis period. Stocks also react with -2.6 % change against 1 % degradation of national currency in pre-crisis period: Strengthening USD is against Chinese stock market gains during period 1. In the base estimation, 1-point change of the interest rate hurts stock prices by 4.3%; this effect is not significant in sub periods. 1% increase in CPI during 00-15 leads to 0.4% increase in stock prices. Estimation with gold price as the dependent variable does not strongly support the inflation hedge argument: Only during 00-07, 1% increase in CPI is reflected as 0.5% increase in gold prices. Oil prices and gold prices seem to move in the same direction according to base estimation, with gold prices are moving upward by 0.05 % in (t) with 1 % increase in oil prices; however, this effect is very subtle. In

period 1, Gold prices seem to draw negative influence from Chinese stock market gains in (t-1) and diminishing value of national currency, by 0.08 % and 1.9 % respectively. There is strong negative feedback from gold price gains against 1-point change in interest rates in all periods, varying from 4.4 % to 6.1 %, indicating that investor behaviour strongly reacts against interest rates and moves toward alternatives such as gold. Oil price movements are affected by themselves (t-1) in all periods. Gold prices (t-1) in period 2 and base estimations influence oil prices by roughly 0.2 %; the movement is in the same direction with (t-1) gold returns, thus there is substitution value here, but one cannot use gold and oil prices as complimentary hedge tools against each other. 1% increase in CPI is reflected with 1.6% increase in Brent oil prices during the pre-crisis period. 1% increase in stock prices during 00-07 is associated with 0.12% depreciation in oil prices; thus, there is hedge opportunity in pre-crisis period.

According to impulse responses, in 00-15 there is little to no impact of oil and gold price shocks on stocks. However, the negative response of stocks to shocks from oil price is visualized better in sub periods. Brent and gold prices are positively affected by each other's shocks in 00-15 and 08-15.

4.2.5. South Africa

Results for South African VAR estimations are as follows:

Table 18: VAR Estimation Output for South Africa

	Sample: 2000M01 2015M12			**Sample: 2000M01 2007M12**			**Sample: 2008M01 2015M12**		
	Included observations: 192			**Included observations: 96**			**Included observations: 96**		
	LN(SAF)	**LN(GOLD)**	**LN(OIL)**	**LN(SAF)**	**LN(GOLD)**	**LN(OIL)**	**LN(SAF)**	**LN(GOLD)**	**LN(OIL)**
LN(SAF)(-1)	1.0018***	0.0332	0.1276***	0.9563***	0.1350***	0.3529***	0.9790***	-0.0244	0.3362***
LN(GOLD)(-1)	0.0127	0.9617***	0.1281**	0.0846	0.7352***	-0.1348	-0.0606	0.8332***	0.0475
LN(OIL)(-1)	-0.0284	-0.0243	0.7853***	-0.0163	-0.0153	0.5978***	-0.0128	-0.0133	0.8134***
C	0.3772**	-0.2371	0.0757	0.2867	-1.1527***	-2.2162***	1.3884*	0.6909	2.9351*
LN(CPI_SAF)	-0.0564	0.1071	-0.1704	-0.0767	0.4167***	0.4781*	-0.1275	0.2726	-1.1603**
LN(EX_SAF)	-0.0139	-0.1097***	-0.2545***	0.0551	-0.1177***	-0.4222***	0.0185	-0.1953*	-0.1169
R(SAF)	-0.8800***	0.1964	-0.0575	-0.9689***	0.0019	0.0492	-1.7866**	-0.5940	-3.5013**
R-squared	0.9934	0.9939	0.9675	0.9854	0.9885	0.9501	0.9735	0.9392	0.9231

*, **, and *** indicates significance at 10%, 5%, and 1%.

South African stocks only react to own previous value gain and contemporary interest rate changes; while 1-point increase in interests leads contractions varying from 0.8 % - 1.8 % in stock market gains, which resonates with Hsing (2011).

Estimation with gold price as the dependent variable show that there is no meaningful link between (t-1) gains in oil prices and current gains in gold prices –which is an indicator of independence. Only for period 1, gold prices lose 0.08 % from 1 % gain in stock prices. There is also the inflationary transition seen in the previous BRICS countries with 0.4 % increase in gold prices for 1 % increase in inflation, but only in period 1. 1 % increase in the USD/Rand period 1 turns causes roughly 0.1 % shrinkage in gold prices, which is also similar to countries in this group. Previous gains in South African stock market is affiliated with from 0.1 % to 0.4 % gains in Brent oil price, revealing that increased economic activity may be leading into increasing demand. Base estimation also shows that oil prices move in the same direction with (t-1) gains in gold. The effect coming from the gains in CPI, interest rate and USD/Rand are all in the same direction. CPI and interest rates are most significant during post-crisis, affecting Brent oil prices by 1.16 % and 3.5 % respectively.

Looking at the IRF's in 00-15 shock responses are non-characteristic[5]. Stock exchange exhibits a slight negative reaction to shocks in oil price. Both gold and oil price have positive responses to shocks in stock prices that are fixed overtime. Brent oil has a slight positive response to shocks in gold price. All these effects seem negligible. Sub periods do not provide drastic changes, but the positive response of gold to shocks coming from stocks is clearer in 00-07.

[5] IRF: Impulse Response Function.

4.2.6. Mexico

Estimation results for Mexico are presented below:

Table 19: VAR Estimation Output for Mexico

	Sample: 2000M01 2015M12 Included observations: 192			Sample: 2000M01 2007M12 Included observations: 96			Sample: 2008M01 2015M12 Included observations: 96		
	LN(MEX)	LN(GOLD)	LN(OIL)	LN(MEX)	LN(GOLD)	LN(OIL)	LN(MEX)	LN(GOLD)	LN(OIL)
LN(MEX)(-1)	0.9799***	0.0314	0.1243***	0.8805***	0.0645*	0.2069**	0.7215***	-0.0630	-0.1224
LN(GOLD)(-1)	00.014	0.9661***	0.1686***	0.1236	0.7902***	-0.0413	0.0851***	0.9809***	0.3051***
LN(OIL)(-1)	-0.0154	0.0021	0.8006***	-0.0705	0.0484	0.5903***	-0.0797**	-0.0500	0.6116***
C	0.0827	0.2713	1.1797**	-2.9778***	0.1242	-4.6601**	2.2055	1.8436**	3.7074***
LN(CPI_MEX)	0.0678	-0.0713	-0.3818*	0.9293***	0.1095	0.7889	0.3753**	-0.0364	0.1178
LN(EX_MEX)	-0.0774	-0.0087	-0.3872***	-0.1969	-0.0293	0.4199	-0.4422***	-0.2225	-1.2606***
R(MEX)	-0.3578*	-0.3670*	-0.7137*	0.9425**	-0.5131*	1.5306*	-4.2610***	-2.3654*	-5.2954**
R-squared	0.9947	0.9938	0.9667	0.9908	0.9878	0.9497	0.9695	0.9339	0.9347

*, **, and *** indicates significance at 10%, 5%, and 1%.

Stock market equation for Mexico presents a similar case to India where all the independent variables are significant during period 2. Gains in gold price and oil price (t-1) and exchange rate do not have influence on stock market gains with base and period 1 estimations. Period 2 shows that 1 % increase in gold and oil prices in (t-1) affects the stock market gains in period (t) by 0.08 % and -0.08 %, respectively; meaning that gold may be an alternative instrument for stocks, and oil assets can be complimentary diversification after the crisis. CPI in both sub-period estimations have a positive influence on stock markets, and the effect is strongest during pre-crisis years (0.9 %). USD/Peso disrupts the stock market gains by 0.4 % with 1 % increase (this effect is common for most of BRICS and MINT economies). One peculiar case appears between period 1 and 2 where the effect of interest rates changes both in magnitude and direction: Before the crisis, 1-point increase in the interest rate is affiliated with 0.9 % increase in stock market; after the crisis however, this interaction yields a negative 4.3 % (-0.3% in base estimation). Estimation with gold price produce no interactions between gold and other indicators, except interest rate; which is negative for all periods and largest during 08-15 (-2.4%). One other exception is the positive influence of stock price increases in previous month (0.06%). Gains in Mexican stock market in previous month lead to increases in Brent oil prices by 0.1 % to 0.2 % during 00-15 and 00-07. This may be due to increased economic activity and increased demand for energy input in consequence. Gains in gold price in the previous month is

also a supporter of gains in Brent oil price (only for period 2 and base estimation). There is of course no direct causality in this interaction, but the situation might be hinting at the simultaneous effect of the general demand for commodities. USD/Peso and interest rates have negative influence oil prices during 00-15 and 08-15 and these effects are larger during the latter period. Interest rates also influence the oil prices during pre-crisis era, but this time the effect is positive (1.5%).

IRF's for the VAR system in 00-15 exhibit flat and insignificant effects, only noticeable responses being positive ones from Brent oil price against shocks in gold price and Mexican stocks. Sub periods are in similar character, but the positive response of oil to shocks in gold price is clearer.

4.2.7. Indonesia

Below are the coefficients with statistical significance for Indonesia:

Table 20: VAR Estimation Output for Indonesia

	Sample: 2000M01 2015M12			**Sample: 2000M01 2007M12**			**Sample: 2008M01 2015M12**		
	Included observations: 192			**Included observations: 96**			**Included observations: 96**		
	LN(IDN)	**LN(GOLD)**	**LN(OIL)**	**LN(IDN)**	**LN(GOLD)**	**LN(OIL)**	**LN(IDN)**	**LN(GOLD)**	**LN(OIL)**
LN(IDN)(-1)	0.9512***	0.0201	0.1294***	0.8965***	0.0315	0.1836	0.8537***	0.0540	0.1227
LN(GOLD)(-1)	-0.0146	0.9131***	0.0037	0.0466	0.7557***	-0.1380**	-0.0669	0.8525***	0.0367
LN(OIL)(-1)	-0.0179	0.0062	0.8776***	-0.0266	0.0145	0.7047***	0.0139	-0.0105	0.8711***
C	0.8729*	1.1600***	2.6191***	-3.0536**	-0.8157	-1.8839	0.0365	2.2100***	0.9329
LN(CPI_IDN)	0.1663***	0.1034**	-0.2134**	0.3410**	0.3169***	0.3212	0.3423**	0.0547	-0.7569***
LN(EX_IDN)	-0.1108*	-0.1310***	-0.2286**	0.2388**	0.0785	0.1413	0.0376	-0.1919*	0.2453
R(IDN)	-0.5164**	-0.0889	-0.6843*	-0.1030	0.0663	-0.2754	-5.3686***	-0.4793	-4.9299**
R-squared	0.9949	0.994	0.9657	0.9897	0.9881	0.9482	0.9759	0.9347	0.9193

*, **, and *** indicates significance at 10%, 5%, and 1%.

Stock market gains in Indonesia show no signs of relation with (t-1) gains in oil prices and gold prices. Previously seen positive effect of the CPI is present in all estimation periods, ranging from 0.2 % to 0.3 %. In contrast to other countries USD/Indonesian Rupiah in pre-crisis estimation is pushing stock market gains upward by 0.2 % (the effect is -0.1% with base estimation). There might be benefits of weakening national currency by narrowed-down current account deficit along with boosting economic activity through international trade gains -this interpretation of course needs its own statistical proof. 1 % increase in USD/Rupiah in base estimation leads to rather minimal contraction in stock market gains (0.1 %). Interest rates in in

base and period 2 estimations are disturbing the stock market gains by 0.5 % to 5.36 %. Gold prices do not react to previous gains of stock prices and oil prices, while the positive link with CPI is present (0.1 % to 0.3 %) except period 2. Gold prices are negatively influenced by exchange rates, (0.1% to 0.2%), but the effect is not present during 00-07. 1 % gain in stock prices in a month earlier leads to 0.1% increase in oil prices, but the effect is not significant in sub-periods. Increases in CPI, exchange rates and interest rates lead to lower oil prices, with highest impact coming from interest rates with 4.9 %. Petrol-oriented assets may not be preferred by investors over interest rate gains in Indonesia especially after the financial crisis. Except for the minimal positive response from gold and oil prices to shocks in stock market, impulse responses are weak. Sub period responses are similar.

4.2.8. Nigeria

Significant VAR coefficients for Nigeria are presented below:

Table 21: VAR Estimation Output for Nigeria

	Sample (adjusted): 2002M01 2015M12 Included observations: 168 after adjustments			Sample (adjusted): 2002M01 2007M12 Included observations: 72 after adjustments			Sample: 2008M01 2015M12 Included observations: 96		
	LN(NIG)	**LN(GOLD)**	**LN(OIL)**	**LN(NIG)**	**LN(GOLD)**	**LN(OIL)**	**LN(NIG)**	**LN(GOLD)**	**LN(OIL)**
LN(NIG)(-1)	0.9536***	-0.0228	0.0387	0.9018***	0.0018	0.0085	0.8640***	-0.0937**	0.1324*
LN(GOLD)(-1)	-0.0308	0.9708***	0.1527***	0.3074***	0.8733***	-0.0059	-0.0950	0.8160***	0.3243**
LN(OIL)(-1)	0.0375	-0.0067	0.9373***	-0.1328**	0.0137	0.6698***	0.0500	0.0665	0.9441***
C	0.4997	0.8702	-1.0350	-1.1401	1.2255*	0.8322	2.2219	1.7484*	-4.2879**
LN(CPI_NIG)	0.0063	0.0729	-0.2487**	0.0596	0.1962*	0.6394***	0.2338	0.0411	-0.5541***
LN(EX_NIG)	0.0012	-0.1470	0.2043	0.1104	-0.2739**	-0.4597	-0.2984	0.0073	0.6992**
R(NG)	-0.0536	-0.0459	-0.0743	-0.0919	0.1804	0.0274	0.0488	-0.0178	-0.0411
R-squared	0.9685	0.9913	0.9621	0.9884	0.9820	0.9627	0.9354	0.9355	0.9119

*, **, and *** indicates significance at 10%, 5%, and 1%.

Estimations related to Nigeria have little signs of connection between indicators, like the situation seen in China. Nigerian stock market gains are related to increases in gold prices (0.3 %) and oil prices (-0.1 %) only in period 1. The former dynamic can be evidence for the interpretation that rising demand for gold also accompanied by increased economic activity that boosts the demand for other assets; the latter dynamic supports the cost factor argument for the oil prices. Only in period 2 estimation, 1 % increase in stock prices in previous month leads to contraction in

gold market (0.1 %); this will only make sense if the investors are quitting other assets following a solid performance in stocks in previous period. Gold market is also positively influenced (0.2%) by increases in CPI during 00-07. In post-crisis period, Brent oil prices tend to increase by 0.1 % and 0.3 % following increases in stock prices and gold prices; the effect coming from gold prices is also present in base estimation. Again, the dynamic can be attributed to increased economic activity. CPI on the other hand exhibits a mixed behaviour while shrinking the prices of Brent oil during period 1 by 0.6 % but increasing them during base estimation and period 2 by 0.2 % and 0.6 %. During post crisis period, 1% depreciation of the domestic currency also leads to 0.7% increase in oil prices.

IFR's reveal that in 00-15 there is small positive reaction from stock exchange to shocks in oil price; negligible negative response from gold to shocks in stock market; and small but positive responses from oil price to shocks in stock exchange and gold price, the latter being in increasing behaviour. In 00-07 Nigerian stocks react negatively to shocks form oil price.

4.2.9. Turkey

Following table consists of the significant coefficients produced by VAR estimations for Turkey:

Table 22: VAR Estimation Output for Turkey

	Sample: 2000M01 2015M12			**Sample: 2000M01 2007M12**			**Sample: 2008M01 2015M12**		
	Included observations: 192			**Included observations: 96**			**Included observations: 96**		
	LN(TUR)	**LN(GOLD)**	**LN(OIL)**	**LN(TUR)**	**LN(GOLD)**	**LN(OIL)**	**LN(TUR)**	**LN(GOLD)**	**LN(OIL)**
LN(TUR)(-1)	0.8998***	0.0026	0.0172	0.7709***	0.0550**	0.2199***	0.6058***	-0.0269	-0.0480
LN(GOLD)(-1)	0.0524	0.9562***	0.0365	0.2441	0.8267***	-0.0665	0.0376	0.8969***	0.0627
LN(OIL)(-1)	-0.0627*	-0.0150	0.8508***	-0.0049	0.0082	0.6489***	-0.1454***	-0.0301	0.8334***
C	0.2378	-0.0799	-0.3454*	0.1525	0.1144	-1.0477***	-2.8491***	0.2700	-1.2422
LN(CPI_TUR)	0.1856***	0.1023***	0.1475**	0.1914	0.0939**	0.1555	1.7463***	0.2227	0.5182
LN(EX_TUR)	-0.1576**	-0.0880***	-0.2268***	-0.2398**	-0.0329	-0.1137	-1.0333***	-0.1962	-0.5528**
R(TUR)	-0.0563**	0.0090	-0.0432	-0.0620*	0.0125	-0.0167	-1.0021***	-0.5414*	-0.9056*
R-squared	0.983	0.9939	0.9659	0.9658	0.9879	0.9539	0.9675	0.935	0.9163

*, **, and *** indicates significance at 10%, 5%, and 1%.

Stock market of the Turkish economy is not affected by (t-1) increases in the gold prices. Rising oil prices (t-1) have marginal negative effect on stock prices and these effects are only significant in base and period 2 estimations. One might want to

check the impact of not the world oil prices, but locally set oil prices by the government to see the real impact. Soytas et al (2009) also states that world oil prices do not affect stock prices in Turkey. Rising USD/Lira plays an adversary role in stock prices, which is also seen in other developing economies in BRICS and MINT group. The effect is present in all periods, and most effective with 1 % in post-crisis estimation. Considering recent problems of Turkish economy regarding de-stabilized exchange rate trend towards an eroding Lira, difficulties in managing current account deficit, and firms being exposed to currency risk, this statistical evidence is not surprising. Rising interest rates in all estimations have negative influence on stock market gains while being strongest in period 2 (1 %). Inflationary effects are positive for base estimation (0.2 %) and period 2 (1.7 %) which is indicating a demand pressure especially after financial crisis. The impact of 1% increase in stock market prices in (t-1) have a miniscule impact on gold prices (0.05 %) only in period 1. Inflation hedge argument can be somewhat supported by base and period 1 estimations where 0.1 % positive impact is seen. The link between gold prices and USD/Lira is rather small (-0.08 %) and only seen in pre-crisis period. Gold prices are also negatively influenced by interest rates (0.5%) during post-crisis period. Positive deviations in Turkish stock prices in pre-crisis period seem to push Brent oil prices by 0.2 %; while USD/Lira does the contrary in base and post-crisis estimations (0.2 % and 0.5 %). During 08-15, 1-point increase in interest rates contract oil prices by 1%.

In 00-15, IRF's show that Turkey's stock market reacts negatively to shocks in oil price, and the effect maxes out in 8th period (4th period in 08-15). Gold does not exhibit any reaction. Brent oil has a flat positive response to shocks in gold price, but the effect is rather small. In 00-07 both gold and oil prices react positively to stock market shocks. Other responses do not raise attention.

4.2.10. Lead-Lag Properties

Table 23 summarizes the lead-lag properties for stock prices, oil prices, and gold prices for all estimations:

Table 23: Lead – Lag Properties

	00-15			00-07			08-15		
	Stocks>Gold	**Stocks>Brent**	**Gold>Brent**	**Stocks>Gold**	**Stocks>Brent**	**Gold>Brent**	**Stocks>Gold**	**Stocks>Brent**	**Gold>Brent**
BRA	Lead (1-5)	Lead	Lead	Lead	Lead	Lead	Lag (3-10)	Lead (1-4)	Lag (2-10)
RUS	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead (1-3)
IND	Lead (1-6)	Lead	Lead	Lead	Lead	Lead	Lag (2-10)	Lead	Lead
CHI	Lead	Lead	Lead	Lead	Lag (2-10)	Lead (1-3)	Lead	Lead	Lead
SAF	Lead	Lead	Lead	Lead	Lead	Lead	Lead (1-4)	Lead	Lead
MEX	Lead	Lead	Lead	Lead	Lead	Lead	Lag (3-10)	Lag (2-10)	Lead
IDN	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead
NIG	Lead	Lead	Lead	Lag (2-10)	Lag (2-10)	Lead	Lead	Lead	Lead
TUR	Lead (1-7)	Lag (3-10)	Lead	Lead	Lead	Lead	Lead	Lag (2-10)	Lead

Almost uniformly thorough all tests, gold prices lead Brent oil prices except minor cases. Similarly, stock markets seem to lead both gold and oil prices, except in Turkey, according to base and post crisis estimations. The evidence may suggest keeping an eye on the movements of the gold price before Brent oil; and on the movements of stock markets before the other two. Perhaps, responses to (and therefore actions against) changes in the economic environment are reflected on the stock markets faster: Valuation movements in local stock markets would be much higher in frequency than in world prices of gold and oil. Thus, ranking among these instruments in terms of pace could be derived as: Stock markets > Gold prices > Oil prices. This evidence is a contradiction to Huang et al (1996) who find that returns of oil futures lead returns of stock prices; however, that finding was specific to stocks of oil-related firms and was non-existent when broad index of S&P 500 is considered. Hammoudeh et al (2008) also finds no evidence that oil prices lead other commodities.

4.3.DISCUSSION

Output from these estimations give hints about connections between national macro indicators and some of the financial variables but fail to detect consistent ties between stocks markets, gold prices and oil prices of these economies:

- It must be mentioned that stock markets, gold prices and oil prices are largely influenced by themselves. The influence ranges from 0.7 % to 1 % following 1 % change in own series in the previous month. Samanta and Zadeh (2012) reaches a similar conclusion for US stock prices and world gold prices during 1989-2009; while Sujit and Kumar (2011) also states the same for gold prices during 1998-2011.
- Rise of interest rates hurt stock market performance (Brazil, South Africa, Mexico, Indonesia, Turkey).
- Rise of USD against domestic currencies hurt stock market performance (Brazil, Russia, India, China, Mexico, Turkey).
- There is positive connection between rising inflation and gold prices (Brazil, Russia, India, South Africa, Indonesia, Turkey). This finding may support the inflation-hedge argument.
- Significant connections between (t-1) gains in oil prices and (t) gains in stock markets tend to be negative (Brazil, Russia, India, South Africa, Indonesia, Turkey). This connection is especially significant after the financial crisis and does not change between oil exporters and oil importers. Sadorsky (1999) also finds this negative link during 1947-1996 for US stock market (also stated by Mollick and Assefa (2013) in pre-crisis period). Basher et al (2012) finds this effect for emerging markets during 1988-2008. However, the impact of (t-1) gains in oil price by 1 % translates into a maximum of -0.5 % only in post-crisis period in Russia. This reminds Apergis and Miller (2009) as they state that oil market does not cause large reactions in international stock markets.
- The connection between (t-1) gains in stock prices and (t) gains in gold prices are usually positive before the crisis (Russia, India, South Africa, Turkey); but this relationship negative after the crisis (India, Nigeria). The only apparent

example of this shift however is India. The effects, however, are also not strong.

- Movements in Brent oil prices are always positively linked to (t-1) gains in stock markets, where significant (Brazil, Russia, South Africa, Mexico, Indonesia, Nigeria, Turkey). This effect may be the reflection of economic activity as demand towards oil products. Direction of the effect is not changing between oil exporters and oil importers. This effect coincides with findings of Basher et al (2012). Filis et al (2011) finds a similar result during 1987-2009, stating that oil prices cannot be an alternative instrument to stock markets.
- Movements in Brent oil prices are positively linked to (t-1) gains in gold prices in some estimations (China, South Africa, Mexico, Nigeria) and this effect is either present in base equation or after-crisis.
- The link between oil prices and stock markets are weak in magnitude, reminding Maghyereh (2004) who indicates that the effects of oil prices on emerging economies might be overestimated for 1998-2004.
- Lead-lag properties show that gold price leads Brent oil price, while stock market indices consistently [6]lead both gold and oil prices, suggesting that tracking movements of gold price before Brent oil, and movements of stock markets before both gold and Brent oil may be useful. Hammoudeh et al (2008) also find that oil prices do not lead other commodities during 1990-2006. This is, however, a contradiction to Huang et al (1996) who find that returns of oil futures lead stock market returns.

These VAR systems produce weak impulse responses, which largely show that stock markets react negatively to the shocks coming from Brent oil price, with one exception being Nigeria, which is one of the next exporters among MINT group. Reaction of stock markets to shocks from gold price are rather flat, minor exceptions being Brazil (00-15, positive), Russia (00-15, positive), India (00-15, negative), and Nigeria (00-15, positive). Gold price and Brent Oil price are mostly unresponsive to each other, with minor cases being China equation (00-15 and 08-15), Mexico equation (with varying magnitudes in each period), Nigeria equation (00-15 and 08-15), where both react positively to shocks coming from the other party. Again, these are weak

[6] Except for Turkey where Brent oil price leads stock market index.

results which do not accumulate into a strong argument rather than this: BRICS and MINT economies in a monthly VAR setting during period 00-15 do not provide strong evidence for the relationship between stock markets, gold and oil prices.

CHAPTER FIVE
CAUSALITY RELATIONSHIPS BETWEEN STOCK PRICES, GOLD PRICES, AND OIL PRICES: PANEL GRANGER CAUSALITY ANALYSIS

This section includes data and method description, unit root tests, and discussion of the results for the Panel Granger Causality analysis part of the study thesis. Additionally, a complementing literature review is carried out with focus on studies with similar methods.

5.1.INTRODUCTION

Understanding the connections between financial variables ultimately serves the purpose of predicting the future. Potential benefits of being able to predict the movements of these variables include better chance of efficient investment allocation on micro level, and more accurate policy guidance on macro level. Prediction of movements also involves the detection of which indicator preceding the other; and by definition, the use of Granger Causality test is a relevant tool in this context. This section is dedicated to the use of Granger Causality technique in a panel setting introduced by Hurlin and Dumitrescu (2012).

5.2.STUDIES ON GRANGER CAUSALITY BETWEEN STOCK MARKET, GOLD, AND OIL PRICES

Using daily data between Feb 1995 and Dec 2009, Narayan et al (2010) finds that gold and oil spot and futures markets cointegrated up to 10 months; which confirms the use of gold against inflation that originates from the increase in oil price. Authors argue that oil market can be used to predict gold market, and the same is also possible when the relationship is reversed; thus, these two markets are jointly inefficient.

Patel (2012) focuses on the links between Indian stock market and macroeconomic determinants between 1991 and 2011[7]. Using VECM, Granger

[7] Interest rate, inflation, exchange rate, index of industrial production, money supply, gold price, silver price, oil price.

Causality, Johansen cointegration and ADF unit root analyses, the study finds that there is causality from exchange rates to stocks, industrial production, and oil price. Patel argues that India is dependent on oil market; thus, increasing oil prices are expected to lower stock market performance through decreasing firm profitability.

Samanta and Zadeh (2012) show that between 1989:01 and 2009:09, world gold prices and Dow Jones Industrial index are influenced by themselves only. Using VARMA and Granger Causality methods, the authors find that stock prices and gold prices Granger cause USD exchange rate and oil prices, but reverse causality is does not exist. Oil price is only caused by other variables. There are also signs of volatility transmission, but with asymmetric properties.

Ji and Fan (2012) employs bivariate GARCH method using daily log returns of WTI crude oil futures and non-energy commodity prices[8] from 2006:07 to 2010:06 to capture price and volatility spillovers. Authors argue that linkages between crude oil and non-commodity markets was raised due to hedge strategies against inflationary pressures from rising oil prices and substitution of fossil fuels by bio fuel. The study finds that crude oil has significant volatility spillovers on non-energy commodity prices, and this effect weakens after financial crises. However, the level of correlation between the two variables is higher after the crisis; indicating that economic recession influenced the market towards more jointly moving trends.

Reboredo (2013) studies the hedge properties of gold against oil price movements, using weekly data of WTI crude oil price and Bank of England gold price from 2000:01 to 2011:09. Methodically, the study uses average dependence and tail dependence information provided by copulas to see whether gold has any hedge value against oil price movements. Results indicate that there is positive and significant average dependence and tail independence between these markets, meaning that gold in average cannot be used as a hedge against oil price movements; however, in extreme oil price volatility, gold can act as a safe haven.

Miyazaki and Hamori (2013) find unidirectional causality in mean from S&P 500 and London gold prices, using daily data from 2000:01 to 2011:04. The study which employs ADF and ARCH family analyses finds no causality in variance between gold and stock markets, adding that there is no volatility transmission in the

[8] Non-energy CRB index is selected as the representative of non-energy commodity prices.

long run. Authors argue that during financial crisis, the relationship between these variables change, as unilateral causality emerges in mean variance from stocks to gold. This finding is interpreted as a "flight to quality", where investors lean towards gold-linked assets as a protection measure against ill-performing stock market.

Choudhry et al (2015) work with Japan, UK, and US stocks and global gold prices using daily data from 2000:01 to 2014:03, as they examine the relationship between gold prices and stock markets during global crisis. Bivariate and multivariate nonlinear tests show that there are only weak signs of causality between stock returns and gold returns for all countries during pre-crisis period, indicating that gold was a safe haven during pre-crisis. However, significant causality emerges between stocks and gold during crisis period. This contrast to the literature shows that gold has lost its safe-haven status for UK, US, and Japan economies during financial crisis and cannot be used to reduce portfolio risk.

Jain and Biswal (2016) employs DCC-GARCH and symmetric and asymmetric non-linear causality tests with daily data from 2006 to 2015 using global prices of gold, Brent oil, USD/Rupee and stock market of India. During 2008 and 2013, authors find that the correlation between crude oil and Indian Rupee was higher than the rest of the period. Similar pattern emerges for the correlation between Crude oil and stock prices. Short periods of negative correlation between gold price and stock market are observed, which justifies the safe-haven argument for gold prices. Both symmetric and asymmetric non-linear causality analyses reveal that causality runs from gold price to exchange rate then from exchange rate to stock market.

Huang et al (2016) study Chinese stock market's dynamics against Brent oil price and London gold price between 1991:01 and 2014:09. Authors argue that China is one of the largest oil importers and also among the largest economies; thus, the Chinese market is a similar environment to international markets. The study takes an interesting path by including frequency-based approach in Granger causality, with multiple frequencies from 2-4 days to 128-256 days. Findings indicate that Brent oil and stock prices can Granger cause each other, as well as gold prices and stock prices, but the latter causality is more inconsistent.

Shahzadi and Chohan (2016) use Johansen cointegration and Granger causality tests between 2006 and 2010 on gold price and stock exchange of Pakistan. Due to

economic and political unrest and uncertainty, people in Pakistan tend to invest in precious metals than in stock markets, and Karachi stock exchange faces selloffs as a result while Pakistan becomes one of the top ten consumers of gold. The study finds negative relationship between monthly average gold prices and KSE index; no evidence of long-run relationship is detected.

Ayaydın and Barut (2016) examine stock returns for Turkey, Brent oil prices, and gold prices using techniques such as Johansen Cointegration, VAR, Impulse responses, and Granger Causality between 1997:01 and May 2016:01; and detects a positive correlation between oil price and stock returns; while the correlation is negative between gold price and stock returns.

Research conducted by Zhu et al (2011), Zhang and Wei (2010), Bhunia (2013), Bhunia and Mukhuti (2013), Ray (2012), Le and Chang (2011), and Sujit and Kumar (2011) are addressed in the literature review in Section II, and thus are not included here.

5.3.DATA DESCRIPTION AND METHOD OF ANALYSIS

The data consist of monthly international gold and Brent oil prices, along with all-share stock market indices of BRICS and MINT country groups for the period 2000:01-2015:12. International prices of gold and Brent crude oil are obtained from World Gold Council and U.S. Energy Information Administration (EIA). Stock market data comes from a combination of sources, including databases of Thomson Reuters, Yahoo Finance, and Investing.

Similar to the procedure utilized by Liddle and Messinis (2015), this section employs the panel Granger causality test introduced by Hurlin and Dumitrescu (2012):

$$\Delta S_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^k \, \Delta S_{i,t-k} + \sum_{k=1}^{K} \beta_i^k \, \Delta B_{i,t-k} + \varepsilon_{i,t} \qquad (4)$$

Where Δ denotes difference, S stands for the log of stock prices for country i (i=1, 2,…,N) , B stands for the log of Brent oil price; γ and β vary across countries. Ɛ represents the residuals. The rationale behind the expression tells us that, even after past values of S are included, if past values of *B* are significant predictors of the current

value of S, then B has an influence on S. For all items in the panel, the lag order K is assumed to be identical; and the panel must be balanced (Lopez & Weber, 2017).

The aim of this procedure is to detect causality from B to S. Thus, we must test for effects of past values of B on the present value of S. The null hypothesis suggests the absence of causality for all items in the panel, and is expressed as (Granger 1969; Lopez and Weber, 2017):

$$H_0: \beta_{i1} = \cdots = \beta_{iK} = 0 \qquad \forall i = 1, \dots, N \tag{5}$$

The alternative hypothesis can be expressed as:

$$H_1: \ \beta_{i1} = \cdots = \beta_{iK} = 0 \qquad \forall i = 1, \dots, N_1$$

$$\beta_{i1} \neq or \dots or \ \beta_{iK} \neq 0 \qquad \forall i = N_1 + 1, \dots, N \tag{6}$$

Above hypothesis indicates that, for $0 \leq N_1 < \mathrm{N}$, causality may exist for some (or all) individuals in the panel. In order to test these hypotheses, Hurlin and Dumitrescu (2012) suggests using the procedure below (Lopez and Weber, 2017):

- Run N individual regressions based on (4); extract w_i by performing F tests of the K linear hypotheses $\beta_{i1} = \cdots = \beta_{iK} = 0$; and using N individual Wald statistics, calculate $\bar{w}$:

$$\bar{w} = \frac{1}{N} \sum_{i=1}^{N} w_i \tag{7}$$

- The assumption here is that Wald statistics are independently and identically distributed across individuals. Thus, the standardized statistic $\bar{z}$ has a standard normal distribution:

$$\bar{z} = \sqrt{\frac{N}{2K}} \cdot (\bar{w} - K) \qquad \xrightarrow[T, N \to \infty]{d} \qquad N(0,1) \tag{8}$$

- The approximated standardized statistic $\tilde{z}$ also has a standard normal distribution, for a fixed T dimension with $T > 5 + 3K$:

$$\tilde{z} = \sqrt{\frac{N}{2K} \cdot \frac{T-3K-5}{T-2K-3}} \cdot \left[\frac{T-3K-3}{T-3K-1} \cdot \bar{w} - K\right] \xrightarrow[N \to \infty]{d} N(0,1) \qquad (9)$$

Finally, to test the null hypothesis (5) we consider $\tilde{z}$ and $\bar{z}$. If these values are larger than the corresponding normal critical values, H_0 is rejected, and we can conclude that there is Granger causality.

5.4.PANEL UNIT ROOT TESTS

Testing for unit roots is done by using the Summary test method in EViews in levels and 1st differences, by allowing for intercept and intercept & trend specifications. Presented test results are based on Levin, Lin, and Chu (LLC) test method, which assumes a common unit root process across all cross-sections. As Nell and Zimmermann (2011) describes, LLC test has following hypotheses:

H_0: *Each series has a unit root*
H_1: *Each series is stationary*

The process of LLC includes four steps (Levin et al, 2002; Nell and Zimmermann, 2011):

1. Running Augmented Dickey-Fuller test for each cross-section:

$$\Delta S_{i,t} = \alpha_i S_{i,t-1} + \sum_{k=1}^{p_i} \gamma_i^k \Delta S_{i,t-k} + \alpha_{mi} d_{mt} + \varepsilon_{i,t} \qquad (10)$$

2. Estimating two auxiliary regressions and capturing their residuals:
   $\Delta S_{i,t}$ on $\Delta S_{i,t-k}$ and d_{mt}, with residuals $\hat{e}_{i,t}$
   $S_{i,t-1}$on $\Delta S_{i,t-k}$ and d_{mt}, with residuals $\hat{v}_{i,t-1}$

3. Standardizing $\hat{\varepsilon}_{i,t}$ and $\hat{v}_{i,t}$:

$$\tilde{e}_{i,t} = \hat{e}_{i,t} / \hat{\sigma}_{\varepsilon_i} \qquad (11)$$

$$\tilde{v}_{i,t-1} = \hat{v}_{i,t-1}/\hat{\sigma}_{\varepsilon_i} \quad (12)$$

4. Running the below OLS regression with residuals:

$$\tilde{e}_{i,t} = \alpha\tilde{v}_{i,t-1} + \tilde{\varepsilon}_{i,t} \quad (13)$$

The above-mentioned null hypothesis suggests that $\alpha = 0$.

Lag Length is based on Schwarz Information Criterion, with maximum lags of 10. Panel unit root tests in Table 24 across all sub time and country group variations show that return series (first difference of logged variables) are stationary:

Table 24: Panel Unit Root Tests

Intercept	00-15 Statistic	Prob.	SIC lags	Obs	00-07 Statistic	Prob.	SIC lags	Obs	08-15 Statistic	Prob.	SIC lags	Obs	Cross-Sections
Ln(OIL)	-0.9648	0.1673	0	1728	4.3300	0.0000	2	864	3.5056	0.9998	1	864	9
DLn(OIL)**	-45.7684***	0.0000	0	1728	12.0249	1.0000	1	864	-22.3232***	0.0000	0	864	9
Ln(GOLD)	-3.0178***	0.0013	0	1728	6.4062	1.0000	0	864	-3.1118***	0.0009	0	864	9
DLn(GOLD)	-58.2347	0.0000	0	1728	-35.2658***	0.0000	0	864	-38.1789***	0.0000	0	864	9
Ln(STOCKS)	-0.6650	0.2530	0 to 1	1727	4.8951	1.0000	0	863	0.2553	0.6007	0 to 1	864	9
DLn(STOCKS)	-40.2299***	0.0000	0	1726	-29.8914***	0.0000	0	862	-26.5147***	0.0000	0	864	9
Ln(BRICS)	-0.0624	0.4751	0 to 1	960	4.1537	1.0000	0	480	0.4456	0.6721	0 to 1	480	5
DLn(BRICS)	-29.7611***	0.0000	0	960	-22.0511***	0.0000	0	480	-20.7158***	0.0000	0	480	5
Ln(MINT)	-0.8272	0.2041	0 to 1	767	2.8390	0.9977	0	383	-0.0562	0.4776	0 to 1	384	4
DLn(MINT)	-27.0334***	0.0000	0	766	-20.1357***	0.0000	0	382	-16.6047***	0.0000	0	384	4
Ln(EXP)	-1.6494**	0.0495	0 to 1	767	2.1113	0.9826	0	383	-0.2274	0.4101	0 to 1	384	4
DLn(EXP)	-25.8864***	0.0000	0	766	-20.4494***	0.0000	0	382	-15.3857***	0.0000	0	384	4
Ln(IMP)	0.5592	0.7120	0 to 1	960	5.0696	1.0000	0	480	0.4714	0.6813	0 to 1	480	5
DLn(IMP)	-30.8154***	0.0000	0	960	-21.7685***	0.0000	0	480	-21.8538***	0.0000	0	480	5
Int. & Trend	**00-15 Statistic**		**SIC lags**	**Obs**	**00-07 Statistic**		**SIC lags**	**Obs**	**08-15 Statistic**		**SIC lags**	**Obs**	**Cross-Sections**
Ln(OIL)	8.2248	1.0000	0	1728	-3.8256***	0.0001	0	864	4.4199	1.0000	1	864	9
DLn(OIL)**	-54.5100***	0.0000	0	1728	18.2748	1.0000	1	864	-25.0265***	0.0000	0	864	9
Ln(GOLD)	5.1635	1.0000	0	1728	-0.4841	0.3142	0	864	-0.0825	0.4671	0	864	9
DLn(GOLD)	-69.1261***	0.0000	0	1728	-40.2277***	0.0000	0	864	-43.3509***	0.0000	0	864	9
Ln(STOCKS)	1.3337	0.9089	0 to 2	1727	-1.1284	0.1296	0 to 1	862	-0.6940	0.2439	0 to 1	864	9
DLn(STOCKS)	-46.8556***	0.0000	0	1726	-33.8958***	0.0000	0	862	-29.0567***	0.0000	0	864	9
Ln(BRICS)	1.5867	0.9437	0 to 2	960	0.5109	0.6953	0	480	-0.7695	0.2208	0 to 1	480	5
DLn(BRICS)	-34.7029***	0.0000	0	960	-25.0991***	0.0000	0	480	-22.8873***	0.0000	0	480	5
Ln(MINT)	0.2751	0.6084	0 to 1	767	-2.5155	0.0059	0 to 1	382	-0.2210	0.4126	0 to 1	384	4
DLn(MINT)	-31.4652***	0.0000	0	766	-22.7663***	0.0000	0	382	-17.9894***	0.0000	0	384	4
Ln(EXP)	1.4610	0.9280	0 to 1	767	-1.8284	0.0337	0 to 1	382	0.0363	0.5245	0 to 1	384	4
DLn(EXP)	-30.3574***	0.0000	0	766	-23.0038***	0.0000	0	382	-16.6028***	0.0000	0	384	4
Ln(IMP)	0.3524	0.6377	0 to 2	960	-0.0731	0.4709	0	480	-1.0312	0.1512	0 to 1	480	5
DLn(IMP)	-35.7131***	0.0000	0	960	-24.8886***	0.0000	0	480	-24.1878***	0.0000	0	480	5

Levin, Lin & Chu method test statistics (assumes common unit root process).
Null Hypothesis: Series has a unit root.
Automatic lag selection based on SIC with max lags 10.
*, **, and *** indicates significance at 10%, 5%, and 1%.

5.5.RESULTS

Lag selection is made regarding the SIC selection criterion values for the unrestricted VAR estimations based on returns of stocks, gold and oil prices. All tests are run with (a) SIC based suggested lags and (b) 1 to 2 lags if SIC lag order is 0:

Table 25: Panel Granger Causality Test Results

Panels	**Brent->Stocks**			**Stocks->Brent**			**Gold->Stocks**			**Stocks->Gold**		
2000:01-2015:12	Lags: 1	Lags:2	Lags (x)	Lags: 1	Lags:2	Lags (x)	Lags: 1	Lags:2	Lags (x)	Lags: 1	Lags:2	Lags (x)
All Countries	0.2787	0.0753	-	0.0000	0.0000	-	0.2896	0.6687	-	0.9598	0.5486	-
BRICS	0.7210	0.7584	-	0.0000	0.0000	-	0.4723	0.5364	-	0.9526	0.3141	-
MINT	0.0429	0.0026	-	0.0000	0.0000	-	0.4326	0.9606	-	0.8871	0.8214	-
Oil-IM	0.2538	0.1751	-	0.0000	0.0000	-	0.2590	0.7492	-	0.9684	0.6413	-
Oil-EX	0.7270	0.2495	-	0.0000	0.0000	-	0.7441	0.7760	-	0.9750	0.7047	-
2000:01-2007:12												
All Countries	0.0003	0.0218	0.0573 (4)	0.3878	0.6039	0.3873 (4)	0.9113	0.3234	0.0668 (4)	0.2189	0.1870	0.0621 (4)
BRICS	0.0829	0.2582	-	0.3807	0.3163	-	0.3293	0.1466	-	0.4721	0.9520	-
MINT	0.0577	0.0296	-	0.0229	0.0006	-	0.2085	0.8875	-	0.2983	0.0559	-
Oil-IM	0.0000	0.0021	-	0.0804	0.3777	-	0.2621	0.1626	-	0.3796	0.2151	-
Oil-EX	0.8729	0.9969	-	0.5099	0.8352	-	0.1554	0.9364	-	0.3889	0.5528	-
2008:01-2015:12												
All Countries	0.2265	0.1080	0.0617 (9) 0.0000 (5)	0.0000	0.0000	0.0028 (9) 0.0000 (5)	0.6138	0.0432	0.0000 (9) 0.2518 (5)	0.1479	0.0729	0.4615 (9) 0.4717 (5)
BRICS	0.1700	0.5746	-	0.0000	0.0000	-	0.8084	0.5411	-	0.2175	0.0814	-
MINT	0.0008	0.0024	-	0.0000	0.0000	-	0.3040	0.0188	-	0.4286	0.4564	-
Oil-IM	0.2854	0.6694	-	0.0000	0.0000	-	0.7598	0.2493	-	0.2791	0.1146	-
Oil-EX	0.0026	0.0532	0.2224 (9)	0.0000	0.0000	0.5859 (9)	0.2729	0.0810	0.0010 (9)	0.3369	0.3528	0.8085 (9)

Summarized probabilities for pairwise Dumitrescu Hurlin Panel Causality tests.
Notes: Brent oil, stocks and gold prices are all in first log differences. The expression "->" means "does granger cause". Null hypothesis for the test suggests no causality. Oil Importers: India, China, South Africa, Indonesia, Turkey. Oil Exporters: Brazil, Russia, Mexico, Nigeria. The numbers in parentheses in lags(x) columns give specific lag orders.

A clear causality relationship emerges between stock prices and oil prices. In full period and post-financial crisis sub period, tests with all country groups suggest that stock prices of these emerging countries Granger cause Brent oil prices at 1 % significance level. Interestingly in pre-financial crisis period this feature remains only in MINT group. The causality is less clear when the relationship is reversed. In full period, Brent oil price significantly Granger causes the stock prices only for MINT group, while the full country group in 2 lagged structure also shows causality with 10 % significance. In pre-financial crisis period, except for oil exporters, Brent oil price Granger causes stock prices. In post-financial crisis period, this relationship is kept only for MINT group and oil exporters. When VAR-specific lags are considered, Brent oil causes stock price at full-country scale in both sub-periods. The opposite is valid only for post-crisis period. On the other hand, there seems to be no granger causality between gold prices and stock markets; except for minor cases[9]. Testing with VAR-specific lags reveals that a bi-directional causality is present for all nine countries

[9] In pre-crisis period, Gold prices Granger cause stocks in full-panel with VAR specific lags at 10% level. This result is similar from stocks to gold. In post-crisis period, there is Granger causality from gold to stocks in full-panel at 2-lagged tests, and this effect is similar from stocks to gold for full-panel and BRICS. In 2-lagged tests and with VAR-specific lags, gold prices Granger cause stock markets for oil-exporter panel. These results are considerably inconsistent between lag, period, and panel specifications.

combined in pre-crisis period. In post-crisis period, combined causality from stocks to gold do not exist, but there is causality from gold to stocks for oil exporters. Combined causality from gold to stocks does vary between cases with SIC-specific lags, but it is largely non-existent in most of the iterations.

5.6.DISCUSSION

In this section, the relationship between stock markets of BRICS and MINT countries and global prices of gold and oil is investigated under a Panel Granger Causality setting introduced by Hurlin and Dumitrescu (2012) and applied by Liddle and Messinis (2015). Compared to VAR analysis, there clearer messages in this section:

- Stock prices of these emerging markets Granger cause Brent oil prices.
- In pre-crisis period, Brent oil prices Granger-cause stock prices, except for oil exporters. In post-crisis period, this is only true for MINT group. With VAR-specific lags, this effect is similar for both pre-and post-crisis periods for the group with all countries, but not for the full period.
- For MINT group, Granger causality between stock markets and oil price is bidirectional in all periods.
- There is no Granger causality between stock markets and gold price. Bhunia (2013) finds the same result for gold prices and Indian stocks during 1991-2012.

The evidence from Panel Granger Causality tests suggest that stock markets of BRICS and MINT Granger cause Brent oil prices, and this causality is stronger in post-crisis period and full period. Thus, the stock markets of these economies can be used as a predictor of Brent oil prices. Gold price and stock markets do not cause each other, and this can be interpreted as a level of independence that isolate the gold market from stock market movements. Combined with relatively steady progression of gold market, it is possible to say that in these economies gold may serve as a hedge instrument against stock market crises.

CONCLUSION

The existing literature is brimming with queries on how financial indicators connect to each other. When brought down to a basic portfolio level, some elements shine above the others: stock markets, gold prices and oil prices. The attention given to these elements have strong theoretical background: Stock markets are a swiftly adjusting indicator of future sentiments and reflect to many political and economic phenomena; gold is regarded as protection from degrading currency and hedge against wealth loss from any other asset in times of high uncertainty; and among this trio, oil is the one with direct impact on the real economy as a major cost factor. These crowning variables are therefore the core subjects of any conversation on portfolio management, and they also induce considerable weight on macroeconomic decisions.

Studies concerning the relationship between stock market, gold, and oil prices have considerable width; and with the impact of recent global financial crisis the urge to understand the links between these variables have increased. The history of economics has no shortage of troubling moments, and the latest one will surely not be the last of them; but with ever-deepening connection of international markets within world financial system through technical and regulatory progression, we can rest assured that every hiccup will resonate wider with clearer implications on real economic activity. Existing papers in this context largely focus on developed markets, although emerging economies are recently gaining more support. Findings of the literature broadly support the notion of oil prices influencing the real economy and therefore stock prices, and the notion of gold being used as a hedge tool, but there are also cases where evidence does not support these dynamics for both oil prices (Apergis and Miller, 2009) and gold prices (Choudhry et al, 2015). On the other hand, evidence on the connection between oil and gold markets is relatively inconclusive. The case for emerging markets is building up, but the evidence is blurred: Maghyereh (2004) concludes that stock markets of emerging countries do not reflect changes in the oil prices while Basher et al (2012) detects the opposite. Other studies are focused more on single economies and there is need to examine the subject on a wider level.

This research focuses on the addressed issues and aims at adding depth by investigating the relationship between stock markets, Brent crude oil prices and world

gold prices in a setting where BRICS and MINT economies are examined in a period that goes before and after the recent financial crisis, with two different approaches.

Firstly, each economy is examined through a VAR process where stock markets, gold prices and oil prices were kept endogenous and figures such as CPI, exchange rate and interest rates are kept exogenous as control factors. Output from these estimations give hints about connections between national macro indicators and some of the financial variables but fail to detect consistent ties between stock markets, gold prices and oil prices of these economies. It appears that the application of a simplistic VAR setting through monthly data with international prices for gold and Brent crude oil do not produce strong evidence of dynamic relationship between oil prices, gold prices and stock markets. This may be due to several factors: The inclusion of figures like CPI and policy interest rates required the narrowing down of data frequency to monthly data, which in turn might have resulted in loss of information in series. Secondly, regardless of the similarity of approach to the empirical studies in this context, these emerging economies may have other factors with better connection to their stock markets; or, in other words, connections between these economies' stock markets and global prices of gold and Brent oil are simply do not exist as expected. Apart from the study's focus, these VAR estimations provide insight on connections between several domestic macro indicators and financial variables: One common finding is the negative impact of interest rates on stock prices (Brazil, South Africa, Mexico, Indonesia, Turkey), which tends to be in the highest level during post-crisis period. Secondly, the rise of USD against national currencies tends to hurt stock market gains (Brazil, Russia, India, China, Mexico, Turkey); and this finding is consistent with the fragility of emerging economies in terms of exposures to hard currency risk. Third common factor is the positive link between inflation and gold prices (Brazil, Russia, India, South Africa, Indonesia, and Turkey), which can support the idea that gold can be used protection against inflation.

Secondly, a different perspective is applied where these stock markets are taken into a Panel Granger Causality setting introduced by Hurlin and Dumitrescu (2012) and applied by Liddle and Messinis (2015). Panel groups for stock markets are divided into 5 groups: All countries, BRICS, MINT, Oil Exporters, and Oil Importers. There are clearer messages in this section. Empirical results show that return series of stock

market prices for BRICS and MINT countries granger cause Brent oil prices. This connection is lost during pre-financial crisis period. Causality is less clear when it is reversed (Brent → stocks), but in pre-crisis period it is stronger for the group that includes all nine economies. For MINT countries, the causality goes both ways in all sub-periods. There is no causality between gold prices and stock market prices except minor cases. Findings indicate that stock market prices of these BRICS and MINT economies can be used as a predictor of Brent oil prices. The absence of a Granger Causality relationship between gold prices and stock markets can be interpreted as an independence factor which supports the safe-haven arguments that suggest the use of gold-linked assets for protection against stock market failures. This is view is also justified by the relatively steady trend of gold prices during the examination period, where stock markets fluctuate drastically.

Further research in this area by increasing data frequency (weekly and daily), including local gold and oil prices, and considering energy and manufacturing sub-sectors of stock markets may enhance the results towards clearer results. Research with clustered approach on these economies are scarce and may yield fruitful insights for those who are concerned in both micro and macro levels.

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APPENDIX

Table 26: AR Roots Statistics of VAR Estimations

	BRA	RUS	IND	CHI	SAF	MEX	IDN	NIG	TUR
00-15	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.
	0.9427	0.9238	0.9680	1.0270*	0.9802	0.9700	0.9231	0.9848	0.9508
	0.8752	0.9117	0.8914	0.9826	0.9466	0.9700	0.9231	0.9848	0.8783
	0.8752	0.7902	0.8497	0.8140	0.8220	0.8067	0.8972	0.8934	0.8783
00-07	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.
	0.8766	0.8959	0.8885	0.9543	0.9860	0.9254	0.8911	0.9143	0.9220
	0.6095	0.6452	0.7271	0.7845	0.7079	0.6743	0.7356	0.8544	0.6641
	0.6095	0.5308	0.7271	0.6601	0.5954	0.6743	0.7356	0.6762	0.6641
08-15	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.	Mod.
	0.9203	0.8908	0.9344	1.0065*	0.9753	0.9310	0.9012	1.0399*	0.8757
	0.8533	0.7613	0.8144	0.8584	0.8268	0.7690	0.8401	0.9364	0.8757
	0.6455	0.7613	0.5225	0.8584	0.8268	0.6141	0.8401	0.6479	0.5853

Roots of Characteristic Polynomial
Endogenous variables: Ln(Stocks) LOGGOLD LOGBRENT
Exogenous variables: C LOGCPI(Country) LOGEX(Country) R(Country)
Lag specification: 1 1

All VAR estimations are based on one-lagged equations. For the full period, the equation for China fail to satisfy the stability condition. Pre-crisis period is without problems; while in post-crisis VAR estimations China and Nigeria equations fail to satisfy the stability condition.

Table 27: Brazil VAR, Variance Decomposition

BRA	2000-2015				2000-2007				2008-2015			
Period	S.E.	BRA	GOLD	BRENT	S.E.	BRA	GOLD	BRENT	S.E.	BRA	GOLD	BRENT
1	0.070	100.000	0.000	0.000	0.063	100.000	0.000	0.000	0.054	100.000	0.000	0.000
2	0.092	99.431	0.338	0.230	0.071	99.365	0.083	0.552	0.066	95.649	0.732	3.620
3	0.106	98.206	1.103	0.690	0.074	98.517	0.206	1.277	0.072	88.257	2.041	9.701
4	0.116	96.447	2.254	1.299	0.074	97.821	0.321	1.858	0.078	80.493	3.502	16.005
5	0.124	94.289	3.726	1.984	0.075	97.366	0.408	2.226	0.082	73.762	4.858	21.380
6	0.129	91.871	5.446	2.683	0.075	97.105	0.468	2.428	0.085	68.423	6.021	25.557
7	0.134	89.317	7.334	3.349	0.075	96.965	0.507	2.528	0.088	64.355	6.987	28.658
8	0.138	86.732	9.317	3.951	0.075	96.893	0.532	2.575	0.090	61.307	7.781	30.911
9	0.142	84.199	11.331	4.470	0.075	96.856	0.548	2.596	0.092	59.035	8.435	32.529
10	0.145	81.777	13.322	4.901	0.075	96.837	0.559	2.605	0.093	57.341	8.975	33.684

GOLD												
Period	S.E.	BRA	GOLD	BRENT	S.E.	BRA	GOLD	BRENT	S.E.	BRA	GOLD	BRENT
1	0.050	6.623	93.377	0.000	0.039	4.985	95.016	0.000	0.055	1.708	98.292	0.000
2	0.068	6.350	93.593	0.057	0.052	3.869	96.083	0.048	0.073	1.038	98.149	0.813
3	0.080	6.087	93.743	0.171	0.060	3.253	96.605	0.142	0.085	1.456	96.622	1.922
4	0.089	5.836	93.838	0.326	0.066	2.894	96.848	0.258	0.094	2.301	94.777	2.922
5	0.096	5.601	93.890	0.508	0.070	2.675	96.949	0.376	0.101	3.232	93.077	3.690
6	0.102	5.384	93.910	0.707	0.073	2.538	96.977	0.485	0.106	4.100	91.672	4.227
7	0.107	5.184	93.904	0.912	0.075	2.451	96.971	0.578	0.111	4.853	90.570	4.577
8	0.110	5.003	93.881	1.116	0.077	2.395	96.950	0.654	0.115	5.483	89.731	4.786
9	0.114	4.840	93.845	1.316	0.078	2.358	96.926	0.716	0.118	6.001	89.101	4.898
10	0.116	4.694	93.801	1.506	0.079	2.334	96.902	0.764	0.120	6.422	88.633	4.945

BRENT												
Period	S.E.	BRA	GOLD	BRENT	S.E.	BRA	GOLD	BRENT	S.E.	BRA	GOLD	BRENT
1	0.107	7.511	1.748	90.741	0.102	0.025	3.376	96.600	0.094	22.751	0.401	76.848
2	0.142	8.570	1.915	89.516	0.124	2.081	3.128	94.791	0.118	21.889	0.273	77.838
3	0.164	9.594	2.053	88.353	0.134	4.238	2.916	92.845	0.130	21.252	0.233	78.515
4	0.179	10.567	2.163	87.270	0.138	5.777	2.779	91.445	0.137	20.790	0.254	78.955
5	0.190	11.477	2.245	86.278	0.139	6.687	2.710	90.603	0.141	20.460	0.314	79.225
6	0.198	12.313	2.302	85.385	0.140	7.162	2.691	90.148	0.144	20.226	0.397	79.377
7	0.203	13.071	2.337	84.593	0.140	7.385	2.699	89.916	0.146	20.061	0.490	79.450
8	0.207	13.747	2.354	83.899	0.140	7.480	2.721	89.799	0.147	19.945	0.585	79.470
9	0.211	14.343	2.357	83.300	0.141	7.516	2.747	89.737	0.148	19.864	0.678	79.459
10	0.213	14.862	2.350	82.788	0.141	7.528	2.772	89.700	0.149	19.807	0.766	79.427

Cholesky Ordering: BRA GOLD BRENT

Table 28: Russia VAR, Variance Decomposition

RUS	2000-2015				2000-2007				2008-2015			
Period	S.E.	RUS	GOLD	BRENT	S.E.	RUS	GOLD	BRENT	S.E.	RUS	GOLD	BRENT
1	0.101	100.000	0.000	0.000	0.092	100.000	0.000	0.000	0.095	100.000	0.000	0.000
2	0.136	98.572	0.020	1.408	0.116	97.571	2.076	0.353	0.128	92.784	0.137	7.079
3	0.161	96.049	0.075	3.876	0.131	94.489	4.786	0.725	0.151	83.229	0.321	16.450
4	0.180	93.071	0.171	6.759	0.142	91.822	7.192	0.986	0.169	74.942	0.484	24.575
5	0.195	90.038	0.310	9.652	0.150	89.775	9.082	1.143	0.181	68.702	0.610	30.688
6	0.208	87.169	0.492	12.339	0.156	88.268	10.502	1.230	0.190	64.306	0.701	34.993
7	0.219	84.567	0.715	14.718	0.161	87.170	11.554	1.275	0.196	61.338	0.765	37.897
8	0.228	82.263	0.975	16.762	0.164	86.369	12.334	1.297	0.200	59.407	0.809	39.784
9	0.235	80.255	1.267	18.478	0.167	85.778	12.915	1.307	0.203	58.197	0.838	40.965
10	0.242	78.517	1.587	19.896	0.170	85.337	13.353	1.310	0.204	57.470	0.857	41.674

GOLD												
Period	S.E.	RUS	GOLD	BRENT	S.E.	RUS	GOLD	BRENT	S.E.	RUS	GOLD	BRENT
1	0.050	2.936	97.064	0.000	0.036	5.821	94.179	0.000	0.058	3.398	96.602	0.000
2	0.068	2.820	96.934	0.246	0.045	14.424	85.284	0.292	0.079	3.088	95.881	1.031
3	0.081	2.717	96.596	0.687	0.051	22.070	77.426	0.504	0.093	2.752	94.751	2.497
4	0.091	2.628	96.151	1.221	0.054	27.867	71.556	0.576	0.103	2.447	93.668	3.886
5	0.098	2.550	95.662	1.787	0.057	32.038	67.390	0.572	0.111	2.195	92.798	5.007
6	0.105	2.483	95.170	2.346	0.059	35.003	64.454	0.543	0.117	2.001	92.168	5.831
7	0.110	2.426	94.699	2.875	0.061	37.119	62.366	0.515	0.121	1.859	91.747	6.394
8	0.114	2.377	94.260	3.362	0.062	38.648	60.858	0.494	0.124	1.759	91.487	6.754
9	0.118	2.336	93.861	3.804	0.063	39.766	59.751	0.482	0.127	1.693	91.341	6.966
10	0.121	2.300	93.503	4.197	0.064	40.597	58.927	0.477	0.129	1.651	91.270	7.079

BRENT												
Period	S.E.	RUS	GOLD	BRENT	S.E.	RUS	GOLD	BRENT	S.E.	RUS	GOLD	BRENT
1	0.100	12.548	1.163	86.289	0.103	1.715	0.611	97.674	0.086	30.416	0.545	69.039
2	0.126	14.154	1.661	84.185	0.129	3.099	0.600	96.301	0.101	40.070	1.398	58.532
3	0.138	15.687	2.209	82.104	0.140	4.046	0.971	94.983	0.109	46.598	2.471	50.931
4	0.145	17.087	2.773	80.140	0.146	4.621	1.298	94.081	0.114	49.445	3.516	47.039
5	0.148	18.314	3.321	78.364	0.148	4.947	1.509	93.544	0.119	49.697	4.390	45.913
6	0.151	19.350	3.829	76.821	0.150	5.124	1.626	93.250	0.124	48.702	5.068	46.230
7	0.152	20.197	4.278	75.525	0.150	5.216	1.685	93.098	0.127	47.361	5.586	47.053
8	0.153	20.870	4.663	74.467	0.150	5.264	1.714	93.023	0.130	46.115	5.982	47.903
9	0.154	21.393	4.981	73.626	0.150	5.288	1.726	92.986	0.132	45.117	6.290	48.594
10	0.155	21.793	5.238	72.970	0.150	5.300	1.731	92.969	0.133	44.384	6.531	49.085

Cholesky Ordering: RUS GOLD BRENT

Table 29: India VAR, Variance Decomposition

IND	2000-2015				2000-2007				2008-2015			
Period	S.E.	IND	GOLD	BRENT	S.E.	IND	GOLD	BRENT	S.E.	IND	GOLD	BRENT
1	0.068	100.000	0.000	0.000	0.063	100.000	0.000	0.000	0.059	100.000	0.000	0.000
2	0.092	99.843	0.078	0.079	0.084	99.609	0.122	0.269	0.071	95.713	3.663	0.624
3	0.109	99.503	0.258	0.239	0.098	98.954	0.338	0.708	0.078	89.059	9.420	1.521
4	0.122	99.006	0.537	0.457	0.107	98.212	0.596	1.193	0.084	82.450	15.212	2.338
5	0.132	98.379	0.909	0.712	0.114	97.481	0.860	1.659	0.089	76.828	20.206	2.967
6	0.140	97.644	1.366	0.990	0.119	96.814	1.111	2.075	0.093	72.316	24.267	3.417
7	0.147	96.823	1.897	1.279	0.123	96.232	1.338	2.430	0.096	68.762	27.510	3.729
8	0.153	95.938	2.493	1.569	0.126	95.737	1.537	2.725	0.099	65.965	30.093	3.942
9	0.158	95.005	3.141	1.854	0.128	95.326	1.708	2.966	0.102	63.751	32.163	4.087
10	0.163	94.041	3.832	2.127	0.130	94.990	1.852	3.159	0.104	61.982	33.834	4.184

GOLD												
Period	S.E.	IND	GOLD	BRENT	S.E.	IND	GOLD	BRENT	S.E.	IND	GOLD	BRENT
1	0.049	2.747	97.253	0.000	0.038	6.679	93.321	0.000	0.054	0.039	99.961	0.000
2	0.067	2.405	97.593	0.002	0.048	10.219	89.706	0.075	0.070	2.831	97.069	0.100
3	0.079	2.113	97.880	0.007	0.053	13.868	85.978	0.154	0.079	6.266	93.549	0.185
4	0.088	1.866	98.118	0.015	0.056	17.320	82.481	0.199	0.087	9.284	90.494	0.222
5	0.095	1.663	98.311	0.027	0.059	20.399	79.391	0.210	0.092	11.656	88.119	0.225
6	0.101	1.499	98.461	0.040	0.060	23.032	76.764	0.204	0.097	13.445	86.343	0.213
7	0.106	1.370	98.573	0.057	0.062	25.222	74.582	0.195	0.100	14.775	85.027	0.198
8	0.110	1.273	98.651	0.076	0.063	27.007	72.799	0.193	0.103	15.764	84.048	0.188
9	0.113	1.204	98.699	0.097	0.063	28.443	71.355	0.202	0.106	16.503	83.313	0.184
10	0.116	1.160	98.719	0.120	0.064	29.585	70.194	0.221	0.108	17.061	82.752	0.187

BRENT												
Period	S.E.	IND	GOLD	BRENT	S.E.	IND	GOLD	BRENT	S.E.	IND	GOLD	BRENT
1	0.104	8.371	2.066	89.563	0.105	9.598	0.711	89.691	0.100	8.379	4.583	87.038
2	0.137	8.516	2.870	88.614	0.132	12.276	0.539	87.185	0.132	8.293	6.150	85.557
3	0.157	8.616	3.764	87.620	0.146	14.850	0.454	84.696	0.151	7.995	7.639	84.365
4	0.171	8.673	4.721	86.605	0.154	17.197	0.410	82.393	0.163	7.617	9.035	83.348
5	0.180	8.695	5.714	85.591	0.159	19.245	0.387	80.368	0.172	7.234	10.329	82.437
6	0.187	8.686	6.718	84.596	0.162	20.970	0.374	78.657	0.178	6.889	11.519	81.592
7	0.192	8.652	7.712	83.635	0.164	22.382	0.367	77.251	0.182	6.602	12.603	80.795
8	0.196	8.601	8.679	82.720	0.165	23.514	0.366	76.120	0.185	6.376	13.582	80.042
9	0.200	8.536	9.607	81.857	0.166	24.408	0.369	75.223	0.188	6.209	14.461	79.331
10	0.202	8.464	10.485	81.051	0.167	25.105	0.377	74.518	0.190	6.093	15.243	78.664

Cholesky Ordering: IND GOLD BRENT

Table 30: China VAR, Variance Decomposition

CHI	2000-2015				2000-2007				2008-2015			
Period	S.E.	CHI	GOLD	BRENT	S.E.	CHI	GOLD	BRENT	S.E.	CHI	GOLD	BRENT
1	0.079	100.000	0.000	0.000	0.068	100.000	0.000	0.000	0.078	100.000	0.000	0.000
2	0.111	99.980	0.005	0.015	0.091	99.048	0.030	0.922	0.103	99.550	0.018	0.432
3	0.135	99.942	0.015	0.043	0.106	97.507	0.089	2.404	0.118	98.521	0.090	1.389
4	0.154	99.895	0.027	0.078	0.118	95.809	0.169	4.023	0.128	96.924	0.255	2.820
5	0.171	99.842	0.042	0.116	0.127	94.171	0.259	5.570	0.136	94.782	0.558	4.660
6	0.186	99.788	0.057	0.156	0.135	92.684	0.354	6.961	0.142	92.135	1.038	6.827
7	0.199	99.733	0.072	0.194	0.141	91.377	0.450	8.173	0.146	89.044	1.729	9.227
8	0.211	99.681	0.088	0.231	0.147	90.245	0.543	9.212	0.151	85.592	2.651	11.758
9	0.222	99.631	0.103	0.266	0.151	89.271	0.632	10.097	0.155	81.879	3.805	14.316
10	0.232	99.584	0.118	0.298	0.156	88.436	0.715	10.850	0.159	78.016	5.178	16.806

GOLD												
Period	S.E.	CHI	GOLD	BRENT	S.E.	CHI	GOLD	BRENT	S.E.	CHI	GOLD	BRENT
1	0.050	3.263	96.737	0.000	0.037	0.774	99.226	0.000	0.058	3.467	96.533	0.000
2	0.070	4.006	95.438	0.556	0.048	0.831	98.515	0.654	0.080	3.711	95.777	0.512
3	0.086	4.766	93.606	1.627	0.055	2.522	95.529	1.949	0.096	4.018	94.419	1.563
4	0.100	5.529	91.463	3.008	0.061	5.402	90.987	3.611	0.110	4.387	92.624	2.989
5	0.112	6.285	89.174	4.541	0.065	8.951	85.652	5.397	0.122	4.814	90.545	4.641
6	0.124	7.029	86.857	6.114	0.069	12.729	80.135	7.135	0.133	5.291	88.314	6.395
7	0.135	7.756	84.588	7.656	0.073	16.434	74.838	8.728	0.143	5.813	86.031	8.156
8	0.146	8.466	82.414	9.120	0.077	19.888	69.975	10.137	0.154	6.370	83.774	9.856
9	0.158	9.158	80.360	10.482	0.080	23.012	65.631	11.357	0.164	6.953	81.594	11.453
10	0.169	9.833	78.439	11.729	0.083	25.785	61.816	12.399	0.173	7.553	79.525	12.923

BRENT												
Period	S.E.	CHI	GOLD	BRENT	S.E.	CHI	GOLD	BRENT	S.E.	CHI	GOLD	BRENT
1	0.107	3.273	3.822	92.906	0.105	0.587	2.145	97.268	0.105	7.451	5.138	87.410
2	0.145	3.635	5.973	90.392	0.129	0.432	2.540	97.028	0.147	9.493	7.646	82.861
3	0.172	4.013	8.461	87.526	0.141	0.835	2.881	96.283	0.178	11.424	10.310	78.266
4	0.194	4.405	11.170	84.425	0.148	1.680	3.158	95.161	0.205	13.181	12.990	73.830
5	0.213	4.811	13.994	81.195	0.152	2.820	3.374	93.807	0.228	14.735	15.592	69.673
6	0.230	5.231	16.845	77.923	0.156	4.117	3.536	92.346	0.250	16.084	18.062	65.854
7	0.246	5.665	19.655	74.680	0.158	5.471	3.656	90.874	0.270	17.240	20.371	62.389
8	0.262	6.113	22.370	71.517	0.161	6.808	3.742	89.450	0.289	18.221	22.508	59.271
9	0.277	6.574	24.957	68.469	0.163	8.086	3.805	88.109	0.307	19.048	24.474	56.478
10	0.292	7.047	27.393	65.559	0.165	9.281	3.848	86.870	0.324	19.741	26.276	53.983

Cholesky Ordering: CHI GOLD BRENT

Table 31: South Africa VAR, Variance Decomposition

SAF

	2000-2015				2000-2007				2008-2015			
Period	S.E.	SAF	GOLD	BRENT	S.E.	SAF	GOLD	BRENT	S.E.	SAF	GOLD	BRENT
1	0.0502	100.0000	0.0000	0.0000	0.0530	100.0000	0.0000	0.0000	0.0475	100.0000	0.0000	0.0000
2	0.0705	99.8489	0.0019	0.1491	0.0737	99.7926	0.1605	0.0469	0.0657	99.6976	0.2753	0.0271
3	0.0859	99.5696	0.0045	0.4259	0.0890	99.4461	0.4358	0.1181	0.0790	99.1031	0.8219	0.0750
4	0.0986	99.2194	0.0065	0.7741	0.1015	99.0503	0.7566	0.1932	0.0896	98.3162	1.5517	0.1321
5	0.1096	98.8365	0.0076	1.1558	0.1122	98.6535	1.0830	0.2635	0.0986	97.4145	2.3946	0.1909
6	0.1194	98.4459	0.0079	1.5462	0.1216	98.2797	1.3940	0.3263	0.1064	96.4563	3.2966	0.2471
7	0.1282	98.0631	0.0075	1.9294	0.1301	97.9394	1.6797	0.3809	0.1133	95.4836	4.2180	0.2984
8	0.1362	97.6974	0.0068	2.2958	0.1378	97.6353	1.9367	0.4280	0.1194	94.5258	5.1304	0.3438
9	0.1436	97.3538	0.0061	2.6401	0.1449	97.3664	2.1652	0.4684	0.1250	93.6026	6.0144	0.3831
10	0.1505	97.0347	0.0058	2.9596	0.1514	97.1297	2.3671	0.5031	0.1301	92.7260	6.8576	0.4165

GOLD

Period	S.E.	SAF	GOLD	BRENT	S.E.	SAF	GOLD	BRENT	S.E.	SAF	GOLD	BRENT
1	0.0499	5.2754	94.7246	0.0000	0.0372	7.5067	92.4933	0.0000	0.0559	3.5464	96.4537	0.0000
2	0.0693	5.6744	94.2125	0.1132	0.0477	13.4467	86.4557	0.0976	0.0725	3.0536	96.9225	0.0239
3	0.0833	6.0792	93.5926	0.3282	0.0544	19.9569	79.8035	0.2396	0.0820	2.6391	97.2930	0.0680
4	0.0944	6.4902	92.9039	0.6060	0.0595	26.3616	73.2616	0.3769	0.0879	2.3274	97.5504	0.1221
5	0.1036	6.9074	92.1735	0.9192	0.0638	32.2704	67.2387	0.4909	0.0919	2.1351	97.6865	0.1784
6	0.1114	7.3305	91.4206	1.2489	0.0677	37.5254	61.8957	0.5789	0.0946	2.0693	97.6995	0.2312
7	0.1181	7.7594	90.6583	1.5823	0.0713	42.1090	57.2464	0.6446	0.0965	2.1286	97.5943	0.2771
8	0.1240	8.1935	89.8957	1.9108	0.0746	46.0725	53.2345	0.6930	0.0980	2.3048	97.3806	0.3146
9	0.1292	8.6322	89.1390	2.2288	0.0778	49.4924	49.7790	0.7286	0.0991	2.5846	97.0721	0.3433
10	0.1338	9.0748	88.3922	2.5330	0.0807	52.4479	46.7970	0.7551	0.1001	2.9518	96.6843	0.3639

BRENT

Period	S.E.	SAF	GOLD	BRENT	S.E.	SAF	GOLD	BRENT	S.E.	SAF	GOLD	BRENT
1	0.1024	11.1393	1.0974	87.7633	0.1018	7.4864	0.1964	92.3172	0.0952	20.0126	0.9707	79.0166
2	0.1325	13.4993	1.8756	84.6251	0.1222	12.9222	0.1665	86.9113	0.1285	26.7985	1.1674	72.0341
3	0.1501	15.9926	2.8216	81.1858	0.1322	18.6394	0.2235	81.1371	0.1514	33.5079	1.2197	65.2724
4	0.1617	18.5444	3.8807	77.5749	0.1388	24.0191	0.2534	75.7276	0.1694	39.8160	1.1592	59.0248
5	0.1702	21.0824	4.9935	73.9240	0.1440	28.7865	0.2477	70.9658	0.1845	45.5310	1.0386	53.4305
6	0.1769	23.5455	6.1038	70.3507	0.1485	32.8961	0.2329	66.8710	0.1976	50.5657	0.9108	48.5235
7	0.1826	25.8883	7.1650	66.9467	0.1526	36.4079	0.2325	63.3596	0.2093	54.9063	0.8184	44.2753
8	0.1876	28.0825	8.1431	63.7744	0.1564	39.4140	0.2575	60.3284	0.2200	58.5853	0.7901	40.6247
9	0.1922	30.1148	9.0169	60.8683	0.1599	42.0050	0.3090	57.6861	0.2298	61.6610	0.8405	37.4985
10	0.1965	31.9836	9.7767	58.2397	0.1632	44.2583	0.3825	55.3592	0.2389	64.2033	0.9738	34.8229

Cholesky Ordering: SAF GOLD BRENT

Table 32: Mexico VAR, Variance Decomposition

MEX	2000-2015				2000-2007				2008-2015			
Period	S.E.	MEX	GOLD	BRENT	S.E.	MEX	GOLD	BRENT	S.E.	MEX	GOLD	BRENT
1	0.0548	100.0000	0.0000	0.0000	0.0571	100.0000	0.0000	0.0000	0.0408	100.0000	0.0000	0.0000
2	0.0766	99.9574	0.0029	0.0396	0.0764	98.9790	0.1781	0.8429	0.0506	97.6211	0.5642	1.8146
3	0.0926	99.8792	0.0081	0.1127	0.0889	97.6106	0.5725	1.8170	0.0557	94.2172	1.4111	4.3718
4	0.1057	99.7813	0.0144	0.2044	0.0979	96.3044	1.1249	2.5707	0.0588	91.0012	2.2570	6.7418
5	0.1167	99.6744	0.0209	0.3048	0.1045	95.1690	1.7677	3.0633	0.0608	88.4038	2.9860	8.6103
6	0.1263	99.5654	0.0271	0.4075	0.1096	94.2101	2.4412	3.3487	0.0620	86.4633	3.5726	9.9641
7	0.1348	99.4585	0.0330	0.5086	0.1136	93.4060	3.1006	3.4935	0.0629	85.0748	4.0289	10.8964
8	0.1424	99.3564	0.0382	0.6055	0.1168	92.7318	3.7166	3.5516	0.0634	84.1050	4.3780	11.5170
9	0.1492	99.2605	0.0427	0.6968	0.1195	92.1662	4.2735	3.5603	0.0638	83.4363	4.6434	11.9203
10	0.1553	99.1714	0.0466	0.7820	0.1216	91.6917	4.7652	3.5431	0.0640	82.9773	4.8452	12.1775

GOLD												
Period	S.E.	MEX	GOLD	BRENT	S.E.	MEX	GOLD	BRENT	S.E.	MEX	GOLD	BRENT
1	0.0505	2.6529	97.3471	0.0000	0.0382	2.6792	97.3208	0.0000	0.0583	0.9425	99.0575	0.0000
2	0.0705	3.2640	96.7352	0.0009	0.0502	4.8974	94.1792	0.9234	0.0811	0.5691	99.1537	0.2772
3	0.0852	3.9358	96.0623	0.0020	0.0575	7.6236	90.5128	1.8636	0.0974	0.3951	98.9847	0.6202
4	0.0972	4.6625	95.3347	0.0028	0.0627	10.6167	86.9340	2.4493	0.1100	0.3196	98.7619	0.9185
5	0.1074	5.4384	94.5583	0.0033	0.0665	13.6474	83.6500	2.7026	0.1200	0.2929	98.5563	1.1509
6	0.1164	6.2576	93.7391	0.0033	0.0695	16.5385	80.7191	2.7423	0.1282	0.2903	98.3862	1.3236
7	0.1244	7.1142	92.8827	0.0031	0.0719	19.1777	78.1466	2.6758	0.1349	0.2992	98.2515	1.4494
8	0.1317	8.0027	91.9946	0.0028	0.0738	21.5112	75.9165	2.5723	0.1405	0.3131	98.1467	1.5403
9	0.1383	8.9176	91.0799	0.0025	0.0755	23.5291	74.0025	2.4684	0.1451	0.3286	98.0655	1.6059
10	0.1445	9.8538	90.1437	0.0026	0.0769	25.2479	72.3727	2.3793	0.1490	0.3440	98.0025	1.6535

BRENT												
Period	S.E.	MEX	GOLD	BRENT	S.E.	MEX	GOLD	BRENT	S.E.	MEX	GOLD	BRENT
1	0.1035	5.4393	3.1080	91.4526	0.1022	1.2151	3.9668	94.8181	0.0877	2.2318	2.6652	95.1031
2	0.1352	7.3318	4.7179	87.9503	0.1197	3.1959	3.6527	93.1513	0.1056	1.7413	8.1172	90.1415
3	0.1546	9.4482	6.5648	83.9870	0.1260	5.5957	3.4909	90.9134	0.1150	1.4683	15.0118	83.5199
4	0.1684	11.7139	8.5469	79.7392	0.1290	7.9719	3.4069	88.6212	0.1219	1.3465	21.9865	76.6670
5	0.1792	14.0525	10.5643	75.3832	0.1307	10.0559	3.3620	86.5821	0.1277	1.3069	28.2309	70.4622
6	0.1883	16.3965	12.5317	71.0718	0.1320	11.7601	3.3432	84.8967	0.1329	1.3032	33.4750	65.2219
7	0.1964	18.6924	14.3856	66.9220	0.1331	13.1050	3.3478	83.5472	0.1375	1.3111	37.7494	60.9396
8	0.2038	20.9029	16.0848	63.0124	0.1340	14.1519	3.3739	82.4743	0.1416	1.3201	41.1961	57.4838
9	0.2108	23.0048	17.6082	59.3870	0.1347	14.9664	3.4175	81.6161	0.1451	1.3267	43.9735	54.6998
10	0.2174	24.9869	18.9499	56.0632	0.1353	15.6044	3.4735	80.9221	0.1482	1.3303	46.2209	52.4488

Cholesky Ordering: MEX GOLD BRENT

Table 33: Indonesia VAR, Variance Decomposition

IDN	2000-2015				2000-2007				2008-2015			
Period	S.E.	IDN	GOLD	BRENT	S.E.	IDN	GOLD	BRENT	S.E.	IDN	GOLD	BRENT
1	0.0656	100.0000	0.0000	0.0000	0.0621	100.0000	0.0000	0.0000	0.0613	100.0000	0.0000	0.0000
2	0.0901	99.9476	0.0128	0.0396	0.0834	99.8696	0.0247	0.1057	0.0802	99.7862	0.1895	0.0244
3	0.1072	99.8377	0.0402	0.1221	0.0972	99.6532	0.0760	0.2708	0.0915	99.3586	0.5635	0.0779
4	0.1203	99.6819	0.0799	0.2382	0.1070	99.4072	0.1457	0.4471	0.0989	98.7855	1.0583	0.1561
5	0.1307	99.4902	0.1297	0.3800	0.1143	99.1628	0.2262	0.6111	0.1039	98.1276	1.6186	0.2538
6	0.1393	99.2713	0.1879	0.5408	0.1197	98.9359	0.3110	0.7531	0.1075	97.4353	2.1995	0.3652
7	0.1463	99.0326	0.2525	0.7149	0.1239	98.7339	0.3950	0.8711	0.1101	96.7480	2.7672	0.4848
8	0.1522	98.7806	0.3221	0.8973	0.1271	98.5589	0.4746	0.9665	0.1120	96.0938	3.2985	0.6078
9	0.1571	98.5208	0.3952	1.0840	0.1296	98.4103	0.5476	1.0421	0.1134	95.4909	3.7793	0.7298
10	0.1613	98.2578	0.4705	1.2717	0.1315	98.2859	0.6129	1.1012	0.1145	94.9497	4.2027	0.8476

GOLD												
Period	S.E.	IDN	GOLD	BRENT	S.E.	IDN	GOLD	BRENT	S.E.	IDN	GOLD	BRENT
1	0.0496	5.0910	94.9090	0.0000	0.0378	2.9132	97.0868	0.0000	0.0579	7.7048	92.2952	0.0000
2	0.0675	5.7552	94.2363	0.0085	0.0478	3.9558	95.9485	0.0957	0.0766	9.1389	90.8459	0.0152
3	0.0796	6.4500	93.5257	0.0244	0.0530	5.1119	94.6569	0.2312	0.0880	10.4916	89.4653	0.0430
4	0.0887	7.1691	92.7866	0.0444	0.0560	6.3206	93.3239	0.3555	0.0956	11.7339	88.1888	0.0773
5	0.0958	7.9060	92.0282	0.0659	0.0578	7.5221	92.0296	0.4484	0.1008	12.8485	87.0380	0.1134
6	0.1015	8.6540	91.2588	0.0871	0.0591	8.6666	90.8256	0.5078	0.1045	13.8279	86.0236	0.1485
7	0.1061	9.4067	90.4865	0.1068	0.0599	9.7193	89.7405	0.5402	0.1071	14.6722	85.1471	0.1807
8	0.1100	10.1575	89.7183	0.1241	0.0605	10.6602	88.7857	0.5541	0.1089	15.3874	84.4039	0.2087
9	0.1132	10.9007	88.9606	0.1387	0.0610	11.4816	87.9612	0.5572	0.1102	15.9833	83.7843	0.2324
10	0.1159	11.6307	88.2190	0.1503	0.0613	12.1856	87.2594	0.5550	0.1112	16.4722	83.2760	0.2517

BRENT												
Period	S.E.	IDN	GOLD	BRENT	S.E.	IDN	GOLD	BRENT	S.E.	IDN	GOLD	BRENT
1	0.1051	6.3057	2.7778	90.9165	0.1037	1.0479	2.3376	96.6146	0.0975	11.5001	2.9688	85.5311
2	0.1415	8.4921	2.7399	88.7680	0.1276	2.6787	1.7688	95.5525	0.1315	14.1815	3.2362	82.5823
3	0.1656	10.8873	2.6838	86.4289	0.1388	4.7612	1.4974	93.7413	0.1542	16.7491	3.4091	79.8418
4	0.1833	13.4176	2.6135	83.9689	0.1449	7.0189	1.3961	91.5850	0.1708	19.1352	3.5019	77.3630
5	0.1970	16.0128	2.5333	81.4539	0.1486	9.2227	1.3733	89.4040	0.1835	21.3030	3.5317	75.1653
6	0.2080	18.6105	2.4470	78.9425	0.1511	11.2255	1.3758	87.3988	0.1936	23.2376	3.5158	73.2466
7	0.2171	21.1577	2.3583	76.4840	0.1530	12.9574	1.3794	85.6633	0.2016	24.9394	3.4692	71.5914
8	0.2247	23.6118	2.2703	74.1179	0.1544	14.4045	1.3768	84.2186	0.2080	26.4185	3.4044	70.1772
9	0.2313	25.9409	2.1854	71.8737	0.1555	15.5856	1.3687	83.0458	0.2132	27.6906	3.3311	68.9783
10	0.2369	28.1227	2.1055	69.7717	0.1564	16.5340	1.3576	82.1083	0.2174	28.7749	3.2563	67.9688

Cholesky Ordering: IDN GOLD BRENT

Table 34: Nigeria VAR, Variance Decomposition

NIG	2000-2015				2000-2007				2008-2015			
Period	S.E.	NIG	GOLD	BRENT	S.E.	NIG	GOLD	BRENT	S.E.	NIG	GOLD	BRENT
1	0.073	100.000	0.000	0.000	0.053	100.000	0.000	0.000	0.078	100.000	0.000	0.000
2	0.101	99.876	0.005	0.119	0.072	95.471	2.130	2.400	0.105	99.663	0.150	0.187
3	0.122	99.613	0.012	0.375	0.087	88.145	6.303	5.552	0.122	99.132	0.343	0.525
4	0.139	99.235	0.017	0.748	0.100	80.224	11.567	8.209	0.135	98.552	0.497	0.951
5	0.154	98.764	0.018	1.218	0.111	72.754	17.191	10.054	0.146	97.984	0.589	1.427
6	0.166	98.218	0.017	1.765	0.122	66.122	22.716	11.163	0.154	97.444	0.622	1.934
7	0.178	97.613	0.015	2.372	0.131	60.401	27.883	11.716	0.161	96.925	0.613	2.462
8	0.188	96.961	0.015	3.025	0.140	55.536	32.571	11.892	0.168	96.413	0.580	3.008
9	0.198	96.272	0.018	3.709	0.148	51.429	36.741	11.830	0.173	95.887	0.543	3.570
10	0.206	95.555	0.030	4.415	0.155	47.971	40.402	11.628	0.178	95.331	0.520	4.149

GOLD												
Period	S.E.	NIG	GOLD	BRENT	S.E.	NIG	GOLD	BRENT	S.E.	NIG	GOLD	BRENT
1	0.053	0.031	99.969	0.000	0.041	1.482	98.518	0.000	0.058	0.917	99.083	0.000
2	0.073	0.031	99.961	0.007	0.054	1.472	98.482	0.046	0.076	0.534	98.830	0.635
3	0.088	0.111	99.863	0.026	0.063	1.459	98.428	0.113	0.088	0.568	97.610	1.822
4	0.100	0.268	99.676	0.057	0.068	1.443	98.374	0.183	0.097	0.747	95.942	3.311
5	0.111	0.498	99.400	0.102	0.072	1.428	98.328	0.244	0.105	0.928	94.141	4.932
6	0.120	0.799	99.039	0.163	0.075	1.412	98.292	0.295	0.113	1.051	92.367	6.582
7	0.127	1.168	98.592	0.240	0.078	1.398	98.266	0.336	0.120	1.104	90.689	8.208
8	0.134	1.600	98.065	0.335	0.079	1.385	98.249	0.367	0.126	1.097	89.124	9.779
9	0.140	2.094	97.458	0.448	0.081	1.373	98.237	0.390	0.133	1.048	87.668	11.284
10	0.146	2.644	96.775	0.581	0.082	1.362	98.231	0.407	0.139	0.976	86.306	12.718

BRENT												
Period	S.E.	NIG	GOLD	BRENT	S.E.	NIG	GOLD	BRENT	S.E.	NIG	GOLD	BRENT
1	0.099	4.911	5.951	89.138	0.086	0.558	2.717	96.725	0.102	13.497	7.389	79.114
2	0.137	5.457	8.041	86.502	0.103	0.522	2.677	96.801	0.148	16.666	12.609	70.725
3	0.166	5.939	10.343	83.719	0.110	0.496	2.656	96.848	0.187	18.702	17.294	64.004
4	0.189	6.349	12.795	80.856	0.113	0.479	2.649	96.872	0.223	19.891	21.282	58.827
5	0.209	6.685	15.345	77.970	0.114	0.470	2.650	96.880	0.257	20.494	24.639	54.867
6	0.227	6.946	17.949	75.105	0.114	0.466	2.654	96.880	0.290	20.702	27.478	51.820
7	0.243	7.134	20.569	72.297	0.115	0.464	2.661	96.875	0.322	20.647	29.906	49.447
8	0.258	7.255	23.174	69.571	0.115	0.465	2.667	96.868	0.354	20.418	32.009	47.573
9	0.272	7.315	25.741	66.944	0.115	0.466	2.674	96.860	0.386	20.076	33.851	46.072
10	0.284	7.321	28.251	64.429	0.115	0.468	2.680	96.852	0.417	19.663	35.484	44.853

Cholesky Ordering: NIG GOLD BRENT

Table 35: Turkey VAR, Variance Decomposition

TUR

Period	S.E.	TUR	GOLD	BRENT	S.E.	TUR	GOLD	BRENT	S.E.	TUR	GOLD	BRENT
1	0.0990	100.0000	0.0000	0.0000	0.1151	100.0000	0.0000	0.0000	0.0610	100.0000	0.0000	0.0000
2	0.1330	99.7566	0.0097	0.2337	0.1455	99.5972	0.4018	0.0011	0.0721	96.1575	0.0095	3.8331
3	0.1552	99.2634	0.0317	0.7049	0.1620	98.8413	1.1570	0.0018	0.0778	89.7892	0.0412	10.1696
4	0.1712	98.5896	0.0655	1.3450	0.1723	97.8992	2.0990	0.0018	0.0820	83.2588	0.0998	16.6413
5	0.1834	97.7948	0.1099	2.0953	0.1794	96.8990	3.0993	0.0017	0.0853	77.7160	0.1831	22.1009
6	0.1928	96.9284	0.1638	2.9078	0.1846	95.9254	4.0729	0.0017	0.0879	73.3954	0.2860	26.3186
7	0.2004	96.0301	0.2260	3.7439	0.1886	95.0261	4.9719	0.0020	0.0900	70.1521	0.4027	29.4452
8	0.2064	95.1304	0.2952	4.5744	0.1917	94.2227	5.7747	0.0026	0.0916	67.7542	0.5277	31.7181
9	0.2114	94.2522	0.3700	5.3779	0.1942	93.5205	6.4760	0.0035	0.0929	65.9895	0.6559	33.3546
10	0.2154	93.4118	0.4491	6.1391	0.1962	92.9155	7.0800	0.0045	0.0938	64.6906	0.7832	34.5262

GOLD

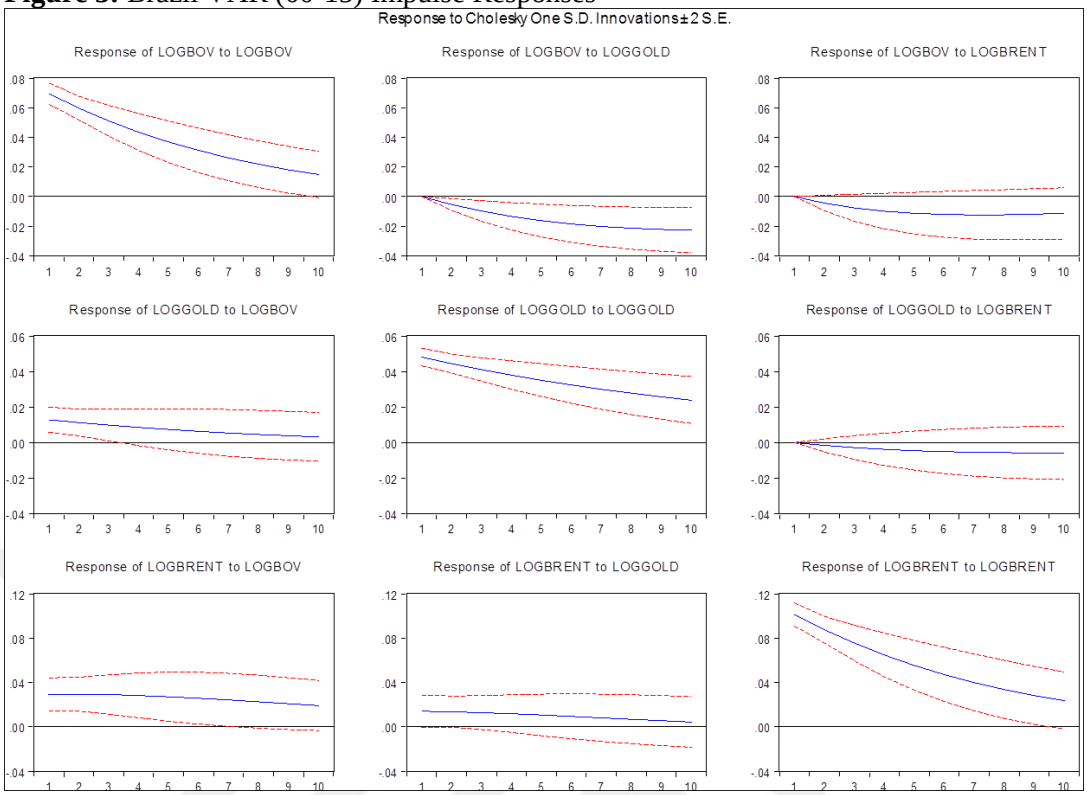
Period	S.E.	TUR	GOLD	BRENT	S.E.	TUR	GOLD	BRENT	S.E.	TUR	GOLD	BRENT
1	0.0499	0.3231	99.6769	0.0000	0.0381	0.0079	99.9921	0.0000	0.0578	1.9496	98.0504	0.0000
2	0.0688	0.3053	99.6448	0.0499	0.0498	1.4862	98.4885	0.0252	0.0775	2.4524	97.4054	0.1422
3	0.0823	0.2907	99.5590	0.1503	0.0574	4.2165	95.7250	0.0585	0.0901	2.8399	96.7860	0.3741
4	0.0928	0.2786	99.4346	0.2869	0.0630	7.4113	92.5009	0.0877	0.0991	3.1299	96.2306	0.6395
5	0.1015	0.2686	99.2833	0.4481	0.0675	10.5767	89.3137	0.1096	0.1056	3.3439	95.7459	0.9102
6	0.1087	0.2604	99.1148	0.6249	0.0712	13.4631	86.4122	0.1248	0.1105	3.5010	95.3273	1.1717
7	0.1149	0.2536	98.9363	0.8101	0.0743	15.9776	83.8877	0.1347	0.1142	3.6160	94.9672	1.4168
8	0.1202	0.2481	98.7536	0.9983	0.0768	18.1121	81.7469	0.1410	0.1170	3.7002	94.6576	1.6422
9	0.1249	0.2437	98.5710	1.1853	0.0790	19.8977	79.9574	0.1449	0.1192	3.7619	94.3916	1.8465
10	0.1290	0.2401	98.3918	1.3681	0.0808	21.3797	78.4730	0.1473	0.1209	3.8071	94.1633	2.0296

BRENT

Period	S.E.	TUR	GOLD	BRENT	S.E.	TUR	GOLD	BRENT	S.E.	TUR	GOLD	BRENT
1	0.1048	0.2460	3.9236	95.8304	0.0978	0.0520	1.6771	98.2709	0.0992	0.3810	3.9181	95.7009
2	0.1379	0.3324	4.2609	95.4066	0.1195	5.0555	1.3507	93.5938	0.1296	0.2401	4.6693	95.0906
3	0.1577	0.4262	4.6047	94.9691	0.1314	11.8728	1.1923	86.9349	0.1477	0.1886	5.4037	94.4077
4	0.1708	0.5243	4.9510	94.5247	0.1394	18.0949	1.1347	80.7704	0.1596	0.1827	6.1078	93.7095
5	0.1797	0.6236	5.2959	94.0805	0.1451	22.9633	1.1608	75.8759	0.1679	0.1989	6.7717	93.0294
6	0.1859	0.7217	5.6357	93.6427	0.1493	26.5179	1.2640	72.2181	0.1738	0.2250	7.3884	92.3867
7	0.1903	0.8162	5.9670	93.2168	0.1524	29.0336	1.4327	69.5337	0.1781	0.2543	7.9535	91.7922
8	0.1935	0.9055	6.2870	92.8074	0.1547	30.7932	1.6492	67.5575	0.1813	0.2835	8.4652	91.2514
9	0.1958	0.9883	6.5935	92.4182	0.1565	32.0231	1.8944	66.0825	0.1836	0.3109	8.9231	90.7660
10	0.1974	1.0638	6.8845	92.0517	0.1578	32.8882	2.1504	64.9614	0.1854	0.3359	9.3287	90.3354

Cholesky Ordering: TUR GOLD BRENT

Figure 3: Brazil VAR (00-15) Impulse Responses



BOV: Brazilian stock market index

Figure 4: Brazil VAR (00-07) Impulse Responses

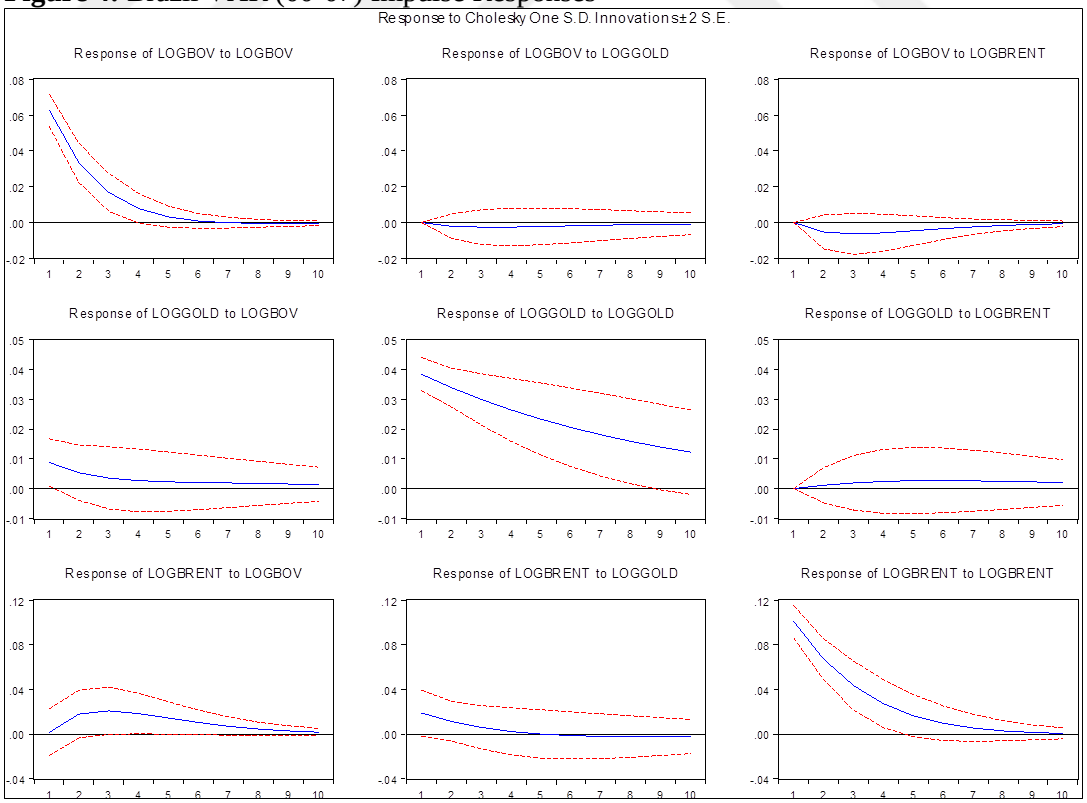


Figure 5: Brazil VAR (08-15) Impulse Responses

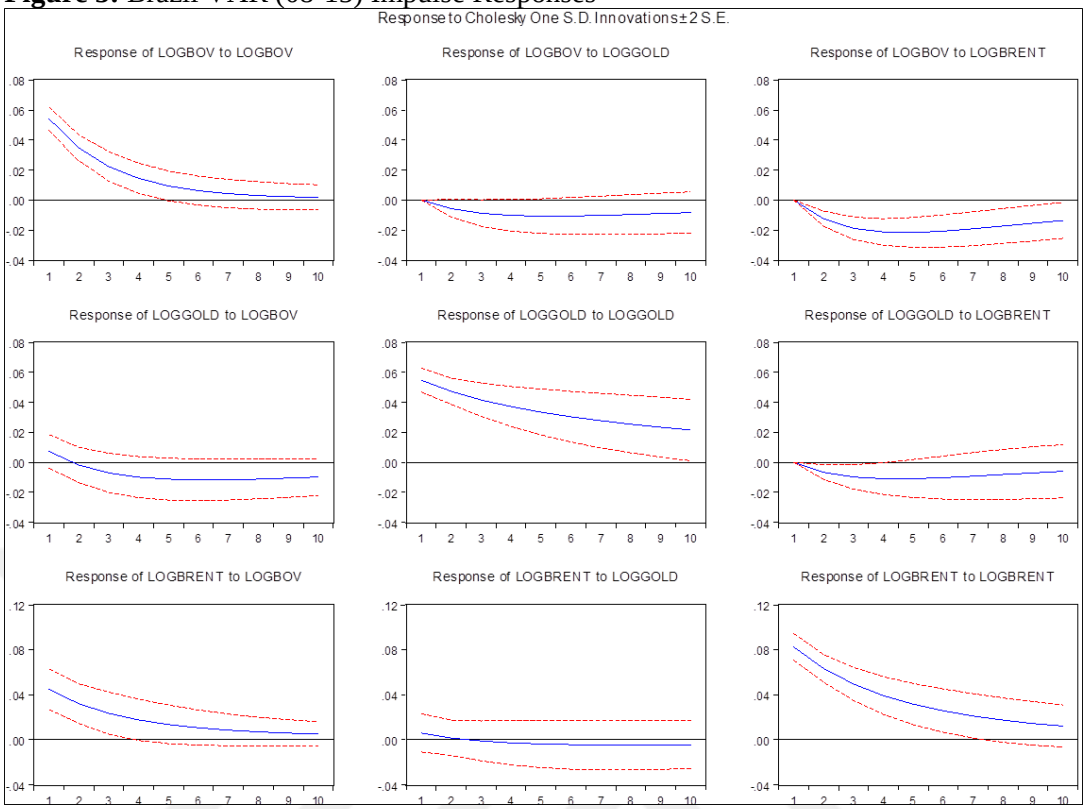
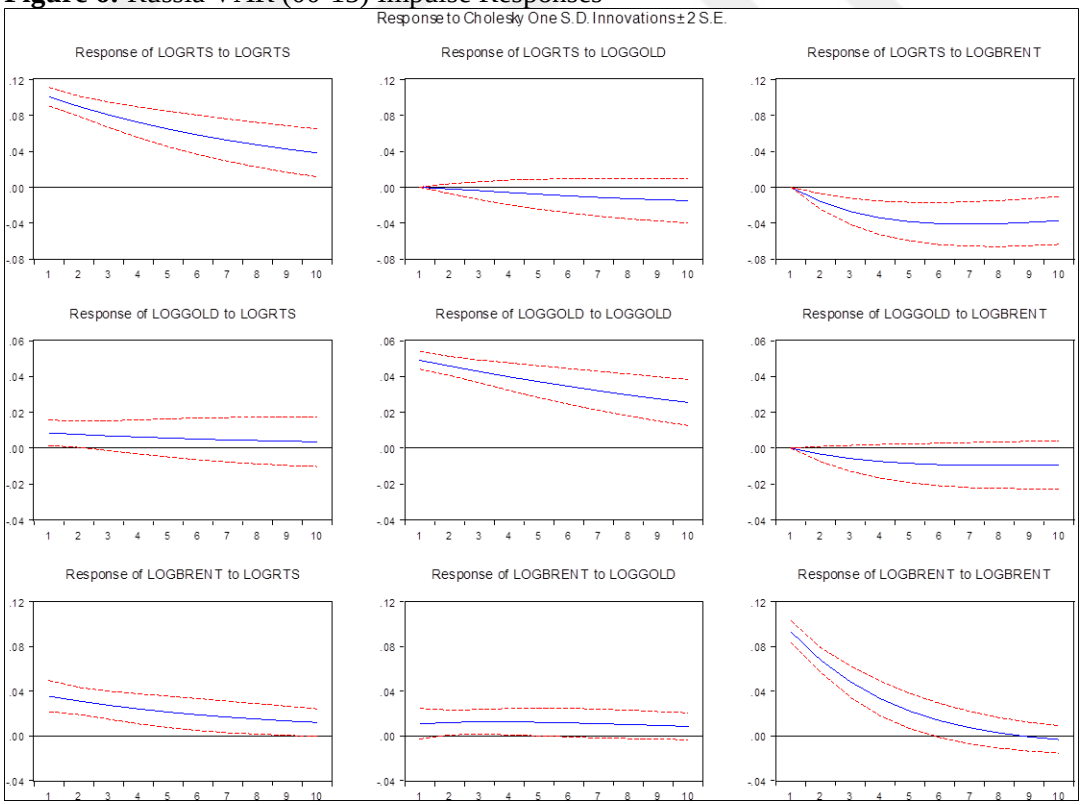


Figure 6: Russia VAR (00-15) Impulse Responses



RTS: Russian stock market index

Figure 7: Russia VAR (00-07) Impulse Responses

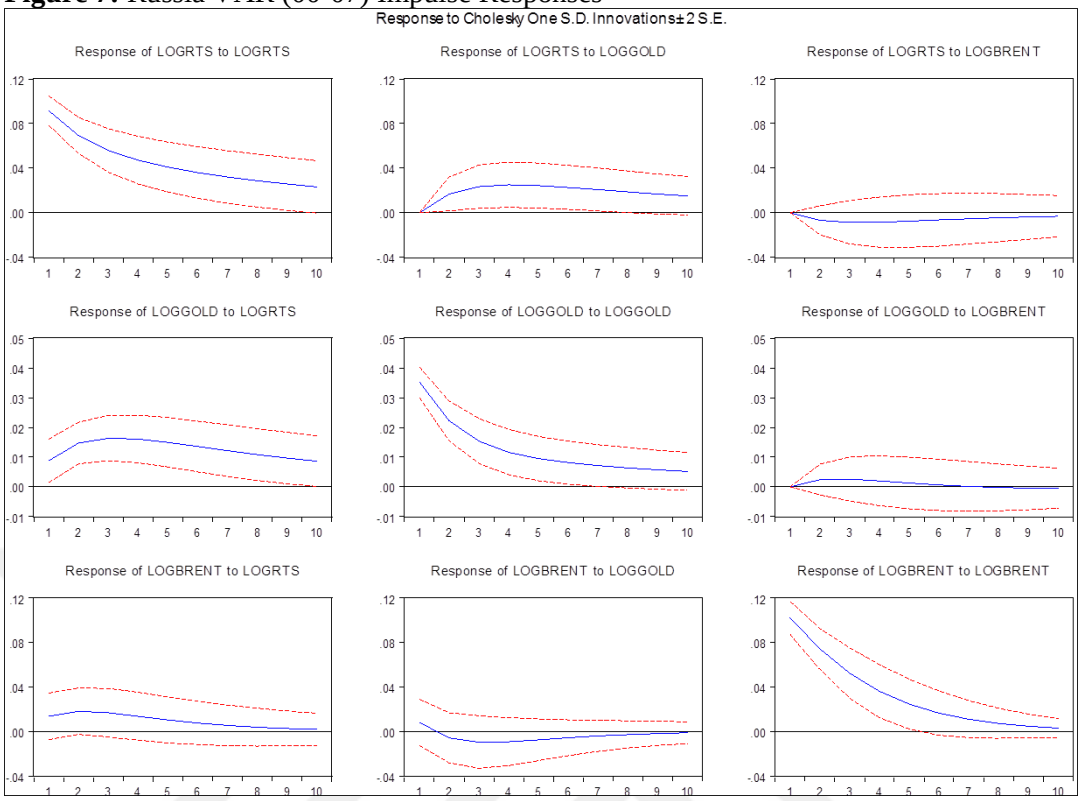


Figure 8: Russia VAR (08-15) Impulse Responses

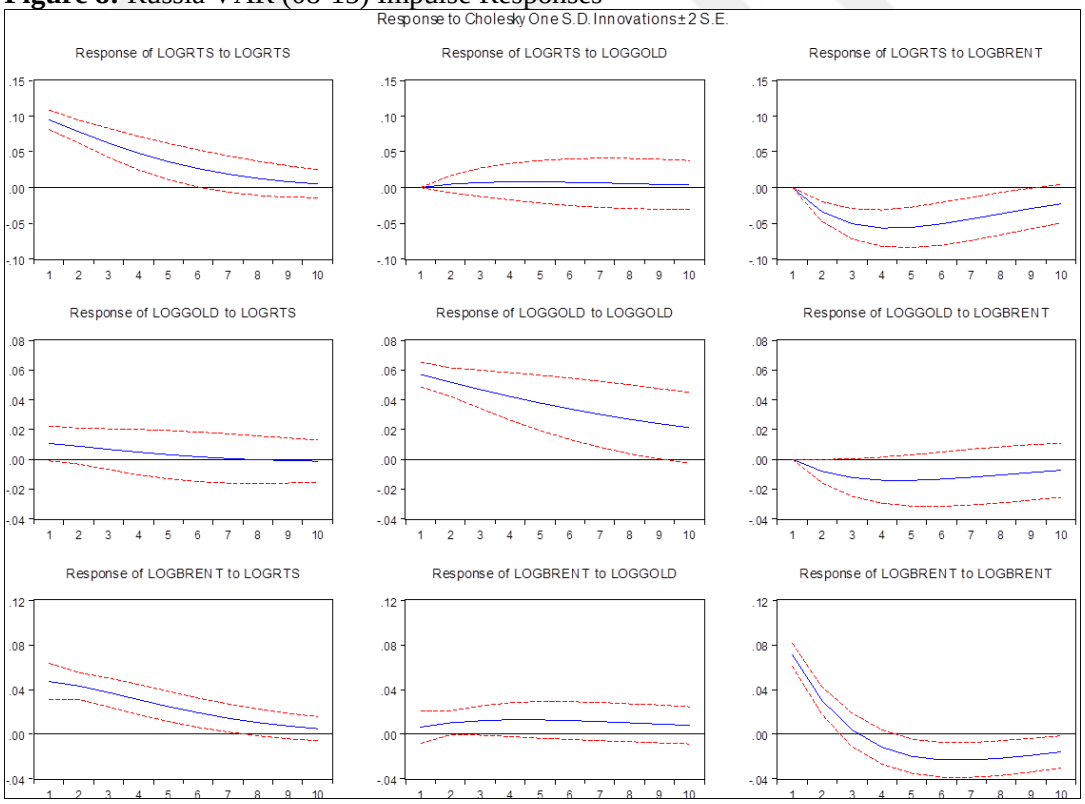
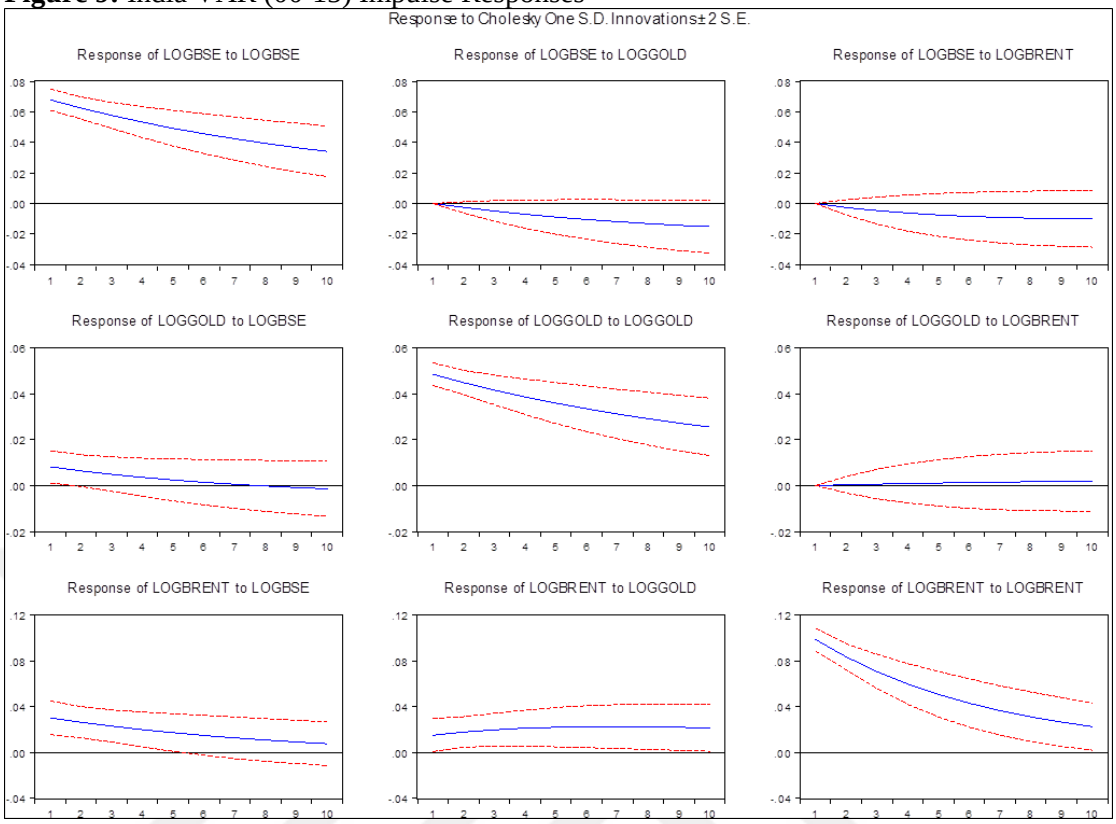


Figure 9: India VAR (00-15) Impulse Responses



BSE: Indian stock market index

Figure 10: India VAR (00-07) Impulse Responses

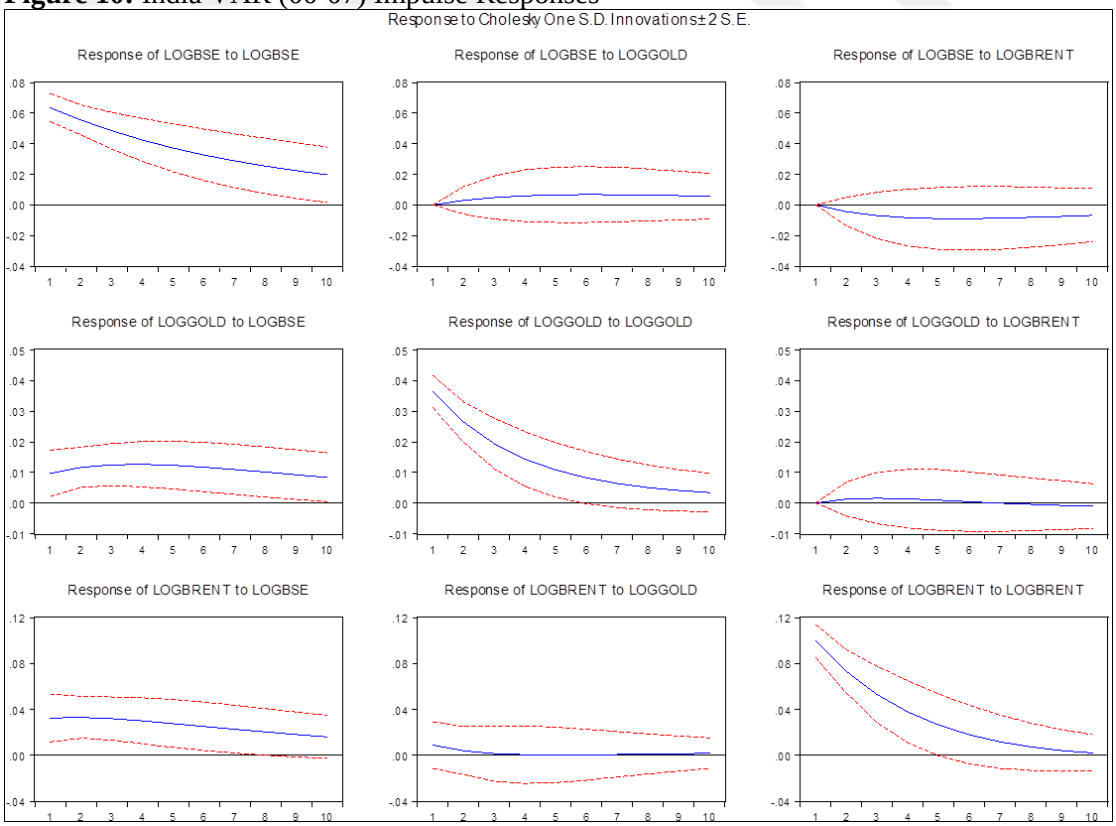


Figure 11: India VAR (08-15) Impulse Responses

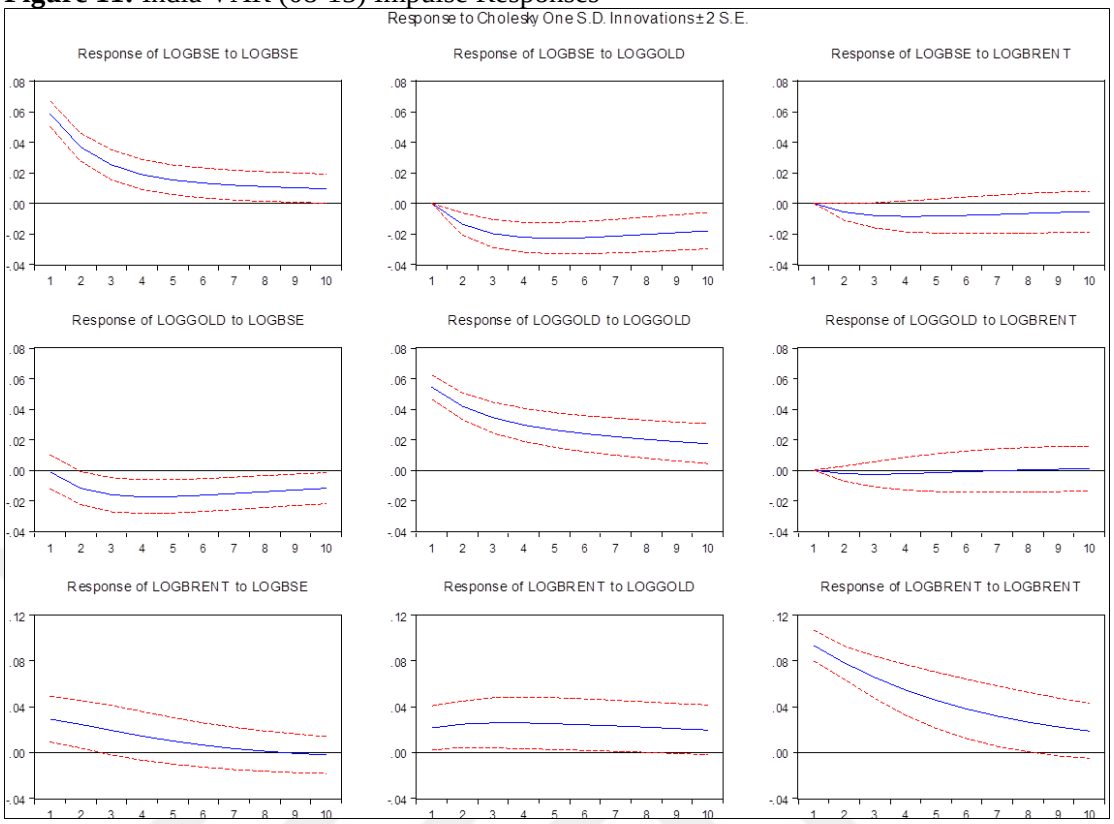
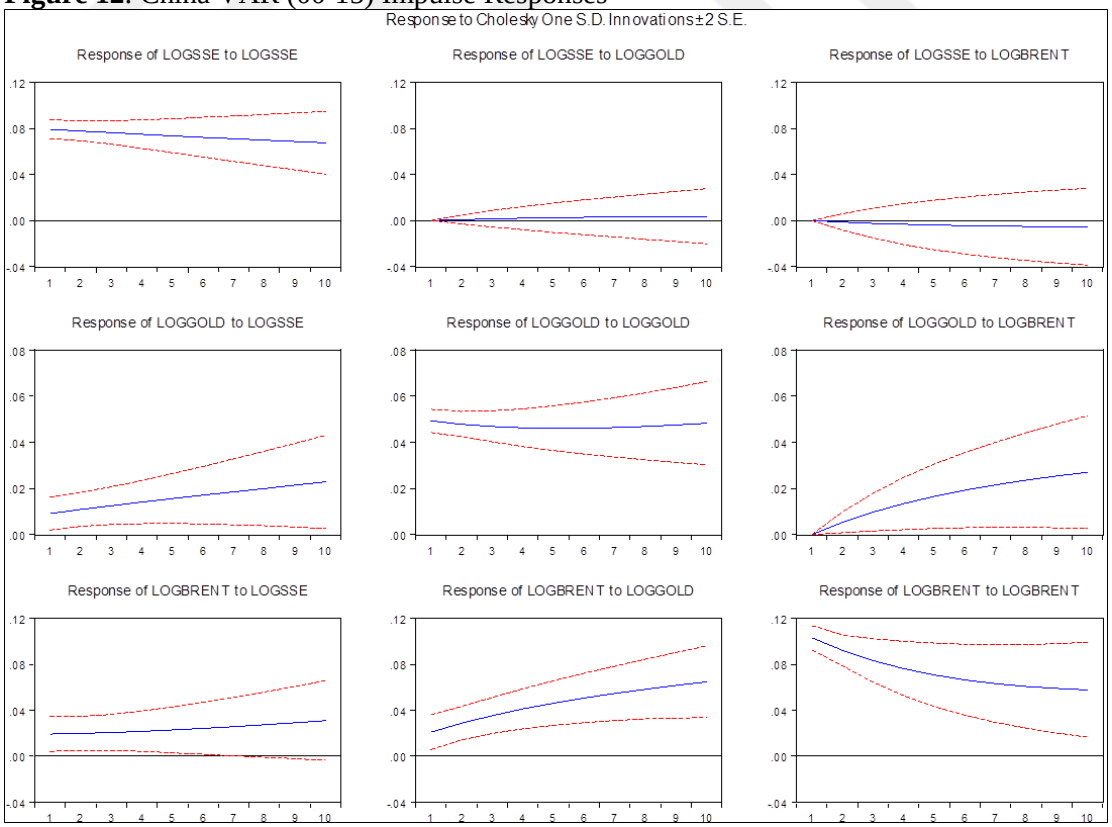


Figure 12: China VAR (00-15) Impulse Responses



SSE: Stock market index of China

Figure 13: China VAR (00-07) Impulse Responses

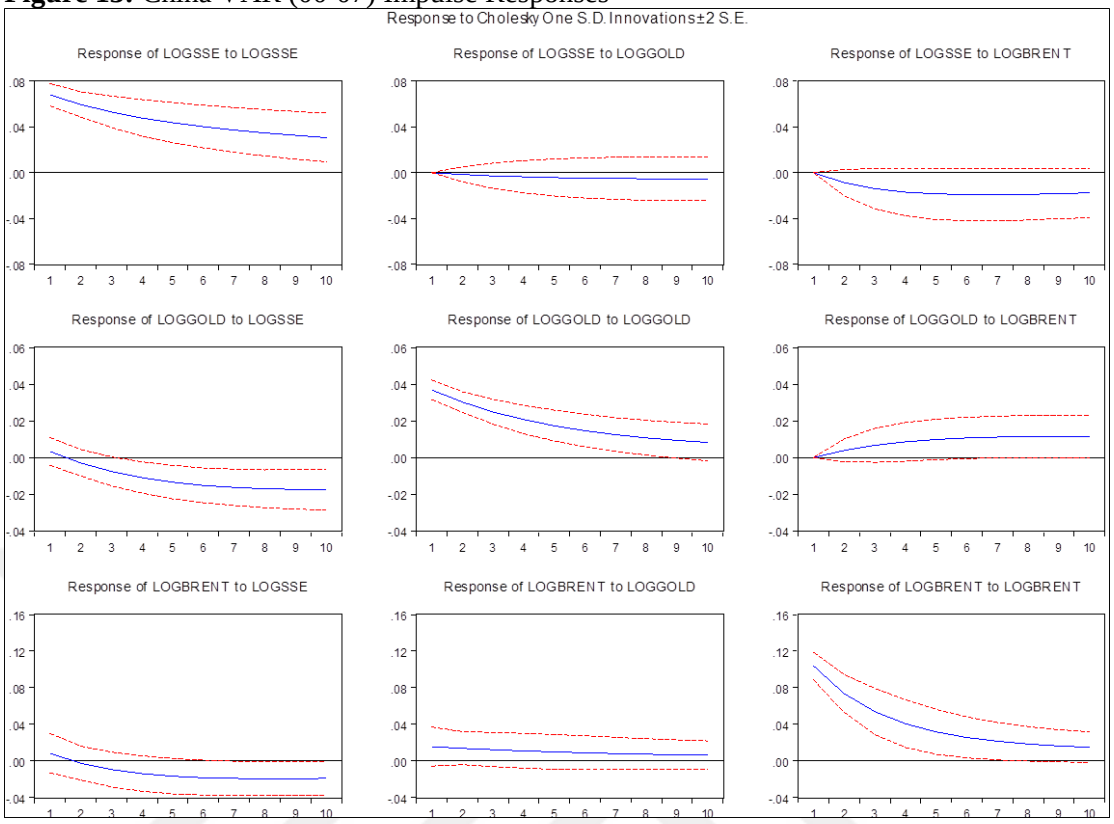


Figure 14: China VAR (08-15) Impulse Responses

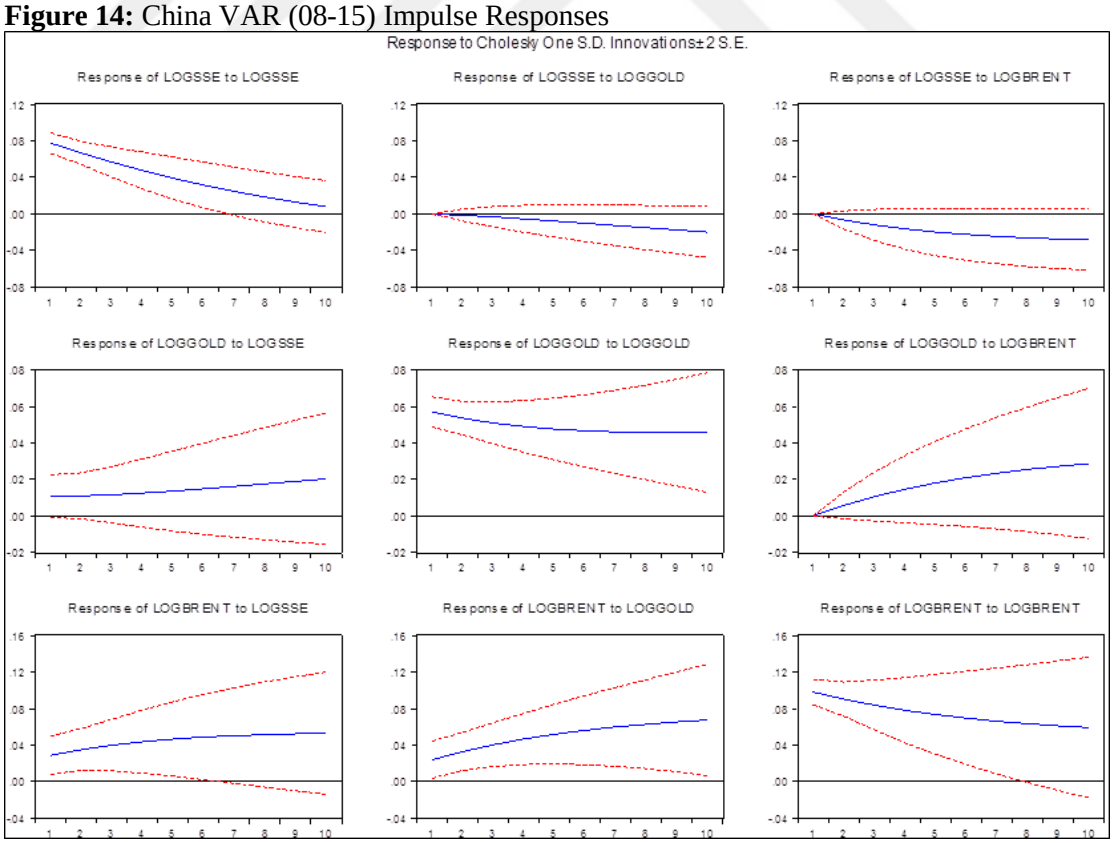
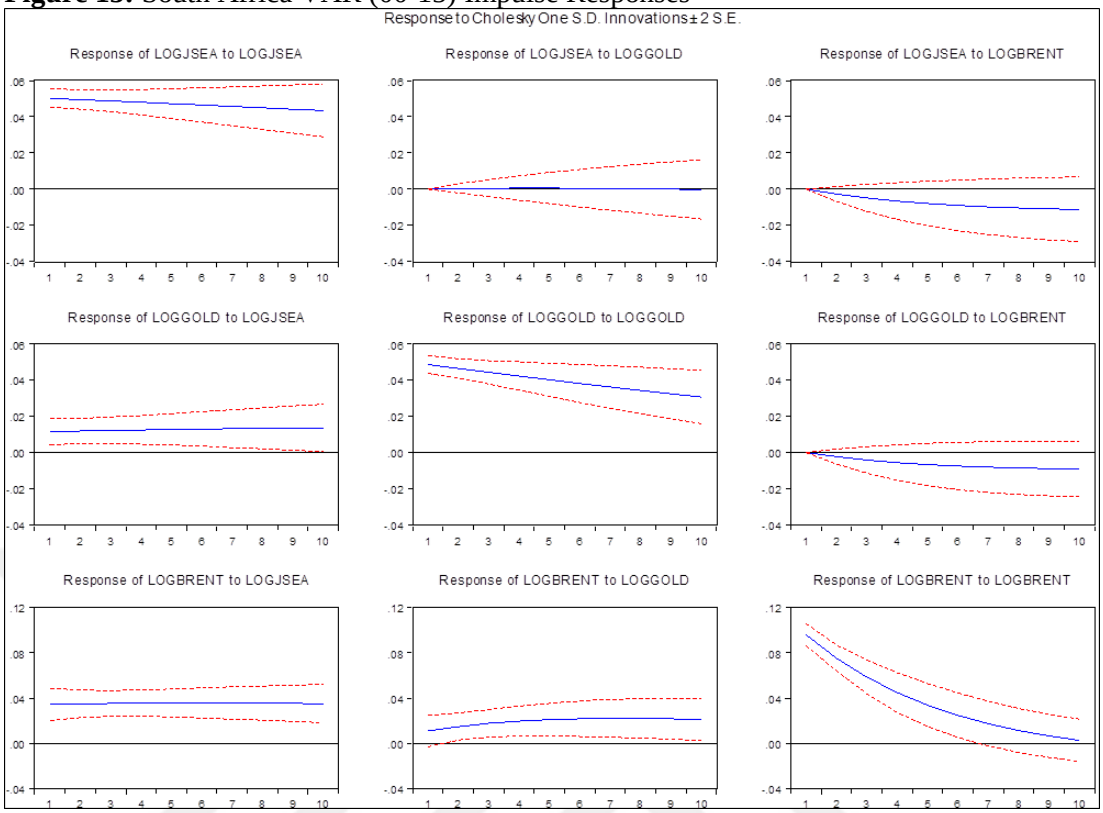


Figure 15: South Africa VAR (00-15) Impulse Responses



JSEA: Stock market index of South Africa

Figure 16: South Africa VAR (00-07) Impulse Responses

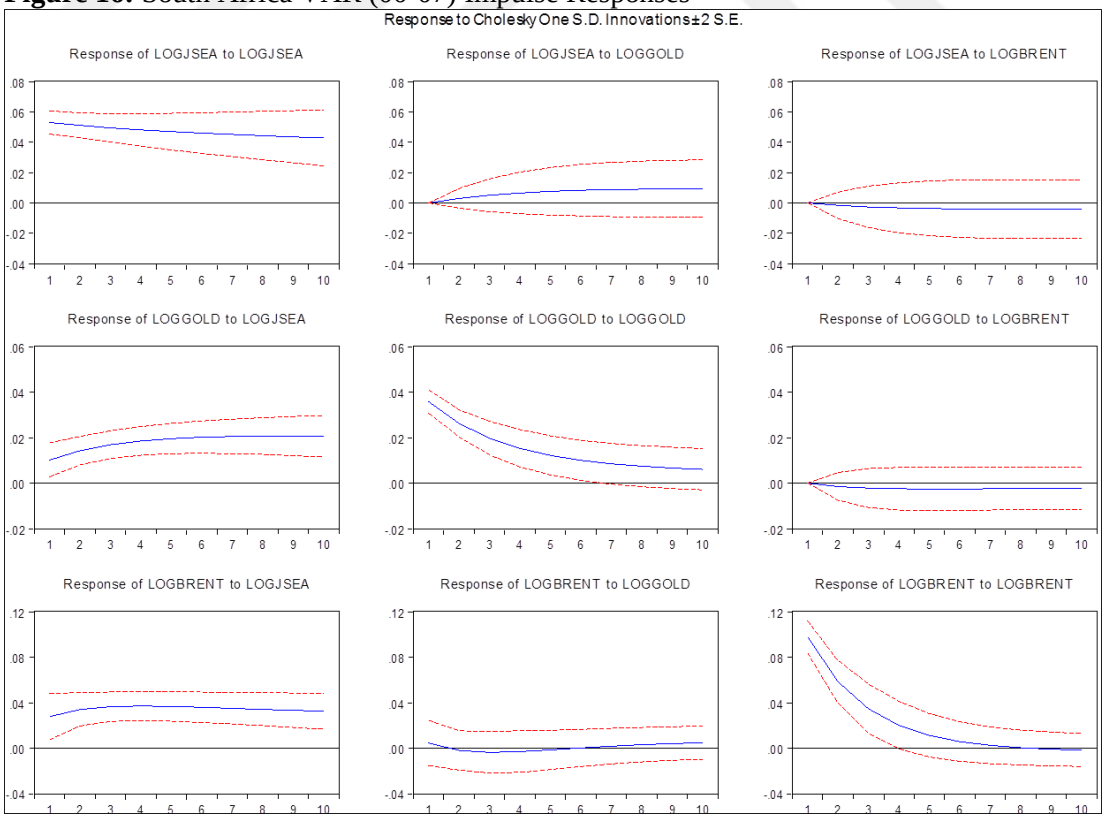


Figure 17: South Africa VAR (08-15) Impulse Responses

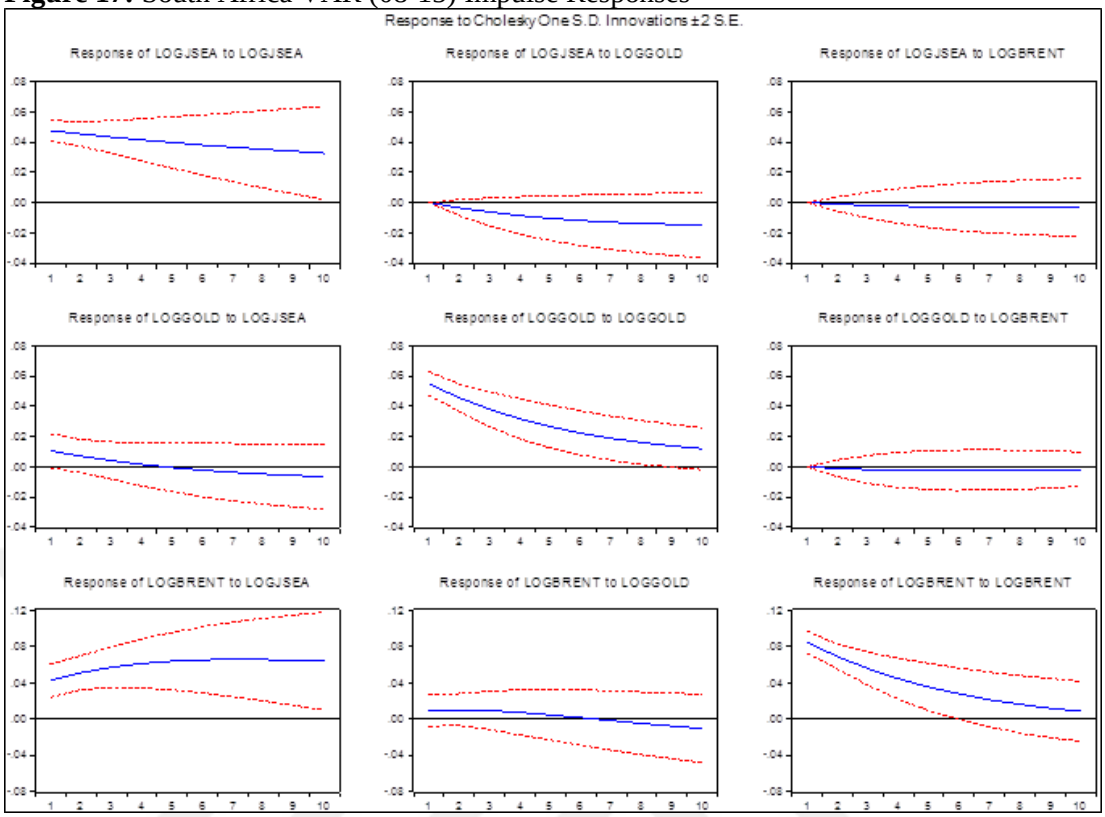
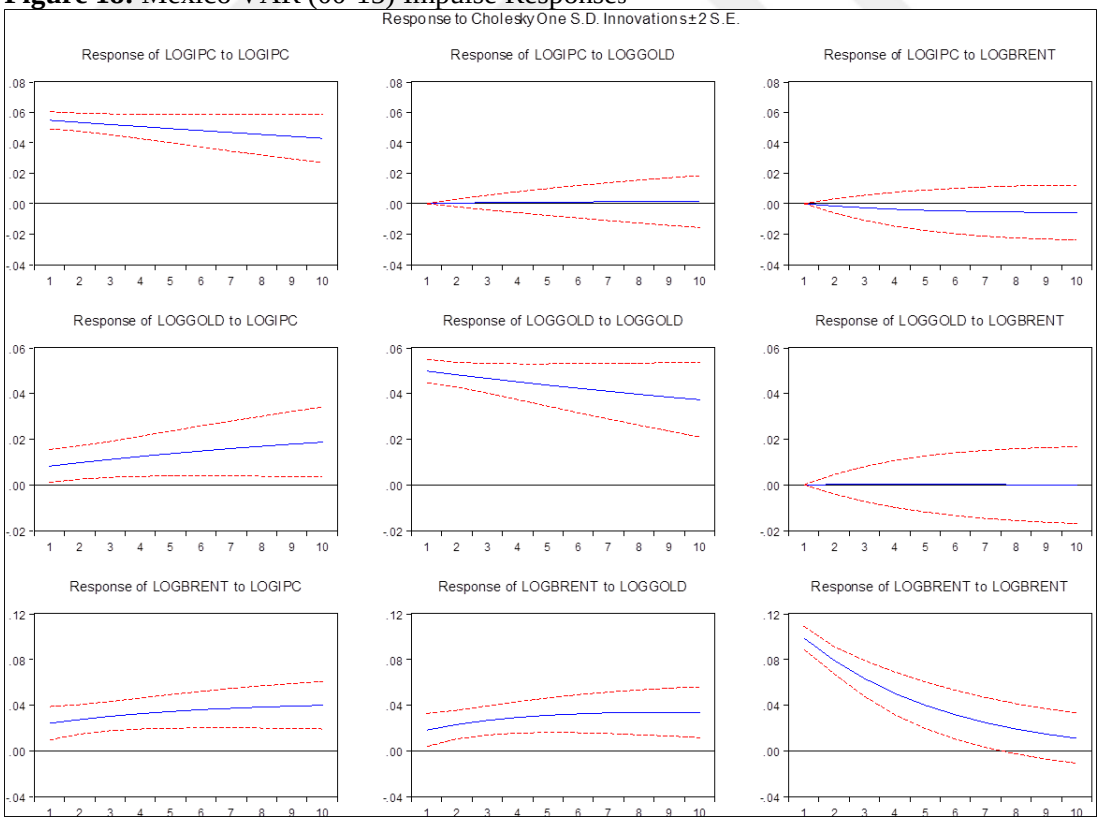


Figure 18: Mexico VAR (00-15) Impulse Responses



IPC: Mexican stock market index

Figure 19: Mexico VAR (00-07) Impulse Responses

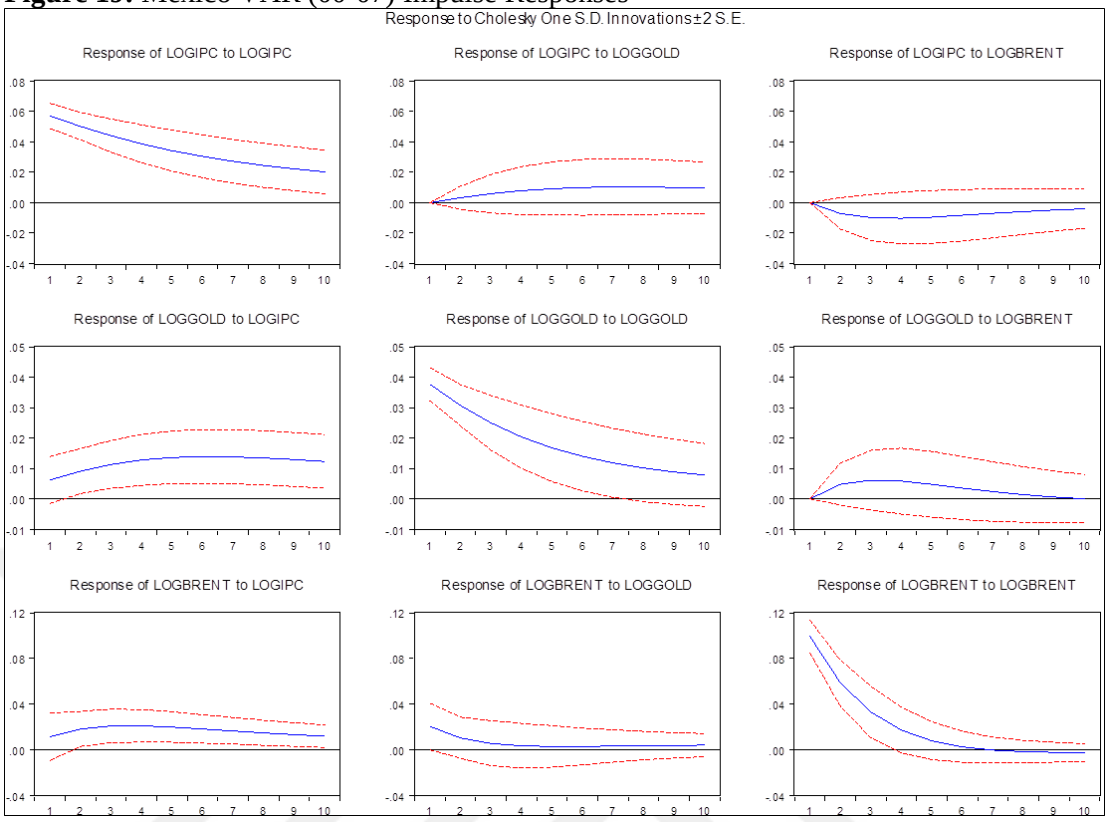


Figure 20: Mexico VAR (08-15) Impulse Responses

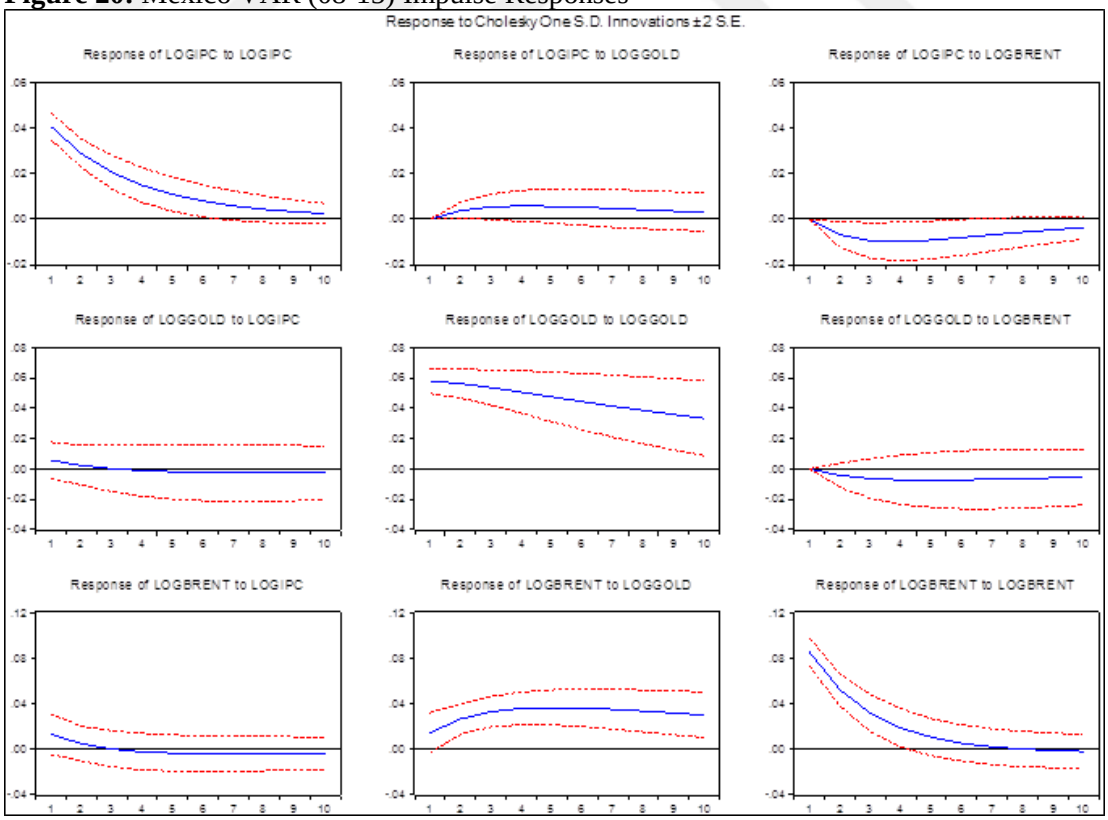
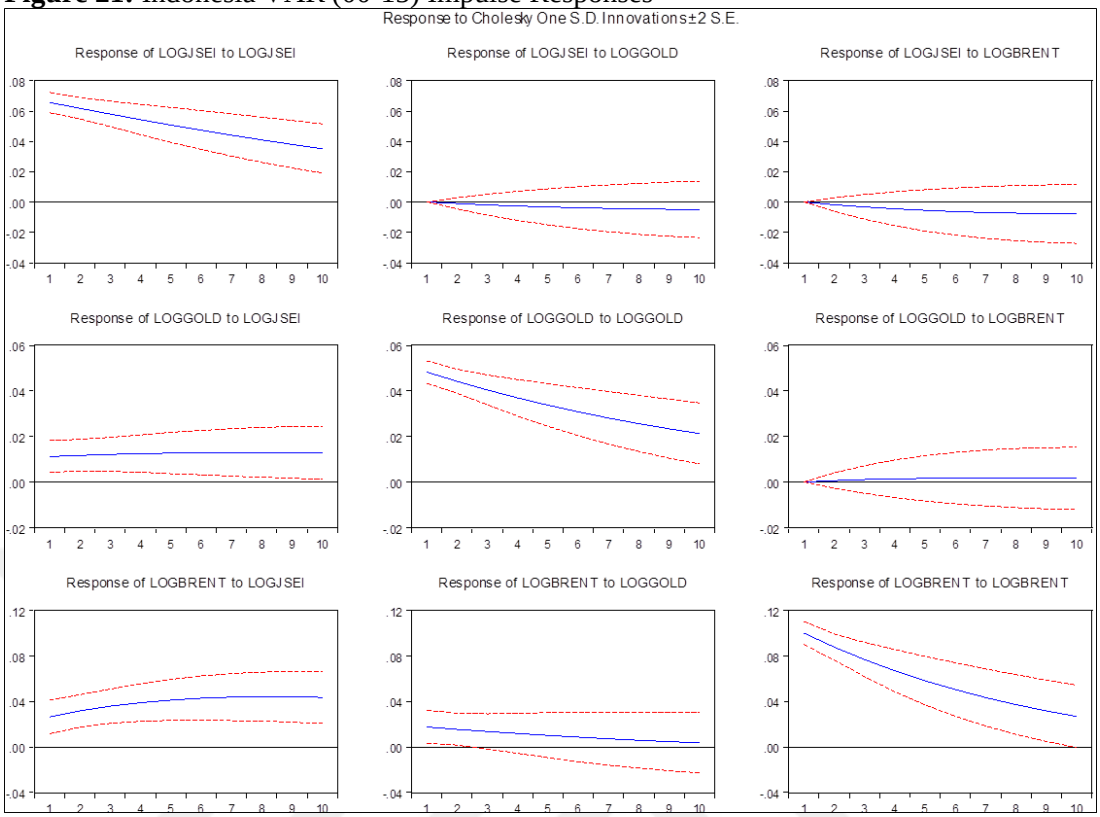


Figure 21: Indonesia VAR (00-15) Impulse Responses



JSEI: Stock market index of Indonesia

Figure 22: Indonesia VAR (00-07) Impulse Responses

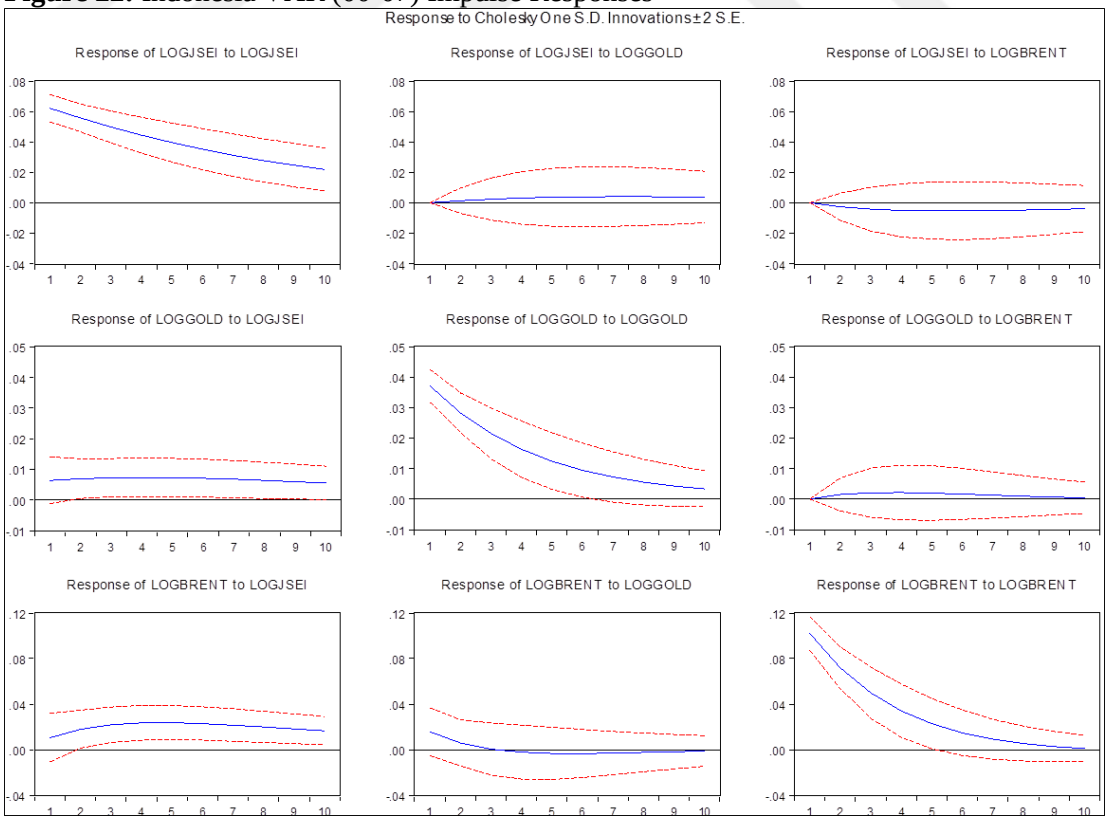


Figure 23: Indonesia VAR (08-15) Impulse Responses

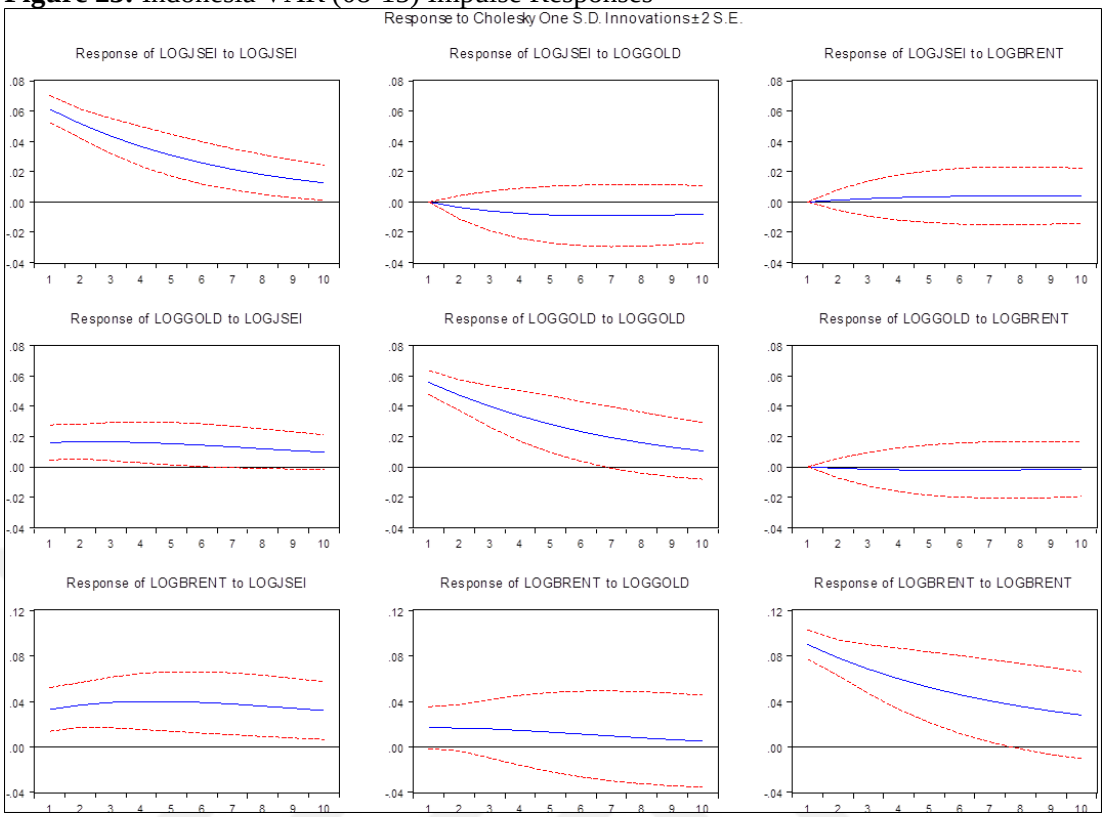
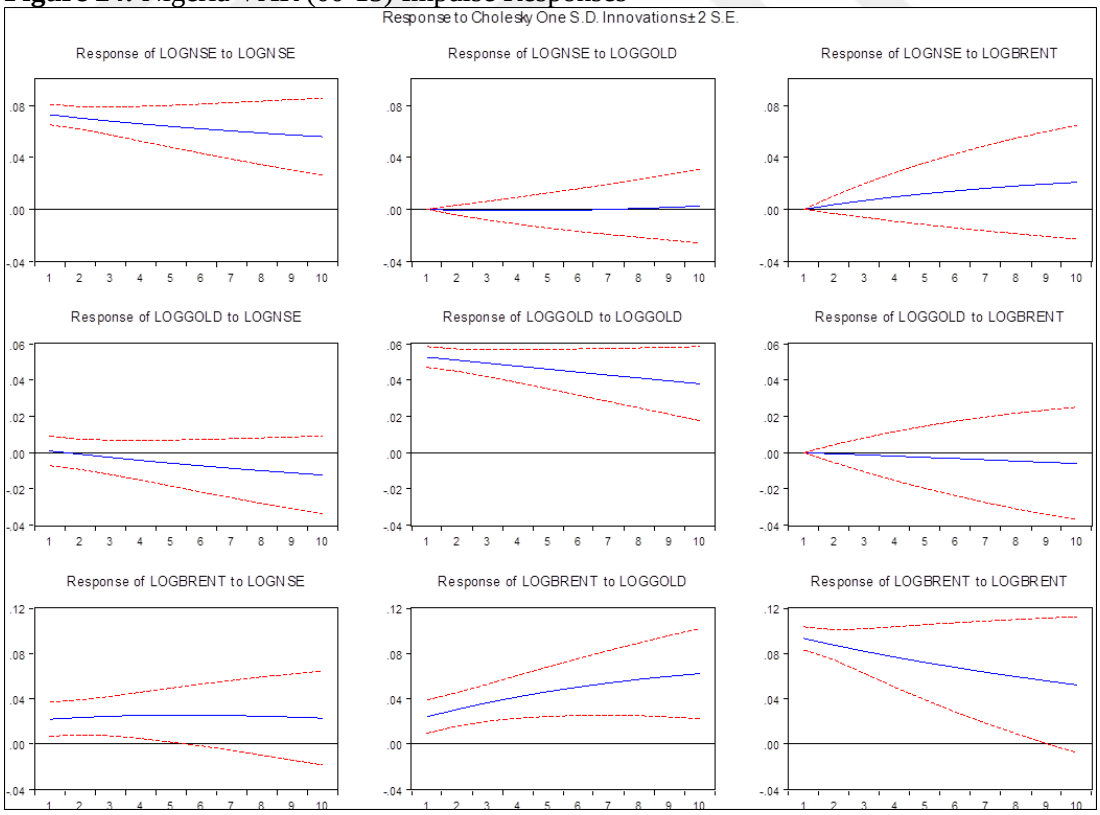


Figure 24: Nigeria VAR (00-15) Impulse Responses



NSE: Nigerian stock market index

Figure 25: Nigeria VAR (00-07) Impulse Responses

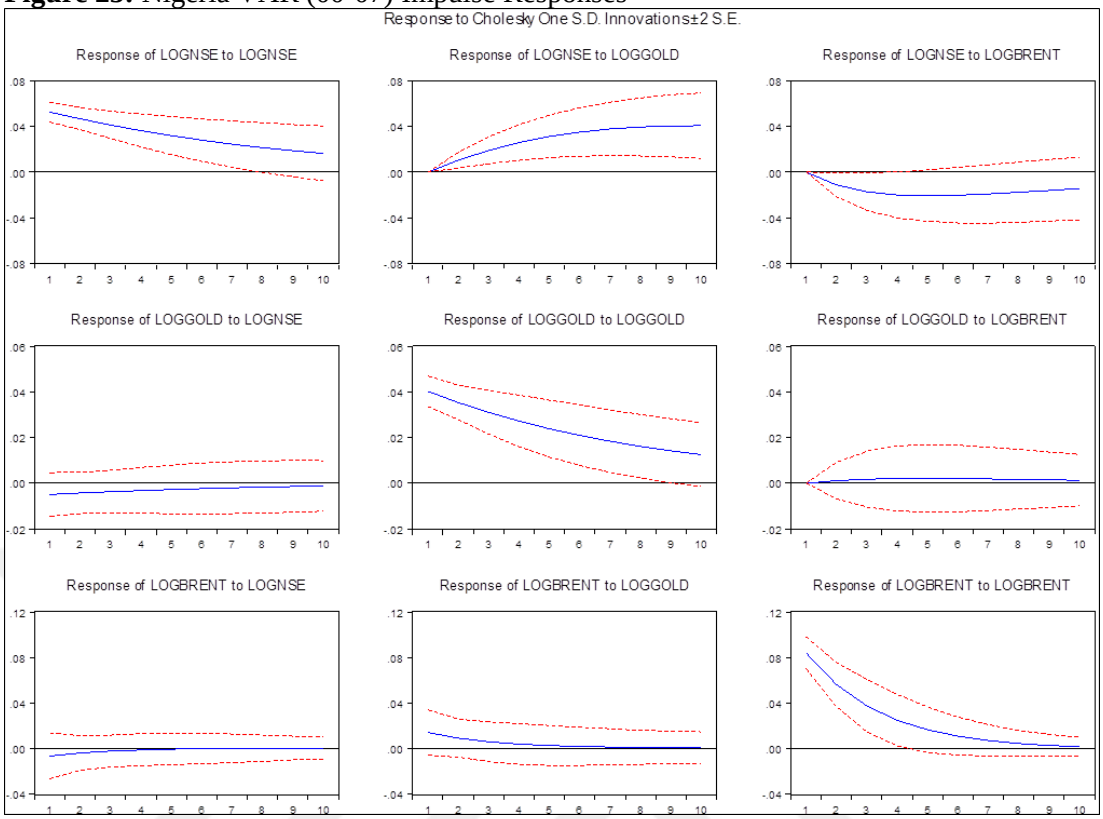


Figure 26: Nigeria VAR (08-15) Impulse Responses

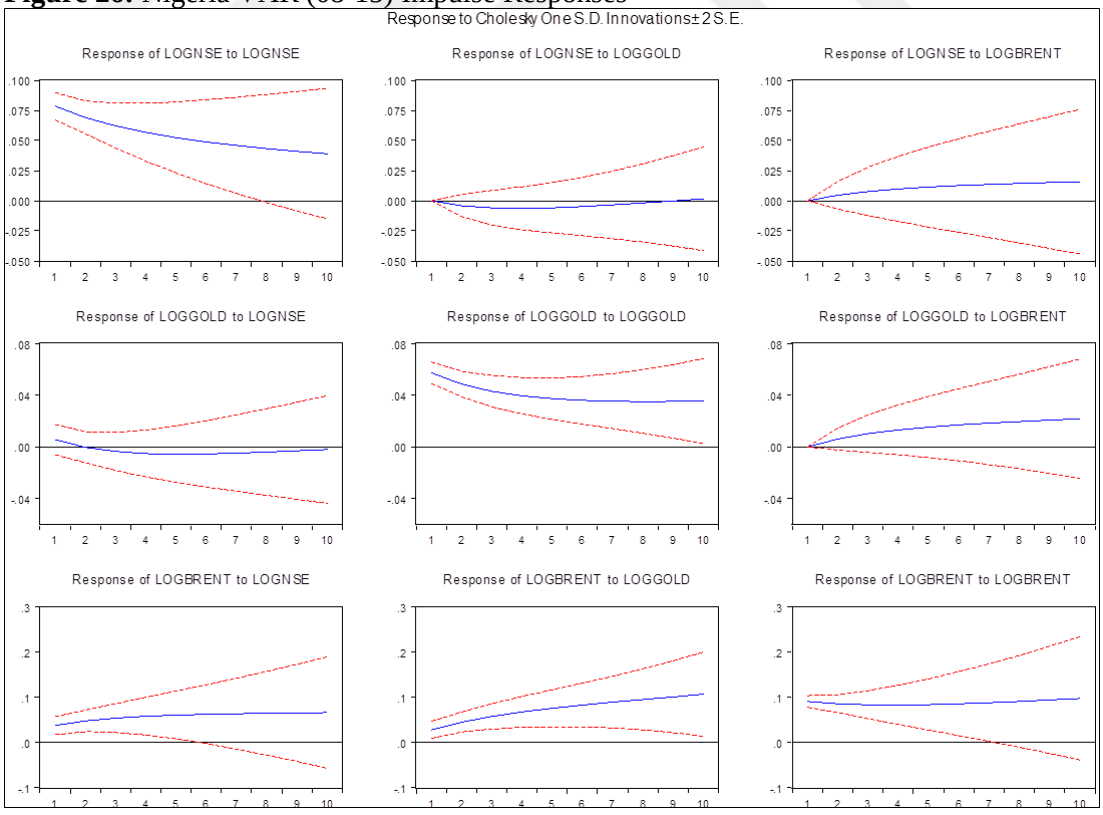
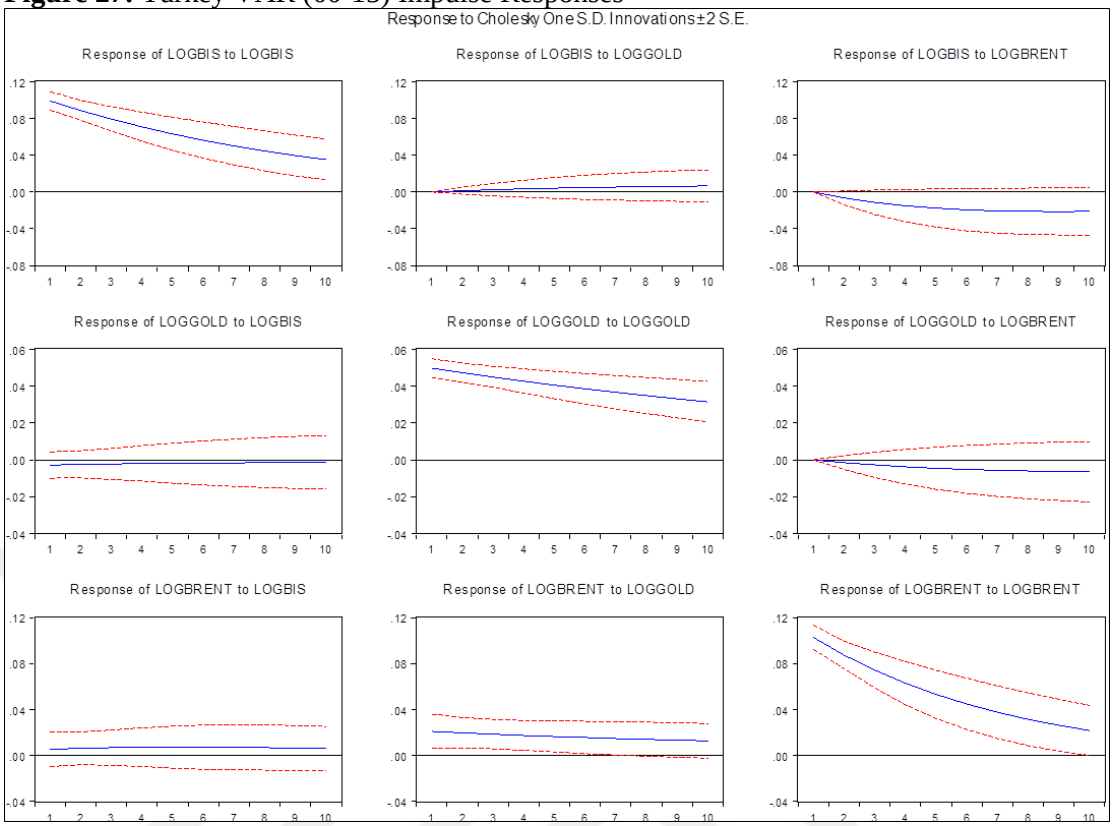


Figure 27: Turkey VAR (00-15) Impulse Responses



BIS: Stock market index of Turkey

Figure 28: Turkey VAR (00-07) Impulse Responses

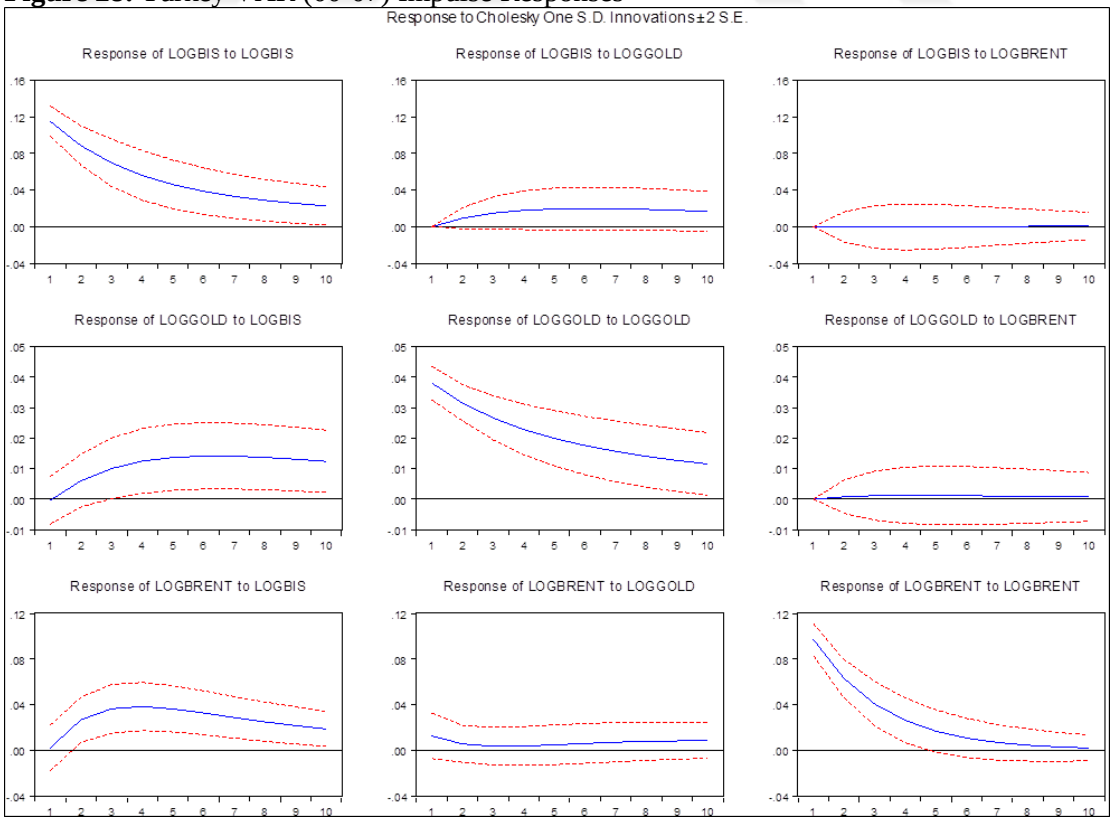


Figure 29: Turkey VAR (08-15) Impulse Responses