Thesis

Topic: ***Macroeconomics Forecasting Using GVAR Model***

(Pakistan Vs Major Trading Partners' Countries)

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Dedication:

This work is dedicated to my parent, brother, sister for their unconditional support during my studies.

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First of all thanks to Almighty Allah for providing me the ability of writing such material without the help of Allah it would not be possible.

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LIST OF SYMBOLS

$\boldsymbol{y_{it}}$ – Real gross domestic production of country i during period t (in local country).

$\boldsymbol{\pi_{it}}$ – Inflation of country i during period t (in local currency).

$\boldsymbol{e_{it}}$ – Exchange rate of country i currency at time in US dollars,

$\boldsymbol{r_{it}}$ – Nominal short-term interest rate per annum, in percent.

$\boldsymbol{P_t^w}$ – World commodity price index.

$\boldsymbol{w_{ij}}$ – Trade weight between country i and country$j$.

y_{it}^*– Real gross domestic product of trade-weight foreign core macro variable.

π_{it}^*– Inflation of trade-weight foreign core macro variable.

e_{it}^*– Exchange rate of trade-weight foreign core macro variable.

r_{it}^*– Nominal short-term interest rate of trade weight foreign core macro variable.

$\emptyset_{i1}$– Parameter of endogenous variable in VARX model

φ_{io}– Parameter of exogenous variable in VARX model

ε_{it}– Error term

t– Time.

h_{io}– Constant term of VARX.

h_{i1}– Parameter of Trend term.

$\alpha_i\beta_i'$– Matrix of rank.

Z_{it}– Vector of exogenous and endogenous variable.

k_i– The domestic variable of the country.

k_i^*– The foreign variable of the country.

Γ_i– Short run parameter

c_{io}– Constant term.

A_i, B_i– Matrix of GVAR model.

μ_t– Error term of GVAR model.

LIST OF ABBREVIATIONS

GVAR- Global Vector Autoregressive Regression.

ADF - Augmented Dickey Fuller.

GDP - Gross Domestic Product.

CPI – Consumer Price Index.

VAR- Vector Autoregressive Regression.

VECMX- Vector Error correction Model X.

MSE – Mean Square Error.

OLS – Ordinary least square.

STPF - Strategic Trade Policy Framework

MSEF- Mean Square Error Forecasts

ARCH- Autoregressive Conditional Heteroskedasticity

GARCH- Generalized Autoregressive Conditional Heteroskedasticity

ABSTRACT

In this thesis an attempt has been made to analyze and estimate the macroeconomic forecasting for Pakistan and its major twelve trading partners for the period of 1995Q1 to 2012Q4, using Global Vector Autoregressive (GVAR) Model. The key feature of GVAR model is to capture the independence and co-movement across countries. Second, it provides better forecasting performance. The GVAR model is estimated for twelve trading economies. During estimation, Pakistan economy is treated as single and also treated as domestic economy whiles other trading partners is treated as foreign economies. The important finding of this study is that the GVAR forecasts better than the VAR forecasts in most of the cases. Second the foreign real gross domestic product and foreign inflation are reflecting the significant impact of their domestic counterpart of Pakistan real gross domestic product and inflation.

CHAPTER – 1

Introduction

The macroeconomic forecasting is considered a vital for policy analysis. Generally two major approaches are followed in the forecasting technique i.e. Structure, approach and reduced approach. The Structure approach is model oriented, and it's allowing the maximum economic structure. In addition to that, it helps to have a complicated economic model with various parameters. Keeping in view the above it is rather more sensitive parameter estimates and explaining the assumption pertaining to economy relative to the reduce form approach. To calculate macroeconomic forecasting for more than one country, it is hard to implement in reality. In contrary to structure approach, the reduced approach is more data oriented and it has not too much economic structure. Reduced approach can be computed with minimum requirements.[1]

Many time series models related to reduced form approach. These variables like Autoregressive Moving Average (ARMA) Univariate forecasting and Autoregressive Integrated Moving Average (ARIMA) are stationary and non stationary time series. (ARCH/GARCH) model is helpful to model time series with time varying conditional variances exhibiting the power to estimate forecasting in finance.

In order to get interdependence among multiple time series and capture the evolution, the vector autoregressive (VAR) model and generalization of the univariate autoregressive model used for multi variant stationary time series.

[1]Fei. H. And. Thiam.H.N.(2011)

The Econometrics theory has introduced nine ways to embed the advantage of structure approach into VAR. Sim (1986) and Bemank (1986) suggested forcing an economics restriction in the regression innovation spoken of a structure Vector Autoregressive (SVAR) model. Although many restrictions to be applied (n^2 - n/2) restriction in "n" variable to get identification. It is very difficult when more than one country exists.

For these technical issues, we use GVAR model, originally introduced in Pesaran. Schuermann and Weiner. PSW, (2004), and additional developed in Dees, di Mauro, Pesaran and Smith, DdPS, (2007), for answering some of these questions. We do so recognizing that Risk management and Macroeconomic policy analysis want to take into account that increasing interdependency that include across markets and countries. Indeed the Real and financial variable there is a main difference across country correlation. For instance output growth and inflation are correlated as compared to the Short-run interest rate in the across countries.

Countries impact each other economically in the globalized world. Some of these are affected by one currency to another currency, one government to the other government and political events. But the great deals of interdepency among that nation in economy are naturally based on production of goods and services.

1.1 Trade liberalization in Pakistan: An Overview

Countries are interlinked with each other through trade in goods and services. This interdepency allows and affect the macroeconomic variables such as output, inflation, exchange rate and short term interest rate in case of Pakistan. We have

observed that these variables are highly volatile when it opens trade liberalization to rest of the world.

In the early years of Pakistan's economy can be considered by a weak industrial foundation, the authority of the agriculture sector, lack of efficient infrastructure, and overall eco-political insecurity. The key objective policy of these years was to support the industrial foundation. Therefore, Pakistan has adopted a limited trade regime to control, the tariff and non tariff barriers in the domestic industries.

In the 60s, the industrial foundation was laid down. Hence, the fast growth of large scale manufacturing industries started in the country. While the highly confined trade regime remained useful in the period some other policies were introduced to support industrial exports from the country, such as, an overrated exchange rate, bonus voucher and open general license scheme. Therefore, both were reasonable to increase industrial production and export registered during in the 1960s. However, industrial growth had not persisted in 79s. Actually, it was suffering delay in the next year for the nationalization of industries. Well the government was nationalizing various types of private industries in the country. It restricted three other trade liberalization measures to support exports during this period; firstly, to reduce Pakistani currency by 57% in 1972, secondly exclusion of the export bonus scheme, and thirdly to control licensing scheme.

The trade liberalization took place in Pakistan late 1980, which was increasing over time. Duties of taxes were reduced, mostly Statutory Regulatory Orders (SROs) were removed and non-tariff barriers (NTBs) were largely to break down. For this, the average tariff rate was reduced quickly from 77 percent in 1985 to

about 17 percent. While trade policies were altered constantly in Pakistan, to achieve the maximum tariff which was declined from 225 percent in 1986 to 87 and 70 percent in 1994 and 1995, respectively. During 2000 - 2003, the beginning of such policies was to support of deregulation, decrease the business cost and liberalization, these policies focused on the promotion of a framework for stability in macroeconomic in shape of exchange rate, inflation and interest rate.

REGIONAL/BILATERAL TRADE AGREEMENTS

To enhance the process of liberalization of trade, Pakistan has done Regional and Bilateral agreement with different countries.

1. Free Trade Agreement of South Asia

The south Asian association for Regional Cooperation (SAAR) was recognized on 8th December 1985. The SAARC license were adopted by different Governments such as, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka with aim to increase the procedure of economic and social development in partner of the states. The Agreement Free on South Asia Trade (SAFTA) was started during the 12th SAARC meeting on 6 January, 2004. The entrance in the force of the Agreement was launched the South Asian Free Trade Area which would be finished by 2016 January. The objective of this agreement was to encourage and promote economic cooperation and mutual trade among contracting nations by removing barriers to trade, facilitating movement of goods across borders and promoting fair competition in the free trade area.

2. Preferential Agreement between Pakistan and Iran

Pakistan signed a preferential trade agreement with Islamic republic of Iran on 4th march 2004. The cabinet ratified the agreement on 25th May as mutually agreed and the agreement become operational form 1st September 2006. Under the Agreement, Pakistan offered concessions to Iran on 338 tariff lines, whereas Iran gave concessions on 309 tariff lines. Preference granted by both countries to each cover approximately 18% of MFN tariff of both countries.

Trade Free Agreement of Sri Lanka and Pakistan

Free Trade Agreement (FTA) between Pakistan and Sri Lanka is operational from 12 June 2005. Under the free trade agreement, Sri Lanka and Pakistan have agreed to offer preferential market access to each other export by way of granting tariff concessions. Sri Lanka would be able to enjoy duty free market access on 206 products in the Pakistan market including tea, rubber and coconut Pakistan, in return, would gain duty free access on 102 products in the Sri Lanka market. These products include oranges, basmati rice and engineering goods.

1.2 Direction of Export

Pakistan trade with a number of different countries and its export are highly concentrated in few countries including Germany, USA, UK, Japan, Hong Kong, Dubai and Saudi. The USA is the single largest export market for Pakistan, accounting for 15%. In addition to that Dubai, Saudi Arabia, United Kingdom and Germany are coming after the USA in term of exports. In spite of focusing on a small number of markets, Pakistan has faced some challenges in term of geographical diversification in export. Whenever we look into the back record it reveals that around 47% of Pakistan exports were focusing in seven markets

namely UK, Germany, USA, Hong Kong, Dubai, and Saudi Arabia while the rest of the shares of the other countries were 53%. It was observed that the share of these seven countries is declining at 30% during current fiscal year on the other hand the markets share of the rest of the countries increased to 70%, because Pakistan has to broaden its exports in terms of goods as well as in terms of markets. Instability in export is because of concentrating heavily in few good and few markets.

Table 2: Major Export Market **US $ Million**

Country	1990	1993	1996	1999	2002	2005	2008	2011	2012
USA	10.8	13.9	15.5	24.8	24.7	23.9	19.5	16.0	15.1
Germany	8.9	7.8	6.8	6.6	4.9	4.8	4.3	4.5	4.8
Japan	8.3	6.8	6.6	3.5	1.8	1.1	0.8	0.7	.50
UK	7.3	7.1	6.4	6.6	7.2	6.2	5.6	5.0	5.1
Honkong	6.0	6.6	9.1	7.1	4.8	3.9	4.0	1.7	1.6
Dubai	2.8	5.9	4.7	5.4	7.9	3.3	1.6	1.4	1.3
Saudi	3.9	4.7	2.4	2.4	3.6	2.5	1.7	1.5	1.4
Sub-total	47.7	52.8	51.5	53.4	54.9	45.7	44.4	30.8	29.8
Other countries	53.3	47.2	48.5	46.6	45.1	54.3	55.6	69.2	70.2

Source: Pakistan Bureau of Statistic

1.3 Imports of Major Countries

Pakistan imports are coming from a small number of countries, which are namely as USA, Japan, Kuwait, Saudi Arabia, Germany, UK and Malaysia. In general, the shares of imports for these countries have remained approximately the same during 2012 as compared to 2011. The involvement has shown a downward trend due to the change in the machinery real import of Japan. But, the

shares of imports from Pakistan from Saudi Arabia and Kuwait are increasing due to increasing in worker remittances in Kuwait worker remittances US$ 582.57 million in 2012 is higher than the previous year worker remittances US$ 495.19 million. In the other hand the Saudi Arabia worker remittances US$ 3687.00 million is also high in the previous year worker remittances US$ 2670.07 million (Pakistan Economy Survey 2012). The share of imports from Malaysia is fluctuating above the years, mainly due to variation in the price of palm oil for the manufacture.

Table 2: Major Import Market **US $ Million**

Country	1990	1993	1996	1999	2002	2005	2008	2011	2012
USA	11.8	10.6	12.0	6.3	6.7	7.6	7.2	3.3	3.6
Japan	13.0	11.8	8.6	6.3	5.0	7.0	4.6	4.2	4.4
Kuwait	0.7	5.3	6.9	12.0	7.1	4.6	6.6	8.4	8.7
Saudi	6.2	5.4	6.0	9.0	11.6	12.0	11.7	10.6	7.7
Germany	7.3	7.7	5.6	4.1	4.3	4.4	3.2	2.5	2.5
UK	4.9	5.1	5.0	3.4	3.4	2.6	2.0	1.2	1.7
Malaysia	4.0	5.5	4.7	4.3	4.4	2.6	3.9	3.7	3.4
Sub-total	47.9	51.2	48.8	45.4	42.5	40.8	38.5	33.9	32.0
Other countries	52.1	48.8	51.2	54.6	57.5	59.2	61.5	66.1	68.00

Source: Pakistan Bureau of Statistic

1.2) Objective of the Study

1) Forecasting of Macroeconomics variable such as output, inflation, interest rate exchange rate by using GVAR Model.
2) To find the contemporaneous effect of foreign macroeconomics variables on domestic macroeconomic variable.
3) Whether GVAR provides better forecasting estimates than ordinary VAR using Forecast Mean Square Error (FMSE) test in case of Pakistan with its major trading partners.

CHAPTER-2

2.1 Literature Review

Numerous studies have been conducted relevant to the issue under consideration. Some studies are summarized below:

Hashem, et al. (2009) conducted a study of Forecasting Economic and Financial Variables. He used a GVAR model in the monthly series covering the period 1979 to 2003. The main finding of this study was that real equity prices and long run interest rates of advance economics help to get better forecasts of real output and inflation, mostly US and Canada, this is not the case more generally.

Sinha, et al (2010) analyzed the forecasting and modeling of Macroeconomics variable of India before and after the recession. In this paper he estimated ARIMA model for the period 2003 to 2009. The finding of this study is that the Indian economy reviving after the global recession. In 2010-11 the inflation, GDP, foreign investment, fiscal deficit and capital market will rise. But the exchange rate will not change in the same year.

Guo-Yong (2008) examines the study of forecasting of GDP Shenzhen. He used the ARIMA model covering the period 1979 to 2006. The finding of this paper was that the ARIMA model is outperform than the other model and its provide the policy making reference to the Shenzhen formulation economic development goal.

Rossi and Sekhposyan (2008) examined that the performance of forecasting for US output growth and inflation change over time. In this paper he estimated economic model for the period 1970Q3 to 2005Q12. The important finding of

this paper is that, the production of industrialization and growth of inflation prediction has performed well in the beginning of the out-of-sample period. The production ability to output and inflation forecasting is very different for two series.

Cashin, et al. (2012) analyzed a study of Global is the Impact on the Systemic Economies with MENA Business Cycles. Author used the GVAR model for the period 1979Q2 to2011Q2. The main finding by the author in the paper is that MENA countries are more sensitive to developments in China than to shocks in the Euro Area, the United States; show the direction of evolving trade patterns and the emergence of China as a key driver of the global economy. Outward spillovers from the GCC region and MENA oil exporters are likely to be stronger in their immediate geographical proximity, but also have global implication.

Maity and Chatterjee (2012) examine the study of forecasting of GDP growth in India. He used the ARIMA (1, 2, 2) covering the period 1959 to 2011. The important finding of this paper was that the manager and policy makers to create business and economics strategies in term of more accurately.

Hashem, et al (2010) used GVAR model for 33 countries by identifying and estimating the demand and monetary policies shock. The important finding of this paper is that output, inflation and interest rate response significantly from international demand and supply shocks in the long run. Second the US monetary policy shock effect output and inflation both the US and other international economics with same order of magnitude.

Stephane, et al. (2007) analyzed a study exploring the international linkages in the Euro area. In this paper the author used global model covering the period

1979 to 2003.The important finding of this paper is that US model allows the feedback effect to change the inflation and output effect outsides the US variable. They are captured the relations of world economy, and also find new channels of bond markets and oil price feedback effects on the economy.

Fei, et al. (2011) conducted a study of macroeconomic forecasts for the original ASEAN-5. The author used (GVAR) model covering 20 countries over the period 1991Q1 to 2009Q1.And important finding of this study was that the interdependence of real equity and short term interest rate in the global financial market. Second the GVAR is the outperform model with the VAR model.

Locoviello and Krueger (2001) analyzed the study of short run forecasting of the Italian project of GDP, one quarter to two years ahead. He used bridal and BVAR model covering the period 1985Q2 to 2000Q2. The important finding of this paper was that the bridle and BVAR model is huge helpful in structure econometric forecasts. Their effortlessness, well forecasting power made the framework more often extended to the variable as fit as another country

Zang (2011) analyzes the study of evaluation the forecast of GDP of Korea. He used VAR and GVAR model covering the period 1970Q1 to 2008Q4. The important finding of this paper was that the performance of the new framework regularly improves the forecast, mainly the quarterly GDP and the forecast excises are superior informed by cross checking with the data driven framework projects

Matthieu, et al. (2009) Conducted a study of Modeling global Trade Flows in this paper he used (GVAR) mode over the period 1980 to 2007. The main finding was the world exports respond much more to a shock to US output than to a real

effective depreciation of the dollar. In addition, the model was used to observe trade developments and capture the financial crisis. While the fall in imports seems well accounted for by the model, the fall in exports of several countries remains partly unexplained, suggesting perhaps that specific factor might have been at play during the crisis.

Cui and Balke (2005) examine the study of monetary policy interdepency between, the ECB and FED. He used VARX and VEC model covering the period 1999-2006. The main finding was that the interdepency of existing between US and euro area interest rate. And the VEC are better show the between ECB and the FED.

Fasial (2012) analyzed the study of inflation forecasting of Bangladesh. He used ARIMA model covering the period 2001Q3 to 2011Q8. The main finding of that paper was that the policy makers and the long-term inflation in Bangladesh are assisting in the adoption of appropriate strategies to contain inflation

Mathieu Bussiere et al (2012) used GVAR model for panel data over the period 1980Q1 to 2007Q4 for 21 emerging and developed economics. The important finding of this paper is that the US output adversely affects export from Canada and Mexico. Second exports of international countries are stimulated by US real exchange rate. Third the Germans and China financial asset market are affecting to the rest of the world.

Christian, el al. (2011) analyzed a study of the Chinese impact on GDP growth and inflation in the industrial countries. In this paper he used vector autoregressive (GVAR) model for the period 1979Q1-2009Q4. The main finding of this expose that the effect on output growth on the economies is quite

considerable, mainly in the region of Asian. The expansionary effects in the US and the euro area responses are lower, as trade linkages are less intensive. The multipliers will be also reduced by a sizeable effect on inflation, as Chinese firms participate in international production chains.

Aro and Muellbauer (2000) conducted the study that the interest rate is affected on output. He used VAR model. The important finding of this paper was that the effect of high interest rate is significant, the impact of growth rate of 1990, and growth rate is more responsive to exchange rate to increasing trade openness in the 1990.

Eickmeier and Ng (2011) used GVAR model for 33 countries. The main finding of this paper is that negative US credit supply shock significantly adversely affecting GDP of international countries, while Japan and Euro area credit supply shock transmission are less efficient and have no significant affect international market. Through US credit supply shocks international credit and equity market respond more quickly, consistent with the international financial multiplier system.

Saymeh and Orabi (2013) conducted the study effect of GDP, interest rate, inflation on the real economic growth rate in Jordan. In this paper he used an economic model over the period 2000 to 2010. The main finding of this paper is that, all variants have a long term equilibrium relationship. Second, inflation, interest rate and GDP influence growth rate.

Kanayama and Thobejane (2013) analyzed the study of the forecasting of macroeconomic variables in South Africa. In this paper he used ARMIA and Kanel model of courtly series covering the period 1960 to 2012. The important

finding of this paper was that the parametric ARIMA regression is better and outperform than the non parametric kanel regression.

Gavin and kliesen (2007) conducted the study of forecasting of inflation and output. In this paper he used Data rich- model. The key finding of this paper was that the data rich-model are significance and improve the forecasting of real output and inflation. Second the model was very useful for the long term horizons.

Aron and Mullbauer (2000) examined the study of forecasting the inflation and output for South Africa. In this paper he used a VAR model of the annual series covering the period 1970 to 1998. The key finding of this paper was that if we change the surplus of the current GDP. It is sensitive to short run interest rate. The increasing the interest rate the increasing the inflation in the short run.

Fayad, et al (2009) conducted the study of forecasting the foreign exchange rate. He used VAR and pp based model covering the period 1995 to 2009. The key finding of this paper was that VAR model is good for long run prediction of nominal exchange rate. Second he used RMSE and MAE to show that the VAR model is outperforming than the pp based model.

There are smaller amount of papers related about this study in Pakistan. Some papers are included in Pakistan literature. But the major work is done at international level.

2.2 Literature related to Pakistan

Bokhari and Feridam (2006) analyzed a study of forecasting inflation through econometric Model. In this paper he used (ARMA) model for the period 1991 to

2004. The main finding is that the VAR model does not better than the ARIMA (2, 1, 2) model. The large models solve many problems, so that statistical models can play major roles in the economic forecasting and macroeconomics policy.

Khan and Din (2011), examined Dynamics of Macroeconomics Model in Pakistan Economy. In this paper he used the Dynamic macroeconomics model over the period 1972 to 2009. The finding of this paper is that the raw material and industrial machinery are significant impact on the manufacturing sector of long runs. The credit disbursed to the manufacturing sector exerts a negative impact to short run and long run. Second the private consumptions are significant impact on interest rate and real disposable income in the long run. But in short run real income and disposable income and not play an important role in the determination of real private consumption.

Haider and Hanif (2009) examined the study of inflation forecasting in Pakistan. He used Artificial Neural Networks (ANN) over the period 1993Q7 to 2007Q6. The main finding of this paper was that the Residual of Mean Square Error of ANN is much less that the Residual Mean Square Error of AR (1). It means that ANN forecasts are outperform

Conclusion:

Few studies had been conducted in finance and trade regarding GVAR model at international level. The authors have focused on the financial side of the economy rather than the macroeconomic side, in financial side, they addressed that the shock of US credit supply significantly adversely affected on GDP of international countries, while Japan and Euro area credit supply shock transmission are less efficient and have no significant affect international market.

Hashem, argued that the equity price and long term interest rate are helpful to the forecasting of real output and inflation in US and Canada. Fei argued that the short term interest rate and equity price are interdependency in the global financial market and the GVAR model is outperform the VAR model.

Countries impact each other economically in the globalized world. Some of these are affected by one currency to another currency, one government to the other government and political events. But the great deals of interdependency among that nation in economy are naturally based on production of goods and services. For this we used GVAR model in our thesis, because its show the interdependency and co-moments across countries. Further, it is incorporates economic structures and global interdependencies of the world economy in to the VAR model, and also avoid the identification problem. Additionally, it provides the better forecasting performance.

CHAPTER-3

Methodology

3.1 GVAR Model

There are two steps in building a GVAR model, first the country-specific models and second the Global VAR. In this part, we give a general idea of the GVAR to explain the Country specific models and to simplify how the global VAR is constructed.

3.2 Country-Specific VARX* Models

The country-specific model is a VARX* model for each individual country. The Endogenous variables are included in the country-specific models. Variables and descriptions are mentioned in chapter 4. Maturity short-term of interest rates is 3 months. In the country-specific model for every country other than the Pakistan, the endogenous variable are ($y_{it}\ \pi_{it}\ e_{it}\ r_{it}$) and for the Pakistan model, the endogenous variable are ($y_{0t}\ \pi_{0t}\ e_{0t}\ r_{0t}\ P_t^W$). The exogenous variables in the VARX* models are trade weighted foreign core macro-variables (denoted by an "*"). In most countries-specific models, foreign variables are constructed as.

$$y_{it}^* = \sum_{k=0}^{n} W_{ij}\, y_{jt},\ \pi_{it}^* = \sum_{k=0}^{n} W_{ij}\, \pi_{it},$$

$$r_{it}^* = \sum_{k=0}^{n} W_{ij}\, r_{it} \qquad e_{it}^* = \sum_{k=0}^{n} W_{ij}\, e_{jt}$$

w_{ij} For i,j = 0,1,…,N3 are the trade weights involving country, i and country j and Computed using the simple average to annual total trade of a country over the perids1995 to 2012. w_{ii} is 0 for every country i. The trade weights inside all countries examined here. We used the exogenous variables in Dees et al (2007).

In the country-specific model for each country or regional economy excluding the Pakistan, the exogenous variables are$(y_{it}^*, \pi_{it}^*, r_{it}^*, P_t^W)$, whereas for the Pakistan model, the exogenous variables are$(y_{0t}^*, \pi_{0t}^*, e_{0t}^*)$. The including of only three foreign variables in the Pakistan model reflects the importance to Pakistan financial markets within the global financial system.

Then we select the order of individual country VARX* (p_i, q_i) Models, where p_i denotes the lag order of endogenous variables and q_i denotes the lag order of exogenous variables. We can examine the case where *pi* is chosen according to the Akaike information criterion (AIC). Due to data restrictions, the order of lag of exogenous variables q_i are (1) for all countries. For the same reason, the maximum p_i is not allowed to be greater than two. Based on the AIC values, a VARX*(2, 1) model is fitted to all 9 countries are (chain, India, Indonesia, Japan, Pakistan, Saudi Arabia, Thailand, Turkey and USA. Where the VARX* (1, 1) model is fitted (Singapore, Kuwait and Malaysia. For all countries, the country-specific VARX*(2, 1) models can be written as

$$y_{it} = h_{io} + h_{i1}t + \emptyset_{i1}y_{i,t-1} + \emptyset_{i2}y_{i,t-2} + \varphi_{io}y_{it}^* + \varphi_{i1}y_{i,t-1}^* + \varepsilon_{it} \qquad \rightarrow 1$$

Where *t* is a linear time trend, and; for the Pakistan

$$Y_{0t} = \quad (y_{0t}\ \pi_{0t}\ e_{0t}\ r_{0t}\ P_t^W)' \ \ , Y_{0t}^* = (y_{0t}^*, \pi_{0t}^*, e_{0t}^*)'$$

For the, chain, India, Indonesia, Japan, USA, Saudi Arabia, Thailand and the turkey, it is

$$Y_{it} = \quad (y_{it}\ \pi_{it}\ e_{it}\ r_{it}\ )' \ , Y_{it}^* = (y_{it}^*, \pi_{it}^*, r_{it}^*, P_t^W)'.$$

The VARX*(1, 1) order is fitted to Kuwait, Singapore, and Malaysia:

$$Y_{it} = h_{io} + h_{i1}t + \emptyset_{i1}Y_{i,t-1} + \varphi_{io}Y_{it}^{*} + \varphi_{i1}Y_{i,t-1}^{*} + \varepsilon_{it} \qquad \rightarrow 2$$

Where: $Y_{it} = (y_{it}\ \pi_{it}\ e_{it}\ r_{it})'$, $Y_{it}^{*} = (y_{it}^{*}, \pi_{it}^{*}, r_{it}^{*}, P_{t}^{W})'$. It is simple to see that the

VARX*(1, 1) arrangement in equation (2) can be rewritten as equation (1) with 1 $\varphi_{i1} = 0$.

"The error term ε_{it} is assumed to be the serially uncorrelated, and a weak, dependent process cross section, such that for every t and i, and the set of granular weights W_{ij},

We have

$$\varepsilon_{it}^{*} = \sum_{j=0}^{N} W_{ij}\,\epsilon_{ji} \quad \overset{P}{\rightarrow} O, as\ N \rightarrow \infty$$

3.3 Estimation procedure

There are two main approaches to estimate the country-specific VARX* models (1) and (2). The first uses Johansen (1988, 1992) and Pesaran, Shin, and Smith's (2000). Fully parametric approach was based on a vector autoregressive error correction model. The Second utilizes Phillips,' (1991, 1995) semi parametric procedure is based on a Triangular formulation of a vector correction model. While the Phillips' approach is robust to the error distribution and Pesaran et al.'s approach relies on the assumption that errors are normally distributed, Phillips' nonparametric correction term is more data-demanding. Due to data limitations, we use Pesaran, Shin, and Smith's (2000) approach in this paper.

Suppose $Z_{it} = (Y_{it}', Y_{it}^{*'})'$ A vector of both exogenous and endogenous variables for the country, I, and let ***i k*** and ***i k***$*$ denote the numbers of domestic and foreign variables in the country I respectively. Then both the error correction model and the VARX* (2, 1) specification (1) and the VARX* (1, 1) specification (2) can be written as,

$$\Delta Y_{it} = c_{io} + \alpha_i \beta_i' Y_{i,t-1}^{*} + \varphi_{io} \Delta Y_{it}^{*} + \Gamma_i \Delta Y_{i,t-1} + \in_{it} \rightarrow \quad (3)$$

Where $\Gamma_i = 0$ for the VARX*(1, 1) specification, $Z_{it}^{*} = (t, Z_{it}')'$, $\alpha_i$is a $k_i + r_i$ Is a rank of a matrix r_i, and "β_i" is a $(k_i + Z_i^{*}) * r_i$ matrix, of r_i. By partitioning β_i as $\beta_i = (\beta_{it}' + \beta_{ix}' + \beta_{ix^{*}}')'$ Conformable to $Z_{i,t-1}^{*}$the r_i the above equation of error-correction terms can be written as,

$$\beta_i' Z_{i,t-1}^{*} = \beta_i'(t-1) + \beta_{iy^{*}}' Y_{i,t-1} + \beta_{iy^{*}}' Y_{i,t-1,}^{*} \quad \rightarrow \quad (4)$$

This clearly permits of co-integration both inside Xit and involving Xit.And $Y_{it,}^{*}$, and therefore across, Y_{it} and $Y_{jt}$when $i \neq j$**.**

Second, rank of β_i, r_i . Is calculated using the maximum Eigenvalue and$\alpha_i \beta_{ix}'$d the Trace statistics proposed in Pesaran, Shin, and Smith, (2000). Third, as shown in Dees et al. (2007), (c_{io}, $\alpha_i, \varphi_{io}, \Gamma_i$) Γ_i=0 in VARX*(1, 1)) can be consistently estimated by "ordinary least squares" regressions of ΔX_{it} and intercepts to estimated error correction terms ($\widehat{\beta_i'} Z_{i,t-1}^{*}$), ΔY_{it}^{*} and $\Delta Y_{i,t-1}$ (no $\Delta Y_{i,t-1}$ for VARX*(1, 1)).

It's explained that in small sample both the test statistics are trending to over reject, but the over rejection is more serious in maximum Eigenvalues compared to trace test. Using Monte Carlo experiments, it has also been shown that the maximum Eigenvalue test is generally less robust to departures from normal

errors than trace statistics (see Cheung, and Lai, 1993). Therefore, we base our assumption on trade statistics. We are estimating all the equation 3, coefficients. We can change them to get all the Coefficient estimates in the original VARX* models. First, partition $\alpha_i\beta_i'$ as $\alpha_i\beta_i' = g_{i1}, g_{i2}, g_{i3})$ Conformable to $(t-1, Y_{t-1}', Y_{t-1}^{*'})$. Second, the relationship between the coefficients in the equation (1) /(2) and those in the equation (3) can be easily derived as

$$\left\{\begin{array}{c} h_{io} = c_{io} - g_{i1} \\ h_{i1} = g_{i1} \\ \emptyset_{i1} = I_{k_i} + g_{i2} + \Gamma_i \\ \emptyset_{i2} = -\Gamma_i \\ \varphi_{i1} = g_{i3} - \varphi_{i0} \end{array}\right\}$$

Where $\Gamma_i = 0$ for the VARX*(1, 1) specification.

3.4 GVAR Model

All estimation of country by country done in GVAR model. The GVAR model wants to be solved and include the endogenous variables at the same time in the global economy. Both the VARX*(2, 1) model (1) and the VARX*(1, 1) model (2) can be rewritten as:

$$A_i Z_{it} = h_{io} + h_{i1} t + B_i Z_{i,t-1} + c_i Z_{i,t-2} + \epsilon_{it} \rightarrow \quad 5$$

Where:

$A_i = \left(I_{k_i}, -\varphi_{io}\right)$,

$B_i = (\emptyset_{i1}, \varphi_{i1})$,

$c_i = (\emptyset_{i2} 0_{k_i * k_i})$ For VARX*(2, 1), and $c_i = 0$ for VARX*(1, 1),

$k_i =$ Show the endogenous variables of country i.

Where $Y_t = (Y_{0t}', Y_{1t}', \ldots\ldots, Y)'$ be the $k * 1$ global vector of endogenous variables with $k = \sum_{i=0}^{N} k_i$. The means to solve, the model is to note that the link

between" Y_{it}" And the variables in the "*it*" country specific model Z_{it} can be expressed by the identity

$$Z_{it} = W_i Y_t, \quad i = 0,1, \ldots., N \qquad 6$$

Where W_i is a $(k_i + k_i^*) * k_i$ "link" matrix explain by the trade weights.8 Then using the

Equation (5) can be rewritten as

$$A_i W_i X_t = h_{io} + h_{i1} t + B_{i1} W_i X_{t-1} + B_{i2} W_i X_{t-2} + \epsilon_{it}$$

Where $A_i W_i$ and $B_{i1} W_i$ are both $k_i * k$ dimensional matrixes. Stacking, these equations now yields

$$GX_t = h_o + h_1 t + H_1 X_{t-1} + H_2 X_{t-2} + \epsilon_t \quad \rightarrow \quad 7$$

Where,

$$h_o = \begin{pmatrix} h_{00} \\ h_{10} \\ . \\ . \\ . \\ . \\ h_{No} \end{pmatrix}, \quad h_1 = \begin{pmatrix} h_{01} \\ h_{11} \\ . \\ . \\ . \\ . \\ h_{N1} \end{pmatrix}, \epsilon_t = \begin{pmatrix} \epsilon_{0t} \\ \epsilon_{1t} \\ . \\ . \\ . \\ . \\ \epsilon_{Nt} \end{pmatrix}, G = \begin{pmatrix} A_0 W_0 \\ A_1 W_1 \\ . \\ . \\ . \\ . \\ A_N W_N \end{pmatrix}, H_1 = \begin{pmatrix} B_{01} W_0 \\ B_{11} W_1 \\ . \\ . \\ . \\ . \\ B_{N1} W_N \end{pmatrix}, H_2 = \begin{pmatrix} B_{02} W_0 \\ B_{12} W_1 \\ . \\ . \\ . \\ . \\ B_{N2} W_N \end{pmatrix}$$

It is simply to see that G is a $k * k$**,** dimensional matrix and, it will be full rank and hence invertible. Now, The GVAR model in all of the variables can be written as

$$Y_t = f_o + f_1 t + F_1 X_{t-1} + F_2 X_{t-2} + \mu_t \quad \rightarrow \quad 8$$

Where: $f_o = G^{-1} h_0, f_1 = G^{-1} h_1, \; F_1 = G^{-1} H_1, F_2 = G^{-1} H_2$, and $\mu_t = G^{-1} \epsilon_t$. The global VAR (2) model (8) can then be solved recursively forward for forecasting.

[8] see the Matlab codes for all the detailed link matrixes

Conclusion:

GVAR model is a global model combining individual country vector error-correcting models, in which domestic variable are related to country-specific foreign variable in a consistent manner. It allows for interdependency at a variety of levels national and international. GVAR model advantage is that it incorporates economic structures and global interdependencies of the world economy in to the VAR model, and also avoid the identification problem, which lies in VAR model. And further there is major difference in the cross-country correlation of various real variables.

CHAPTER-4

4.1 Data Sources:

In this study, we have taken quarter cross section data from different a country that covers the period 1995Q1 to2012Q4. The data are taken International Financial Statistics (IFS) of IMF. The description of all variable used in our model is provided in the table below:

Table 3: Variable Descriptions:

Variable	**Formula**	**Source of Data & Definitions**
Real GDP	RGDP=NGDP/CPI, Industrial production index, Crude oil production index	IMF (IFS)
Price	CPI	IMF, (IFS)
Real-exchange rate	e_{it}	IMF, (IFS)
Nominal short term interest rate	r_{it}	IMF, (IFS)
World commodity price index	ln (P_t^W)	IMF, (IFS)
Inflation	ln ($CPI_{it} - ln(CPI_{i,t-1})$	IMF (IFS)

4.2 Variable Description

Real GDP

We have taken real Gross Domestic Product (GDP) quarter cross section data from china, India, Indonesia, Kuwait, Malaysia, Pakistan, Japan, Singapore, Thailand, Turkey and USA cover the period 1995Q1 to2012Q4. The data of GDP are collected form IMF, S International Financial Statistics (IFS).

Consumer Price Index

We have taken Consumer Price Index (CPI) quarter cross section data from china, India, Indonesia, Kuwait, Malaysia, Pakistan, Japan, Singapore, Thailand, Turkey and USA cover the period 1995Q1 to2012Q4. The data of CPI is collected IMF, S International Financial Statistics (IFS) to index (2005=100)

Short-term Interest Rates

The typically maturity of 3 month short- term interest rate data are collected from IMF'S International Financial Statistics (IFS). The Money Market Rate series are used in Indonesia, Kuwait, Pakistan and deposit rate series are used in Thailand, Turkey and Treasury Bills series are used in China, Japan, Singapore, Malaysia, USA and Lending rate series are used in India.

Exchange Rates

The data of exchange rate are collected from IMF'S International Financial Statistics (IFS) in USD per National currency for all the country. NO combined or artificially generated data are used.

World Commodity Price Index

We have taken the World Commodity Price index (WCPI) quarter cross section data covers the period 1995Q1 to2012Q4. The data of WCPI are collected from IMF, S International Financial Statistics (IFS). Index (2005=100)

Trade

The import and export data are collected for Direction of Trade from the period 1995 to 2012 of different countries.

CHAPTER 5

Result and Discussion

5.1 Descriptive Statistics:

The descriptive statistics of variance, minimum, maximum, Standard Deviation, and probability of all variables are mentioned in table1. The normality of data is checked by Jarque Bera (JB: 1990) test. According to Jarque beta test most Real GDP of domestic, foreign variable is following normal distribution. But most the variable such as inflation and short run interest rate do not follow the normal distribution. We also create a grapes of each variable are mention in appendix.

Table 4.1: Descriptive Statistics of Domestic Variables (Real GDP)

Real GDP	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
CHINA	21.90	22.18	21.70	0.13	3.03	0.22*
INDIA	4.43	4.96	3.96	0.28	3.72	0.16*
INDONESIA	29.42	29.98	28.99	0.28	3.20	0.20*
JAPAN	29.24	29.28	29.17	0.02	28.24	0.00
KUWAIT	3.38	3.38	3.37	0.00	28.38	0.00
MALAYSIA	20.80	21.31	20.31	0.29	4.28	0.12*
USA	4.43	4.96	3.96	0.28	3.72	0.16*
SAUDI	4.50	4.63	4.31	0.07	0.29	0.87*
SINGAPORE	4.41	4.85	3.93	0.26	3.73	0.15*
THAILAND	23.50	23.78	23.25	0.15	4.87	0.09*
TURKEY	21.07	21.40	20.52	0.21	7.69	0.02*
Pakistan	25.47	25.61	25.27	0.10	4.26	0.12*

Note: * denotes the probability of JB statistics is significance 5%

Table 4.2: Descriptive Statistics of Domestic Variables (Inflation)

Inflation	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
China	0.00	0.02	-0.03	0.01	0.18	0.91*
India	-0.02	0.04	-0.07	0.02	8.38	0.02
Indonesia	-0.03	0.02	-0.18	0.04	308.26	0.00
Japan	0.00	0.01	-0.02	0.01	51.17	0.00
Kuwait	-0.01	0.01	-0.04	0.01	15.76	0.00
Malaysia	-0.01	0.01	-0.04	0.01	15.76	0.00
USA	-0.01	0.02	-0.04	0.01	145.28	0.00
Saudi	-0.02	0.00	-0.08	0.01	80.61	0.00
Singapore	0.00	0.01	-0.03	0.01	29.90	0.00
Thailand	0.00	0.01	-0.02	0.01	13.72	0.00
Turkey	-0.01	0.04	-0.04	0.01	25.75	0.00
Pakistan	-0.08	0.00	-0.21	0.06	5.40	0.07*

Note: * denotes the probability of JB statistics is significance 5%

Table 4.3: Descriptive Statistics of Domestic Variables (Real Exchange Rate)

Real Exchange Rate	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
CHINA	7.77	7.82	7.73	0.03	6.09	0.05*
INDIA	42.92	49.77	31.41	4.87	6.68	0.04
INDONESIA	7931.5	12252.10	2209.48	2890.99	13.15	0.00
JAPAN	112.58	139.99	84.43	11.08	0.31	0.86*
KUWAIT	0.30	0.31	0.27	0.01	20.05	0.00
MALAYSIA	3.49	4.06	2.46	0.49	16.12	0.00
USA	55.16	83.69	30.87	12.82	0.03	0.99*
SAUDI	3.75	3.75	3.75	0.00	60.78	0.00
SINGAPORE	1.60	1.83	1.37	0.14	5.27	0.07*
THAILAND	36.68	47.09	24.63	6.19	5.44	0.07*
TURKEY	0.94	1.65	0.04	0.59	7.73	0.02

Note: * denotes the probability of JB statistics is significance 5%

Table 4.4: Descriptive Statistics of Domestic Variables (Interest Rate)

Interest Rate	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
CHINA	3.57	7.13	0.07	2.25	5.42	0.07*
INDIA	12.70	16.50	10.75	1.53	7.66	0.02
INDONESIA	15.43	74.18	4.49	15.24	125.50	0.00
JAPAN	0.26	2.22	0.00	0.37	470.48	0.00
KUWAIT	4.79	7.53	1.13	2.14	5.99	0.05*
MALAYSIA	4.05	9.97	2.00	2.06	17.65	0.00
USA	8.77	15.42	1.05	3.57	1.59	0.45*
SAUDI	4.26	6.98	0.50	1.90	5.39	0.07*
SINGAPORE	2.30	6.04	0.67	1.34	11.15	0.00
THAILAND	4.96	20.64	0.99	5.16	38.22	0.00
TURKEY	46.37	174.72	6.73	31.99	25.29	0.00
Pakistan	3.76	6.52	0.12	2.02	6.56	0.04

Note: * denotes the probability of JB statistics is significance 5%

Table 5.1: Descriptive Statistics of Foreign Variables (Real GDP)

Real GDP	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
CHINA	14.00	14.31	13.70	0.19	4.49	0.11*
INDIA	12.37	12.66	12.09	0.17	4.74	0.09*
INDONESIA	15.61	15.87	15.34	0.16	4.79	0.09*
JAPAN	10.84	11.25	10.49	0.23	4.58	0.10*
KUWAIT	14.97	15.24	14.70	0.16	4.35	0.11*
MALAYSIA	14.58	14.87	14.29	0.18	4.68	0.10*
USA	21.13	21.31	20.96	0.10	4.80	0.09*
SAUDI	14.73	15.03	14.44	0.18	4.23	0.12*
SINGAPORE	18.25	18.60	17.94	0.20	4.59	0.10*

THAILAND	17.69	17.95	17.43	0.15	4.44	0.11*
TURKEY	10.49	10.83	10.17	0.20	4.50	0.11*
Pakistan	10.96	11.22	10.70	0.16	4.95	0.08*

Note: * denotes the probability of JB statistics is significance 5%

Table 5.2: Descriptive Statistics of Foreign Variables (Inflation)

Inflation	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
China	-0.01	0.01	-0.03	0.00	75.45	0.00
India	-0.01	0.00	-0.03	0.01	24.90	0.00
Indonesia	-0.01	0.00	-0.02	0.00	29.97	0.00
Japan	-0.01	0.00	-0.03	0.01	38.44	0.00
Kuwait	-0.01	0.00	-0.03	0.01	2.80	0.25*
Malaysia	-0.01	0.00	-0.02	0.01	22.31	0.00
USA	-0.01	0.00	-0.02	0.01	2.38	0.30*
Saudi	-0.01	0.01	-0.03	0.01	10.71	0.00
Singapore	-0.01	0.00	-0.03	0.01	14.69	0.00
Thailand	-0.01	0.01	-0.02	0.01	16.15	0.00
Turkey	-0.01	0.01	-0.04	0.01	58.96	0.00
Pakistan	-0.01	0.00	-0.03	0.01	48.21	0.00

Note: * denotes the probability of JB statistics is significance 5%

Table 5.3: Descriptive Statistics of Foreign Variables (Real Exchange Rate)

Real Exchange Rate	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
CHINA	228.52	326.32	86.95	67.67	13.45	0.00
INDIA	623.79	946.82	186.20	219.90	13.20	0.00
INDONESIA	50.63	58.60	36.02	4.40	18.79	0.00
JAPAN	630.32	951.91	185.76	223.47	13.21	0.00
KUWAIT	388.95	575.77	134.23	124.71	13.31	0.00
MALAYSIA	501.83	754.77	159.86	170.10	13.26	0.00
USA	379.15	566.77	134.09	118.88	13.19	0.00
SAUDI	318.83	464.76	114.11	99.41	13.37	0.00
SINGAPORE	890.14	1358.59	263.86	315.00	13.20	0.00
THAILAND	537.76	808.80	174.43	179.78	13.22	0.00
TURKEY	368.67	543.06	120.75	123.08	13.26	0.00
PAKISTAN	360.89	540.65	113.64	123.55	13.25	0.00

Note: * denotes the probability of JB statistics is significance 5%

Table 5.4: Descriptive Statistics of Foreign Variables (Interest Rate)

Interest Rate	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
CHINA	5.48	10.78	1.64	2.03	0.35	0.84*
INDIA	6.67	14.76	2.00	2.88	3.14	0.21*
INDONESIA	4.32	8.12	1.75	1.59	2.58	0.27*
JAPAN	7.56	16.90	1.93	3.14	3.25	0.20*
KUWAIT	6.38	11.28	3.24	1.89	1.66	0.44*
MALAYSIA	5.14	12.06	1.54	2.25	9.70	0.01
USA	4.22	9.05	1.62	2.00	6.42	0.04
SAUDI	7.05	12.79	2.96	2.42	1.71	0.43*
SINGAPORE	6.26	16.04	2.34	3.00	25.00	0.00
THAILAND	4.75	10.81	1.61	1.97	7.29	0.03
TURKEY	7.05	13.30	2.18	2.43	0.02	0.99*
Pakistan	7.21	13.63	2.81	2.69	2.42	0.30*

Note: * denotes the probability of JB statistics is significance 5%

Table 6: Descriptive Statistics of Global Variables

World commodity price	Mean	Maximum	Minimum	St. Deviation	Jarque-Bera	Probability
World (CPI)	4.48	4.77	4.09	0.19	2.90	0.23*

Note: * denotes the probability of JB statistics is significance 5%

5.2 Trade weight matrix:

We build weight matrix from the flows of trade data to solving the GVAR model. The weight w_{ij} for $ij = 0,1,2 \dots 12$ are trade country i and country j computed using the sample average of annual total trade of a country over the period 1995 to 2012. w_{ii} Is 0 for every county$i$. Table1 shows that we have to get trade data of 12 major trading partner countries, which trade in Pakistan is 50% of their total trade. The trade matrix provides important information of Independence of Pakistan and its trading partner countries.

Table 7: Trade Weight matrix:

Country	CHINA	INDIA	INDONESIA	JAPAN	KUWAIT	MALAYSIA	Pakistan	SAUDI	SINGAPORE	THAILAND	TURKEY	USA
China	0.00	0.09	0.03	0.08	0.01	0.07	0.04	0.01	0.11	0.07	0.02	0.07
India	0.05	0.00	0.06	0.02	0.19	0.04	0.07	0.12	0.05	0.03	0.09	0.07
Indonesia	0.02	0.07	0.00	0.08	0.04	0.06	0.04	0.03	0.11	0.06	0.04	0.04
Japan	0.28	0.09	0.31	0.00	0.30	0.23	0.10	0.29	0.15	0.35	0.13	0.46
Kuwait	0.00	0.06	0.01	0.02	0.00	0.03	0.10	0.01	0.01	0.0	0.02	0.01
Malaysia	0.06	0.06	0.10	0.08	0.02	0.00	0.08	0.02	0.25	0.11	0.04	0.09
Pakistan	0.00	0.01	0.01	0.00	0.05	0.01	0.00	0.03	0.00	0.01	0.02	0.01
Saudi	0.01	0.14	0.04	0.07	0.05	0.01	0.20	0.00	0.04	0.04	0.13	0.08
Singapore	0.14	0.10	0.21	0.07	0.10	0.25	0.05	0.08	0.00	0.11	0.02	0.09
Thailand	0.05	0.03	0.07	0.09	0.02	0.09	0.03	0.04	0.07	0.00	0.03	0.06
Turkey	0.01	0.02	0.01	0.01	0.01	0.00	0.03	0.03	0.00	0.01	0.00	0.02
USA	0.38	0.31	0.17	0.49	0.22	0.25	0.27	0.34	0.21	0.22	0.47	0.000

5.3 Unit Root Tests

The GVAR, methodology applies to a stationary and integrated variable. The assumption of the variable is that all variable is integrated in the model of order one, in pesaran El al. (2004), Dees et al. (2007), and Pesaran. et al. (2009). This assumption allows us to differentiate, Short and long run relation and interpret, those long run co-integrating. If we estimate the individual series. We use ADF-GLS other than ADF test because ADF test is size problem and severe finite sample power, second ADF test low power against, the alternative hypothesis that the series is stationary with a large autoregressive root. (Delong et. al. J, of Econometrics, 1992). Therefore, we use ADF-GLS statistics introduced by Elliot, Rothenberg, and Stock (1996) for all series in table 8.1, 8.2.

Table 8.1: ADF-GLS Unit Root Test on Domestic and Foreign and Global Variable.

Domestic Variable	China	India	Indonesia	Japan	Kuwait	Malaysia
y	-3.76**	-1.14*	-3.00*	-3.38*	-3.39*	-3.78**
Dy	-3.08	-3.10**	-3.79**	-4.64**	-4.64**	-4.57**
DDy	-25.96	-30.34	-9.91	-8.70	-8.70	-3.83
π	-2.56*	-2.07*	-4.54**	-3.21*	-3.74**	-3.74**
D π	-4.14**	-9.64**	-5.55	-10.27**	-7.40	-7.40
DD π	-10.49	-8.98	-7.14	-6.99	-7.16	-7.16
E	-2.06*	-1.51*	-2.29*	-3.17*	-3.07*	-2.10*
De	-4.29**	-4.65**	-5.06**	-3.32**	-4.95**	-4.13**
DDe	-5.28	-5.42	-6.06	-6.75	-5.99	-6.77

r	-2.18*	-2.42*	-3.72**	-1.71	-2.30	-2.32
Dr	-6.03**	-3.81**	-4.37**	-6.74**	-5.66**	-4.57**
DDr	-8.47	-4.33	-7.09	-7.10	-8.32	-8.77
Y*	-2.22*	-3.51**	-2.40*	-3.38	-3.25*	-2.62*
Dy*	-5.35**	-3.45	-6.36**	-3.66**	-5.17**	-6.53**
DDy*	-7.35	-11.44	-9.02	-4.07	-8.50	-9.33
Π*	-3.41*	-3.25*	-2.24*	-3.58*	-2.96*	-3.09*
D π*	-7.08**	-6.93**	-5.57**	-7.23**	-5.53**	-6.57**
DD π*	-6.46	-6.53	-5.84	-6.84	-6.53	-6.35
e*	-2.27*	-2.29*	-2.96*	-2.29*	-2.27*	-2.28*
De*	-5.06**	-5.06**	-3.30**	-5.06**	-5.06**	-5.06**
DDe*	-6.01	-6.06	-6.50	-6.06	-6.04	-6.05
r*	-2.47*	-2.76*	-2.42*	-2.97*	-2.24*	-2.99*
Dr*	-3.55**	-3.98**	-4.44**	-4.41**	-4.56**	-4.61**
DDr*	-6.54	-7.71	-7.83	-6.98	-8.14	-6.92
p*	-2.41*	-2.41*	-2.41*	-2.41*	-2.41*	-2.41*
Dp*	-3.40**	-3.40**	-3.40**	-3.40**	-3.40**	-3.40**
DDp*	-4.31	-4.31	-4.31	-4.31	-4.31	-4.31

Note: * denotes accept the null hypothesis of unit root at 5% level.** denotes reject the null hypothesis of unit root at 5% level.

Table 8.2: ADF-GLS Unit Root Test on Domestic and Foreign and Global Variable.

Domestic Variable	Pakista	Saudi	Singapore	Thailand	Turkey	US
y	-1.14*	-3.07*	-3.11*	-2.03*	-1.95*	-1.61*
Dy	-3.10**	-6.50**	-6.35**	-2.29*	-3.82**	-1.54*
DDy	-30.34	-9.47	-9.59	-12.83**	-8.40	-8.86**
Π	-5.97**	-2.71*	-3.19*	-3.84**	-5.60**	-3.92**
D π	-7.37	-8.46**	-6.44**	-6.28	-5.32	-7.53
DD π	-6.70	-9.11	-7.21	-7.93	-10.88	-6.91
e		-2.68*	-1.18*	-1.75*	-1.44*	-2.17*
De		-4.34**	-4.17**	-5.15**	-4.84**	-4.71**
DDe		-7.20	-5.58	-7.05	-6.88	-8.21
r	-1.20*	-3.21*	-2.82*	-2.84*	-4.69**	-3.19*
Dr	-3.91**	-2.99**	-4.33**	-4.36**	-6.07**	-2.79**
DDr	-7.15	-4.43	-6.02	-5.18	-6.30	-6.18
Y*	-3.12*	-3.34*	-3.71**	-3.50**	-3.35*	-3.14*
Dy*	-4.03**	-5.13**	-4.40	-3.48	-3.88**	-3.86**
DDy*	-13.77	-7.94	-3.41	-9.19	-3.42	-7.74
π*	-3.01*	-3.17*	-3.19*	-2.23*	-3.31*	-2.90*
D π*	-6.86**	-6.76**	-6.55**	-6.68**	-7.06**	-5.13**
DD π*	-5.79	-5.98	-6.28	-5.62	-6.64	-11.50
e*	-2.28*	-2.27*	-2.28*	-2.28*	-2.28*	-2.27*
De*	-5.06**	-5.06**	-5.06**	-5.06**	-5.06**	-5.05**
DDe*	-6.06	-6.03	-6.06	-6.04	-6.05	-6.02
r*	-2.31*	-2.57*	-3.27*	-3.07*	-2.75*	-2.60*

Dr*	-4.97**	-5.66**	-4.63**	-3.57**	-3.12**	-5.30**
DDr*	-8.62	-9.05	-6.99	-6.86	-6.42	-8.86
p*	-2.41*	-2.41*	-2.41*	-2.41*	-2.41*	-2.41*
Dp*	-3.39**	-3.39**	-3.39**	-3.39**	-3.39**	-3.39**
DDp*	-4.31	-4.31	-4.31	-4.31	-4.31	-4.31

Note: * denotes accept the null hypothesis of unit root at 5% level.** denotes reject the null hypothesis of unit root at 5% level.

The result of the augment Dickey-Fuller-GLS test for all domestic, foreign variables and global variable include in the GVAR. All variable are tested for unit roots in level first difference, and second difference in above mention table. They are two types of regression, we can test it. First constant and trend include in the regression and second only constant are included in the regression. The above table indicates that some variables are stationary at 5% level donated (**) and some variables are not stationary at level and it donated (*) for this reason, we can take first difference of the series to remove the unit root in the series.

5.4 Selected the Lag Order Criteria of VARX Model

Now we check the order of criterion of the VARX model on the basis of maximum Akaike information criterion (AIC). Which was used (L. Vanessa Smith & Alessandro Galesi) 2011 in the Global VAR Modeling (GVAR). The result is mention in table9.

Table 9: Order of VARX Models

Country	P	Q	AIC	SBC	logLik
China	1	1	421.79	364.10	477.79
China	2	1	426.36	352.19	498.36
India	1	1	167.88	110.19	223.88
India	2	1	176.61	102.43	248.61
Indonesia	1	1	-394.54	-452.23	-338.54
Indonesia	2	1	-375.01	-449.18	-303.01

Japan	1	1	320.76	263.06	376.76
Japan	2	1	332.21	258.03	404.21
Kuwait	1	1	801.79	744.10	857.79
Kuwait	2	1	799.36	725.18	871.36
Malaysia	1	1	312.60	254.91	368.60
Malaysia	2	1	311.04	236.86	383.04
Pakistan	1	1	89.44	31.75	145.44
Pakistan	2	1	104.19	30.02	176.19
Saudi	1	1	614.03	556.34	670.03
Saudi	2	1	641.98	567.81	713.98
Singapore	1	1	375.31	317.62	431.31
Singapore	2	1	369.46	295.28	441.46
Thailand	1	1	143.28	85.59	199.28
Thailand	2	1	145.70	71.53	217.70
Turkey	1	1	43.31	-14.38	99.31
Turkey	2	1	58.56	-15.61	130.56
USA	1	1	538.31	488.86	586.31
USA	2	1	543.09	477.15	607.09

To select the VARX model, we have to choose the maximum values of AIC in the above table9.In the Pakistan case we can select VARX (2,1) because the maximum values of AIC are high.

5.5 Co-integration

Johansen approach is used to check the co-integration relationship between domestic and foreign variable. The co-integration result is given below in Table-10.

Table 10.1: Number of Co-integration Relationships in the Country Specific Model

			Maximum Eigenvalues Statistics				
Country	CHINA	INDIA	INDONESIA	JAPAN	KUWAIT	MALAYSIA	Critical values
r=0 r=1	86.57	92.09	89.58	93.98	95.87	89.36	87.76
r=1 r=2	21.86	47.46	43.90	52.09	36.42	41.70	66.89
r=2 r=3	17.23	24.12	26.44	23.48	26.88	26.74	54.98
r=3 r=4	15.29	9.41	12.98	16.89	16.04	15.90	34.95
			Trace Statistics				
r=0 r≥1	98.94	147.08	172.90	146.44	138.21	135.70	100.96
r=1 r≥2	54.37	80.99	83.32	92.46	79.34	84.34	71.56
r=2 r≥3	32.51	33.53	39.42	40.37	42.92	42.65	45.9
r=3 r≥4	15.29	9.41	12.98	16.89	16.04	15.90	23.63

Table 10.2

			Maximum Eigen values Statistics				
Country	Pakistan	SAUDI	SINGAPORE	THAILAND	TURKEY	USA	critical values
r=0 r=1	92.43	45.45	88.04	89.35	92.22	45.86	87.76
r=1 r=2	42.39	26.97	32.47	50.89	39.01	34.17	66.89
r=2 r=3	23.33	19.31	28.22	25.28	34.87	15.81	54.98
r=3 r=4	9.85	10.78	13.34	16.64	16.52	7.67	34.95
			Trace Statistics				
r=0 r≥1	168.00	99.52	122.07	175.15	182.62	95.51	100.96
r=1 r≥2	75.56	57.07	74.03	92.81	90.39	57.65	71.56
r=2 r≥3	33.18	30.09	41.56	41.92	51.39	23.48	45.9
r=3 r≥4	9.85	10.78	13.34	16.64	16.52	7.67	23.63

Note: the critical values are obtained from Pesaran et.al (2000) paper.

The result indicates the Johansen co-integration test that Relationships for the individual VARX Model on the basis of maximum Eigen values statistics and trade statistics. The china, Saudi and US maximum eigenvalues are less than its critical values mention in the above table4. So we reject Ho and say that there is one co-integration vector include in the model. But in the trace statistics it is opposite to the maximum eigenvalues statistics because its one tail tests. In the above table4 the trace statistics indicate that the china, Saudi and US trace statistics values is less than its critical values, so we accept Ho and say that there is one co-integration vector lies in the model. The India, Indonesia, Japan, Kuwait, Pakistan, Malaysia and Singapore are two co-integration vectors on the basis of maximum eigenvalues and trace statistics.

5.6 Contemporaneous Effects of Foreign Variables on Domestic Counterparts

We can use coefficients and Newey-West Hetroscedasticity and autocorrelation consistent (HAC) covariance matrix estimator are present in table11. These estimates show the impacted of elasticity's between foreign and domestic variable. If 100% changes in Pakistan foreign real GDP in a given quarter to increases of 2% in domestic real GDP within same quarter. And Pakistan real GDP variable is statistically significant. It means that Pakistan real GDP is affected to its foreign GDP, and interdepency exist between Pakistan and its trading partners. Other hand foreign inflation impact on Pakistan domestic inflation is 77% and is statistically significant. It is suggested that the Pakistan area price is much affected for its trading partner price, and there is a strong co-moment between them.

Table 11: Contemporaneous Effect of Foreign Variable on their Domestic.

	Domestic Variable		
Country	**Y**	**π**	**r**
CHINA	0.53***	0.03	0.17
	(0.17)	(0.16)	(0.19)
INDIA	0.88***	0.91***	0.12***
	(0.17)	(0.18)	(0.03)
INDONESIA	-0.13	0.61	-0.33
	(0.21)	(0.97)	(0.73)
JAPAN	0.16***	0.12	0.00
	(0.07)	(0.13)	(0.00)
KUWAIT	0.01***	0.14	0.09
	(0.00)	(0.15)	(0.13)
MALAYSIA	0.55***	0.22	0.16
	(0.19)	(0.30)	(0.13)
USA	0.66***	0.59***	0.08
	(0.25)	(0.12)	(0.62)
SAUDI	-0.33*	1.10***	-0.06*
	(0.23)	(0.33)	(0.05)
SINGAPORE	2.22***	0.29**	0.12*
	(0.62)	(0.13)	(0.09)
THAILAND	0.62**	0.15	1.18***
	(0.36)	(0.14)	(0.37)
TURKEY	1.37**	1.10***	0.16
	(0.61)	(0.21)	(3.03)
Pakistan	0.02**	0.71**	0.02
	(0.01)	(0.38)	(0.03)

Note: Newey- west HEC standard errors are given in parentheses.* denote significance at the 10% level. ** denotes significances at the 5% level, and***denotes significance at the 1% level.

5.7 Forecast and Evaluation

a) GVAR Forecast Result

Estimate the 12, one quarter a head forecasts for 2010Q1-2012Q4. Table12 presents real GDP, Inflation, Short-term, interest rate and real exchange rate forecasts for all the countries under consideration. Real GDP, Inflation, Short-term, interest rate and real exchange rate forecasts for all countries except Pakistan have clear upward in 2012.

Table 12.1: GVAR forecasting of Inflation, Interest Rate, GDP and Short Term Interest Rate

Country	variable	2010Q1	2010Q2	2010Q3	2010Q4	2011Q1	2011Q2
China	Y	22.19	22.13	22.13	22.16	22.17	22.17
China	Π	-0.01	-0.02	-0.01	-0.02	-0.02	-0.02
China	E	7.75	7.75	7.75	7.74	7.74	7.74
China	R	-0.35	-0.47	-0.61	-0.78	-0.99	-1.13
India	Y	4.98	4.97	4.98	5.01	5.04	5.06
India	Π	-0.05	-0.06	-0.05	-0.05	-0.05	-0.06
India	E	45.99	46.11	46.71	46.59	45.90	45.26
India	R	12.25	12.32	12.30	12.22	12.20	12.24
Indonesia	Y	29.96	29.97	29.99	30.00	30.01	30.02
Indonesia	Π	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02
Indonesia	E	9790.70	9812.58	10020.22	10305.43	10290.03	10533.47
Indonesia	R	4.53	3.60	2.04	2.19	0.95	0.04
Japan	Y	29.19	29.19	29.19	29.19	29.19	29.20
Japan	Π	0.01	0.00	0.00	0.00	0.00	0.00

Japan	E	88.61	91.06	93.33	93.48	93.16	93.33
Japan	R	0.06	0.02	-0.01	-0.03	-0.03	-0.03
Kuwait	Y	3.37	3.37	3.37	3.37	3.37	3.37
Kuwait	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Kuwait	E	0.28	0.28	0.28	0.28	0.28	0.28
Kuwait	R	0.96	0.50	0.42	0.44	0.35	0.19
Malaysia	Y	21.27	21.25	21.25	21.26	21.27	21.28
Malaysia	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Malaysia	E	3.50	3.57	3.62	3.66	3.69	3.71
Malaysia	R	2.01	1.97	1.85	1.72	1.55	1.43
USA	Y	25.58	25.59	25.87	25.59	5.60	5.63
USA	Π	-0.1	-.02	0	0	0	0
USA	E	418.45	414.46	408.57	417.09	402.46	389.96
USA	R	12.23	11.97	13.06	12.59	12.17	11.97
Saudi	Y	4.46	4.46	4.47	4.47	4.46	4.47
Saudi	Π	-0.04	-0.04	-0.04	-0.04	-0.04	-0.05
Saudi	E	3.75	3.75	3.75	3.75	3.75	3.75
Saudi	R	0.38	0.14	-0.05	-0.22	-0.40	-0.57
Singapore	Y	4.70	4.66	4.67	4.69	4.69	4.69
Singapore	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Singapore	E	1.41	1.40	1.40	1.39	1.37	1.36
Singapore	R	0.91	0.73	0.59	0.59	0.55	0.50
Thailand	Y	23.82	23.82	23.81	23.83	23.85	23.87
Thailand	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Thailand	E	32.39	31.88	31.61	31.28	30.93	30.41
Thailand	R	1.83	1.93	1.44	1.13	0.61	0.37
Turkey	Y	21.21	21.24	21.25	21.27	21.26	21.23

Turkey	Π	-0.01	-0.01	0.00	0.00	-0.01	-0.01
Turkey	E	1.53	1.55	1.59	1.63	1.66	1.68
Turkey	R	-10.66	-5.25	-8.15	-14.33	-13.43	-14.07
Pakistan	Y	4.92	4.94	4.95	4.96	5.00	5.02
Pakistan	Π	-0.01	-0.01	0	0	-0.01	-0.01
Pakistan	R	12.23	11.97	13.06	12.59	12.17	11.97

Table 12.2: GVAR forecasting of Inflation, Interest Rate, GDP and Short Term Interest Rate.

country	**variable**	**2011Q3**	**2011Q4**	**2012Q1**	**2012Q2**	**2012Q3**	**2012Q4**
China	Y	22.17	22.18	22.18	22.19	22.19	22.20
China	Π	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
China	E	7.74	7.74	7.74	7.74	7.73	7.73
China	R	-1.31	-1.55	-1.74	-1.94	-2.14	-2.35
Indonesia	Y	5.08	5.10	5.12	5.13	5.15	5.17
Indonesia	Π	-0.07	-0.07	-0.07	-0.07	-0.07	-0.08
Indonesia	E	44.92	44.75	44.60	44.45	44.35	44.28
Indonesia	R	12.27	12.27	12.26	12.24	12.21	12.17
Indonesia	Y	30.03	30.04	30.06	30.07	30.08	30.10
Indonesia	Π	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03
Indonesia	E	10649.91	10772.13	10867.41	10980.62	11125.21	11251.53
Indonesia	R	-0.88	-2.17	-3.40	-4.60	-5.69	-6.80
Japan	Y	29.20	29.20	29.20	29.20	29.20	29.20
Japan	Π	0.00	0.00	0.00	-0.01	-0.01	-0.01
Japan	E	93.86	93.97	94.02	94.10	94.10	94.06

Japan	R	-0.04	-0.05	-0.06	-0.07	-0.09	-0.10
Kuwait	Y	3.37	3.37	3.37	3.37	3.37	3.37
Kuwait	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Kuwait	E	0.28	0.28	0.28	0.28	0.28	0.28
Kuwait	R	0.01	-0.13	-0.26	-0.42	-0.58	-0.73
Malaysia	Y	21.29	21.30	21.31	21.32	21.33	21.33
Malaysia	Dp	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02
Malaysia	ep	3.74	3.77	3.79	3.81	3.83	3.85
Malaysia	R	1.30	1.13	0.98	0.82	0.66	0.50
USA	Y	5.60	5.61	5.61	5.61	5.62	5.62
USA	Π	0.01	0.01	0.01	0.02	0.02	0.03
USA	E	386.65	405.67	407.56	417.65	415.54	418.76
USA	R	.38	.37	.35	.32	.28	.25
Saudi	Y	4.47	4.48	4.48	4.48	4.48	4.48
Saudi	Π	-0.05	-0.05	-0.05	-0.05	-0.06	-0.06
Saudi	E	3.75	3.75	3.75	3.75	3.75	3.75
Saudi	R	-0.72	-0.86	-1.01	-1.16	-1.30	-1.43
Singapore	Y	4.68	4.68	4.68	4.67	4.67	4.67
Singapore	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Singapore	E	1.34	1.33	1.31	1.29	1.28	1.26
Singapore	R	0.39	0.26	0.13	0.01	-0.12	-0.24
Thailand	Y	23.88	23.89	23.90	23.91	23.92	23.93
Thailand	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Thailand	E	29.85	29.35	28.87	28.37	27.84	27.32
Thailand	R	-0.04	-0.68	-1.32	-1.96	-2.59	-3.25
Turkey	Y	21.24	21.26	21.26	21.24	21.24	21.25
Turkey	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Turkey	E	1.71	1.74	1.77	1.80	1.83	1.86
Turkey	R	-17.83	-21.46	-21.96	-22.72	-25.97	-29.06
Pakistan	Y	5.02	5.04	5.06	5.08	5.09	5.11
Pakistan	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Pakistan	R	11.88	11.78	11.61	11.41	11.26	11.13

b) VAR Forecast Result

Estimate the 12, one quarter a head forecasts for 2010Q1-2012Q4. Table13 presents real GDP, Inflation, Short-term, interest rate and real exchange rate forecasts for all the countries under consideration. Real GDP, Inflation, Short-term, interest rate and real exchange rate forecasts for all countries except Pakistan have clear upward in 2012.

Table 13.1: VAR Forecasting of Inflation, GDP, Real Exchange Rate and Short Term Interest Rate

Country	**variable**	**2010Q1**	**2010Q2**	**2010Q3**	**2010Q4**	**201Q1**	**2011Q2**
China	Y	22.13	22.18	22.20	22.22	22.17	22.15
China	R	1.94	1.93	1.92	1.91	1.90	1.89
China	E	7.78	7.78	7.78	7.78	7.78	7.78
China	Π	0.00	0.00	-0.01	-0.01	-0.01	-0.01
India	Y	4.95	5.01	5.01	5.03	5.05	5.06
India	R	12.06	12.13	12.19	12.25	12.33	12.39
India	E	45.42	44.79	44.60	44.70	44.86	44.98
India	Π	-0.01	-0.02	-0.03	-0.03	-0.03	-0.03
Indonesia	Y	29.97	29.99	30.01	30.02	30.04	30.06

Indonesia	R	8.80	8.63	8.46	8.29	8.12	7.95
Indonesia	E	11015.12	11106.89	11198.66	11290.44	11382.23	11474.03
Indonesia	Π	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Japan	Y	29.20	29.20	29.21	29.22	29.22	29.22
Japan	R	0.07	0.05	0.05	0.06	0.09	0.12
Japan	E	86.57	85.72	87.11	89.01	91.23	93.56
Japan	Π	0.00	0.00	0.00	0.00	0.00	0.00
Kuwait	Y	3.37	3.37	3.37	3.37	3.37	3.37
Kuwait	R	0.72	0.48	0.39	0.34	0.34	0.37
Kuwait	E	0.29	0.29	0.29	0.29	0.29	0.29
Kuwait	Π	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	Y	21.32	21.33	21.33	21.34	21.35	21.36
Malaysia	R	2.06	2.39	2.72	2.91	3.01	3.08
Malaysia	E	3.41	3.44	3.45	3.45	3.47	3.48
Malaysia	Π	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01
USA	Y	25.58	25.58	25.59	25.59	25.60	25.60
USA	R	0.14	0.26	0.34	0.43	0.53	0.63
USA	E	418.47	415.46	407.55	416.03	401.43	388.96
USA	Π	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
Saudi	Y	4.49	4.52	4.53	4.55	4.56	4.57
Saudi	R	0.45	0.48	0.58	0.75	0.98	1.26
Saudi	E	3.75	3.75	3.75	3.75	3.75	3.75
Saudi	Π	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02
Singapore	Y	4.73	4.74	4.73	4.73	4.72	4.71
Singapore	R	0.93	1.34	1.67	1.92	2.09	2.23
Singapore	E	1.40	1.39	1.39	1.38	1.38	1.37
Singapore	Π	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02

Thailand	Y	23.78	23.79	23.80	23.80	23.80	23.80
Thailand	R	2.08	2.94	3.86	4.60	5.10	5.37
Thailand	E	32.13	32.21	32.32	32.40	32.35	32.17
Thailand	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Turkey	Y	21.26	21.24	21.23	21.21	21.21	21.20
Turkey	R	10.58	14.62	17.96	20.19	21.58	22.52
Turkey	E	1.46	1.43	1.42	1.41	1.40	1.40
Turkey	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Pakistan	Y	4.96	4.96	4.97	4.98	5.00	5.01
Pakistan	R	10.36	9.30	8.54	7.82	7.08	6.45
Pakistan	Π	0.00	0.00	0.00	0.00	0.00	0.00

Table 13.2: VAR Forecasting of Inflation, GDP, Real Exchange Rate and Short Term Interest Rate.

Country	**variable**	**2011Q3**	**2011Q4**	**2012Q1**	**2012Q2**	**2012Q3**	**2012Q4**
China	Y	22.19	22.21	22.23	22.16	22.21	22.23
China	R	1.88	1.87	1.86	1.85	1.84	1.84
China	E	7.78	7.78	7.78	7.77	7.77	7.77
China	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
India	Y	5.09	5.10	5.11	5.12	5.14	5.15
India	R	12.42	12.44	12.47	12.48	12.51	12.52
India	E	45.07	45.14	45.19	45.20	45.19	45.19
India	Π	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Indonesia	Y	30.08	30.10	30.11	30.13	30.15	30.17
Indonesia	R	7.78	7.61	7.44	7.27	7.10	6.93
Indonesia	E	11565.83	11657.65	11749.47	11841.3	11933.14	12024.99

Indonesia	Π	-0.01	-0.02	-0.01	-0.02	-0.02	-0.02
Japan	Y	29.23	29.23	29.23	29.23	29.24	29.24
Japan	R	0.15	0.18	0.21	0.22	0.24	0.24
Japan	E	95.89	98.14	100.25	102.19	103.92	105.42
Japan	Π	0.00	0.00	0.00	0.00	0.00	0.00
Kuwait	Y	3.37	3.37	3.37	3.37	3.37	3.38
Kuwait	R	0.43	0.51	0.61	0.73	0.86	0.99
Kuwait	E	0.29	0.29	0.29	0.29	0.29	0.29
Kuwait	Π	0.00	0.00	0.00	0.00	-0.00	-0.00
Malaysia	Y	21.36	21.36	21.36	21.37	21.37	21.37
Malaysia	R	3.12	3.13	3.12	3.08	3.04	2.99
Malaysia	E	3.50	3.52	3.53	3.55	3.56	3.58
Malaysia	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.06
USA	Y	25.60	25.61	25.61	25.62	25.62	25.62
USA	R	0.73	0.82	0.90	0.96	1.00	1.03
USA	E	386.61	406.07	407.10	418.74	415.34	419.89
USA	Π	-0.01	-0.01	-0.01	0.00	0.00	0.00
Saudi	Y	4.58	4.58	4.59	4.59	4.59	4.59
Saudi	R	1.55	1.85	2.13	2.39	2.62	2.81
Saudi	E	3.75	3.75	3.75	3.75	3.75	3.75
Saudi	Π	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03
Singapore	Y	4.71	4.70	4.69	4.68	4.67	4.66
Singapore	R	2.33	2.40	2.46	2.51	2.56	2.59
Singapore	E	1.37	1.37	1.37	1.37	1.36	1.36
Singapore	Π	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01
Thailand	Y	23.80	23.80	23.80	23.79	23.79	23.79
Thailand	R	5.49	5.55	5.61	5.70	5.83	6.00

Thailand	E	31.90	31.59	31.30	31.05	30.85	30.69
Thailand	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Turkey	Y	21.20	21.19	21.19	21.19	21.19	21.19
Turkey	R	23.22	23.72	24.06	24.29	24.45	24.56
Turkey	E	1.39	1.39	1.39	1.39	1.39	1.39
Turkey	Π	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Pakistan	Y	5.02	5.04	5.05	5.07	5.09	5.10
Pakistan	R	5.92	5.49	5.15	4.90	4.73	4.64
Pakistan	Π	0.00	0.00	0.00	0.00	0.00	0.00

5.8 Comparisons between VAR and GVAR model

It is essential to evaluate how well these forecasts perform compared to other model. For this we used Mean Square error forecasts (MSEF) to compare the VAR model to GVAR model. We can see in the table14.1, 2 it is clearly shown that the VAR model MSEF is larger than the GVAR model MSEF. It means that the GVAR is outperforming than the VAR model in the forecasting.

Table 14.1: Comparison between GVAR and VAR Models

				VAR (MSEF)		
Variable\country	China	India	Indonesia	Japan	Kuwait	Malaysia
Y	0.11	0.07	0.05	0.03	0.02	0.08
Π	1.77	2.34	0.03	0.04	0.04	0.02
EP	0.02	6.2	2460.43	16.41	0.05	0.82
R	0.03	0.06	2.69	0.232	0.63	2.14
				GVAR(MSEF)		
variable\country	China	India	Indonesia	Japan	Kuwait	Malaysia
Y	0.07	0.06	0.04	0.01	0.01	0.06
Π	1.52	1.65	0.02	0.01	0.02	0.01
EP	0.01	5.66	1522.82	12.19	0.04	0.61
R	0.02	0.04	1.65	0.12	0.23	1.64

Table 14.2

			VAR(MSEF)			
Variable \country	Pakistan	Saudi	Singapore	Thailand	Turkey	USA
Y	0.07	0.23	0.35	0.08	0.19	0.04
Π	0.04	0.04	0.04	0.06	0.08	0.05
EP	4.87	0.03	0.09	3.26	0.29	0.59
R	5.15	3.55	1.75	5.54	28.19	0.05
			GVAR(MSEF)			
variable\country	Pakistan	Saudi	Singapore	Thailand	Turkey	USA

Y	0.06	0.11	0.32	0.06	0.15	0.02
Π	0.01	0.02	0.02	0.03	0.03	0.03
EP	3.04	0.01	0.06	1.86	0.07	0.19
R	0.95	2.13	0.28	3.46	22.78	0.02

Conclusion:

In this chapter, we generated 12 one quarter a head forecasts of short-term interest rate, inflation, exchange rate and GDP over the period 2010Q1 to 2012Q4. The forecasts results based on the Mean Square Error forecast (MSEF). The forecast is compared with Vector autoregressive (VAR) model. The forecast results indicate that the GVAR forecasts outperform then the VAR forecasts.

The contemporaneous analysis indicates that Pakistan economy is affected by its major trading partners. The foreign real gross domestic product and foreign inflation have shown significant impact to their domestic counterpart of Pakistan real gross domestic product and inflation.

CHAPTER-6

6.1 Conclusion and policy Recommendations

In this study, we analyzed and estimated the macroeconomic forecasts for Pakistan and its major trading partners in the context of a Global Vector Autoregressive (GVAR) model covering 12 countries. I generate 12 one quarter a head forecasts of short-term interest rate, inflation, exchange rate and GDP over the period 2010Q1 to 2012Q4. The forecasts results based on the Mean Square Error forecast (MSEF). The forecast is compared with Vector autoregressive (VAR) model. The forecast results indicate that the GVAR forecasts outperform then the VAR forecasts.

The contemporaneous analysis indicates that Pakistan economy is affected by its major trading partners. The foreign real gross domestic product and foreign inflation have shown significant impact to their domestic counterpart of Pakistan real gross domestic product and inflation. It implies that there is a significant co-moment between Pakistan and her major trading partners.

On the basics of result, it is recommending to the policy maker that if they constructed the policy. They will not ignore the foreign variable such as Gross Domestic Product and Inflation of major trading partners since they are significance impact of their domestic variable Gross Domestic Product and Inflation of Pakistan.

On the basics of result, it is recommending to the policy maker that if they estimate the forecasting of Macroeconomic variable. They should consider the GVAR model rather than VAR model. Because they incorporates the global variable alone the domestic variable

6.2 Reference

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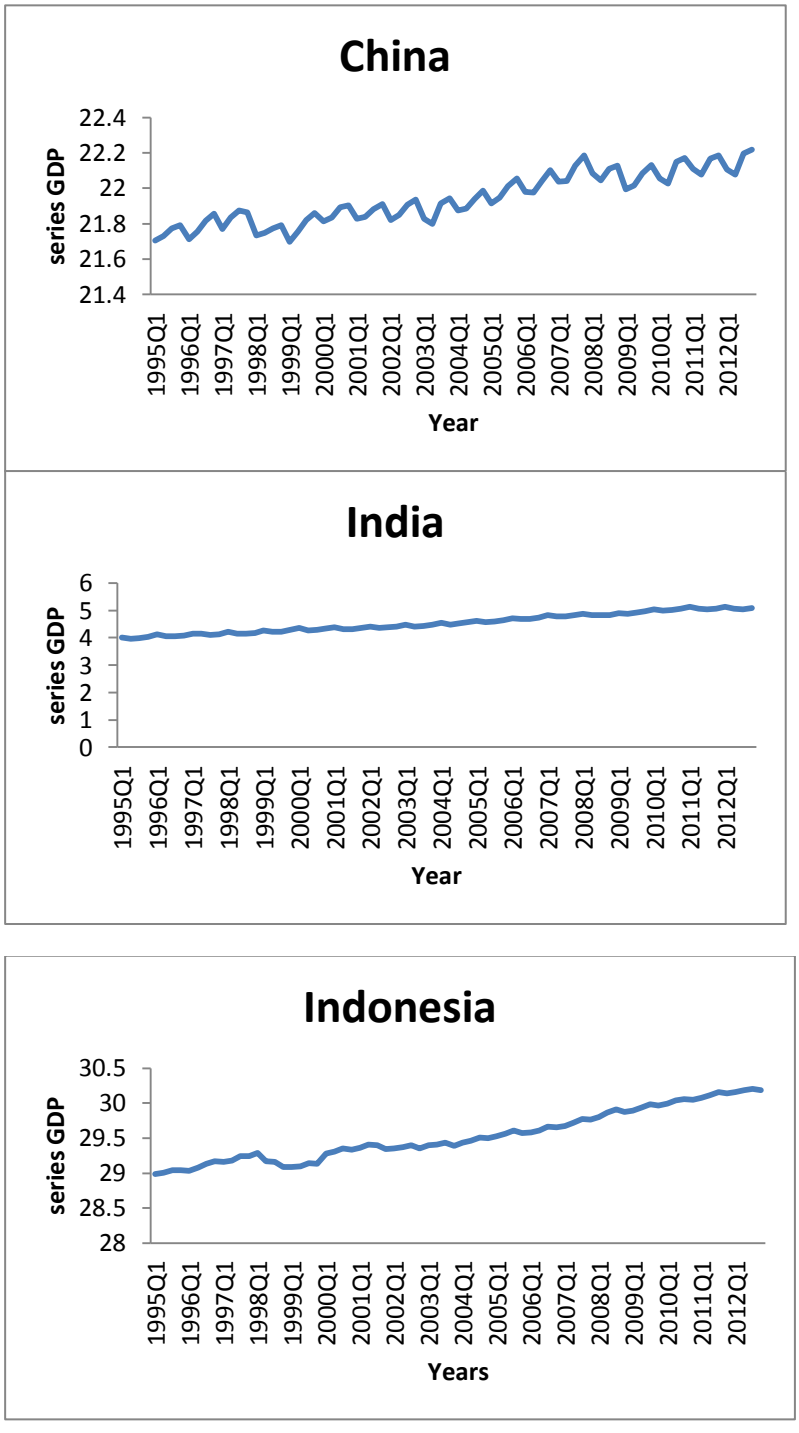
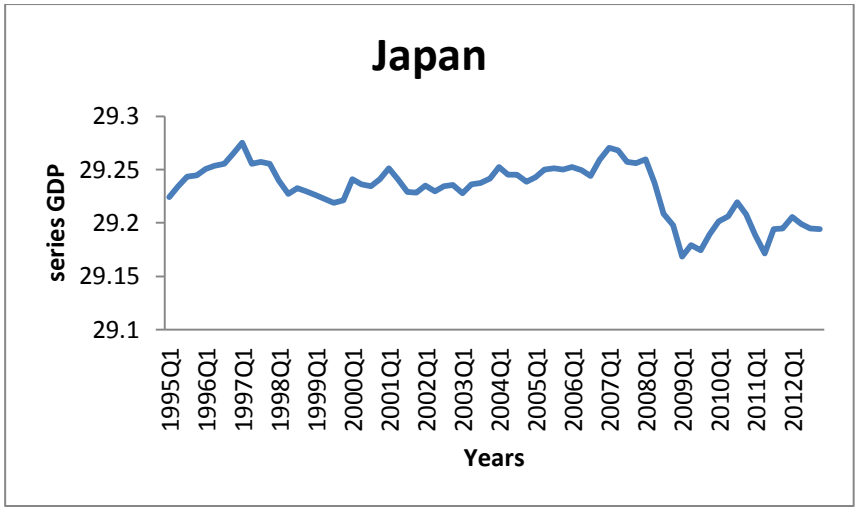
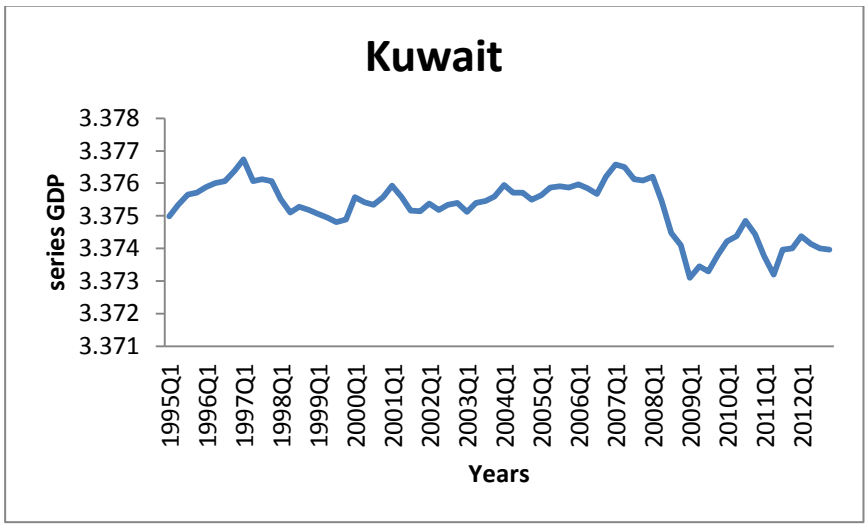
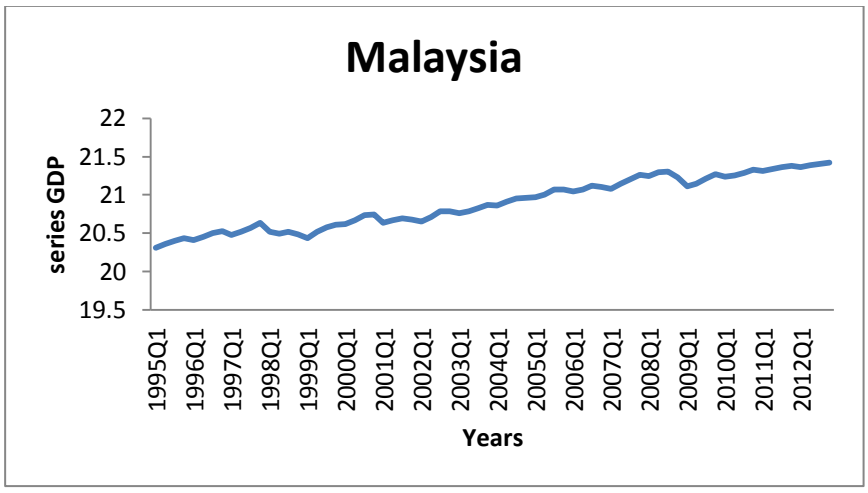
Appendix:

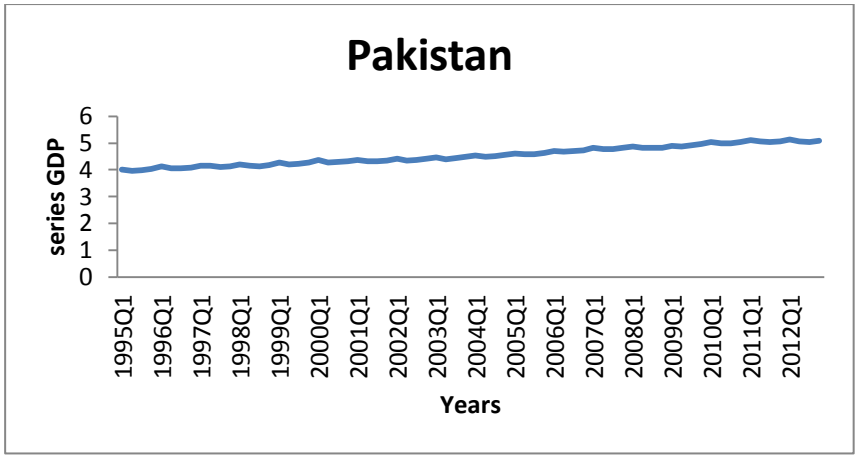
Figure 1: Grapes of Gross Domestic Product (GDP) of different Countries

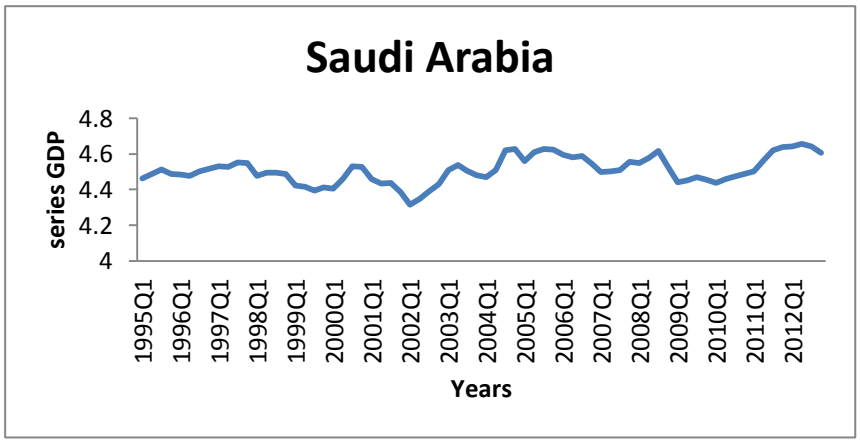


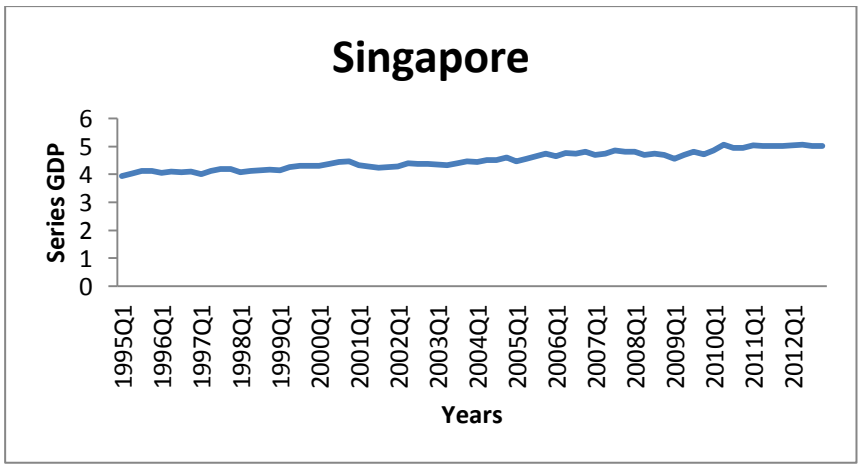

Japan
29.3
29.25
29.2
29.15
29.1
series GDP
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

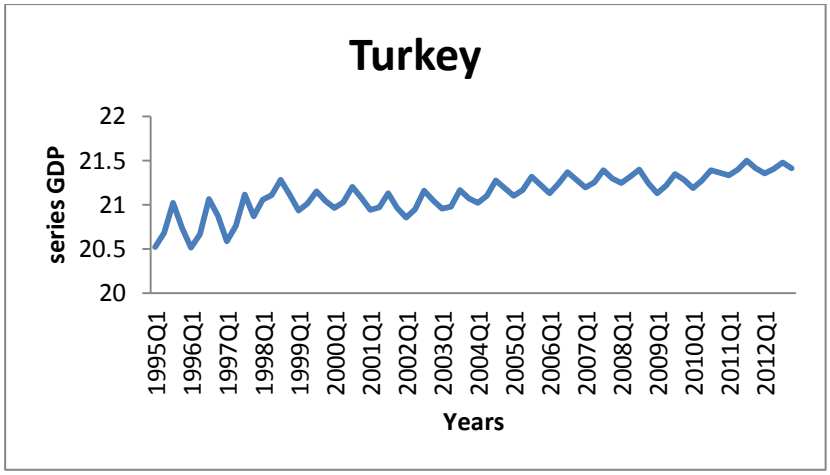

Kuwait
3.378
3.377
3.376
3.375
3.374
3.373
3.372
3.371
series GDP
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

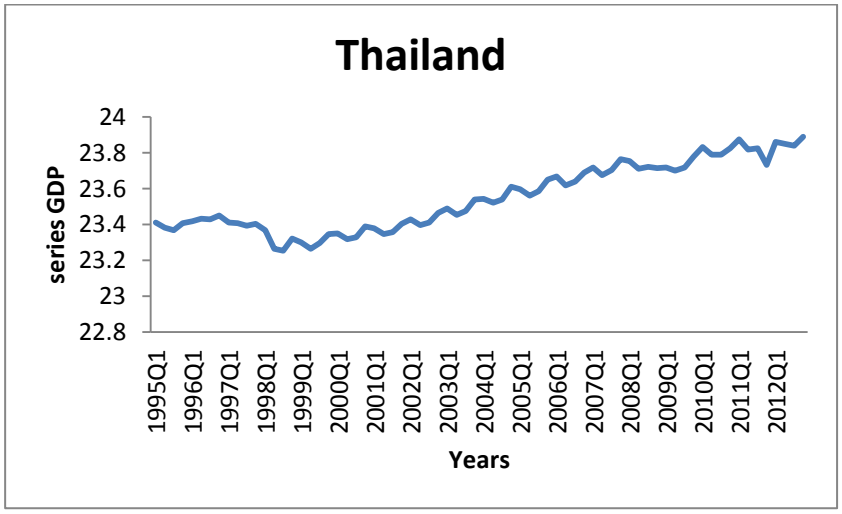

Malaysia
22
21.5
21
20.5
20
19.5
series GDP
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Pakistan
series GDP
6
5
4
3
2
1
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Saudi Arabia
series GDP
4.8
4.6
4.4
4.2
4
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Singapore
Series GDP
6
5
4
3
2
1
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Turkey
series GDP
22
21.5
21
20.5
20
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Thailand
series GDP
24
23.8
23.6
23.4
23.2
23
22.8
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

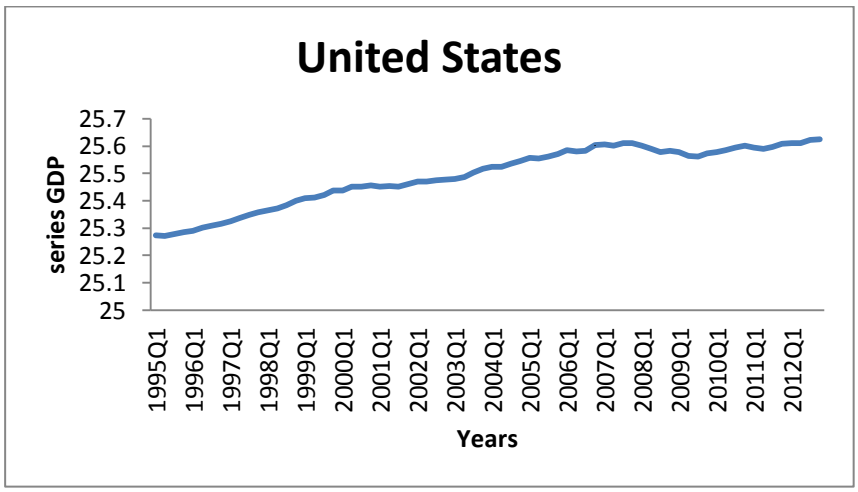
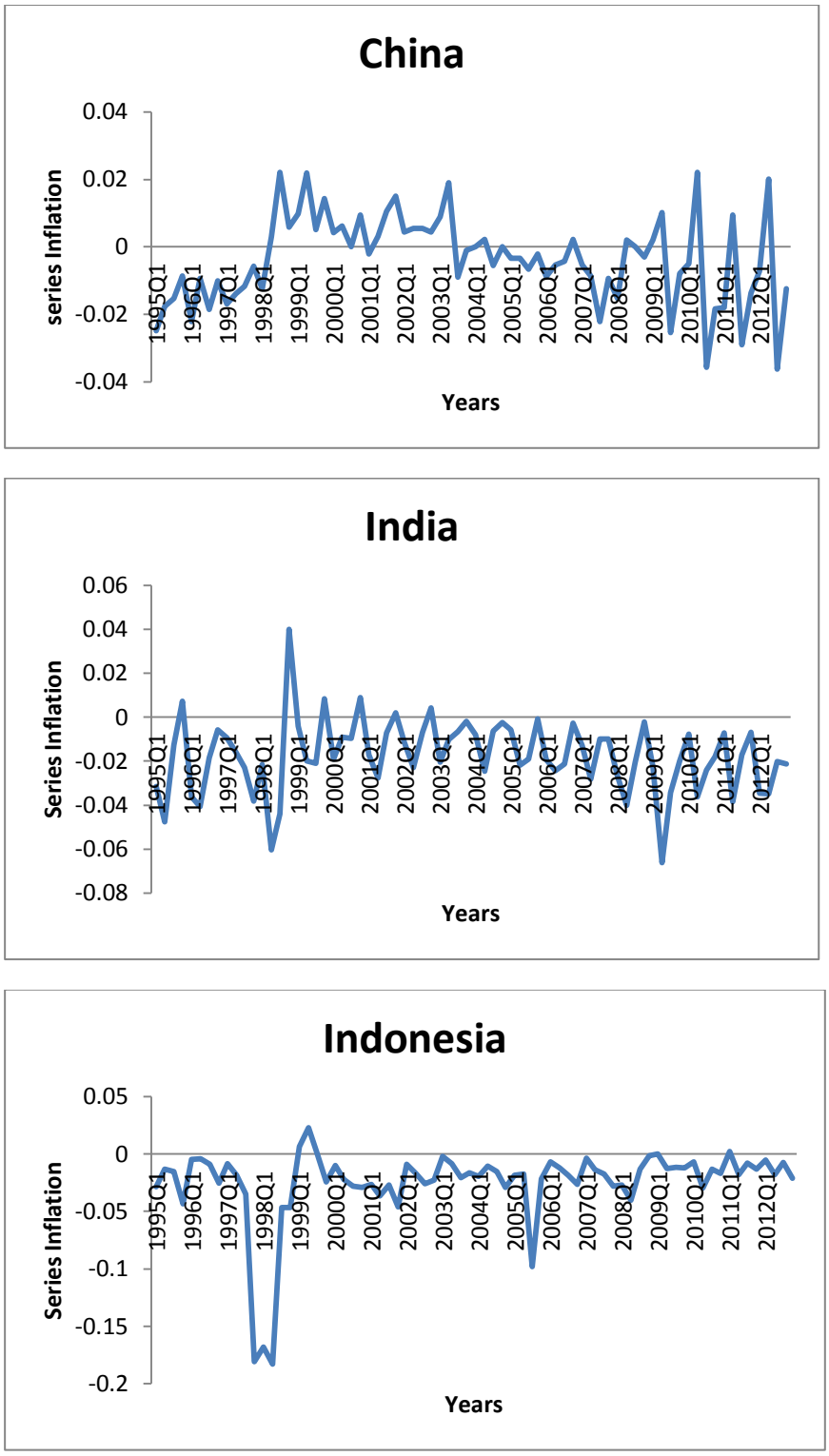
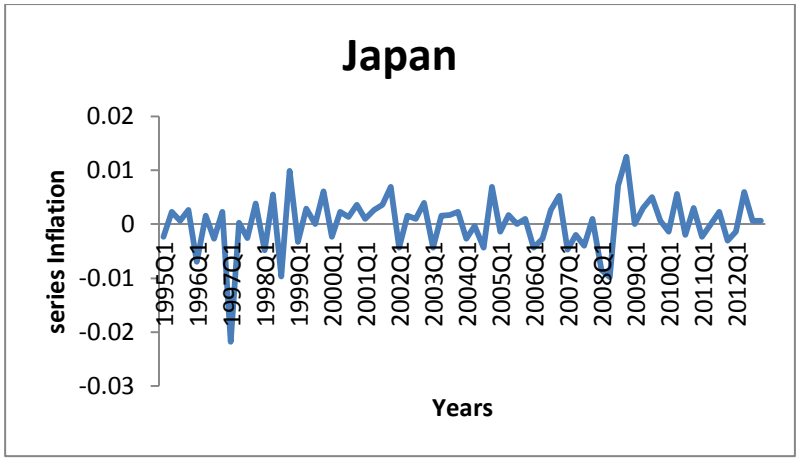
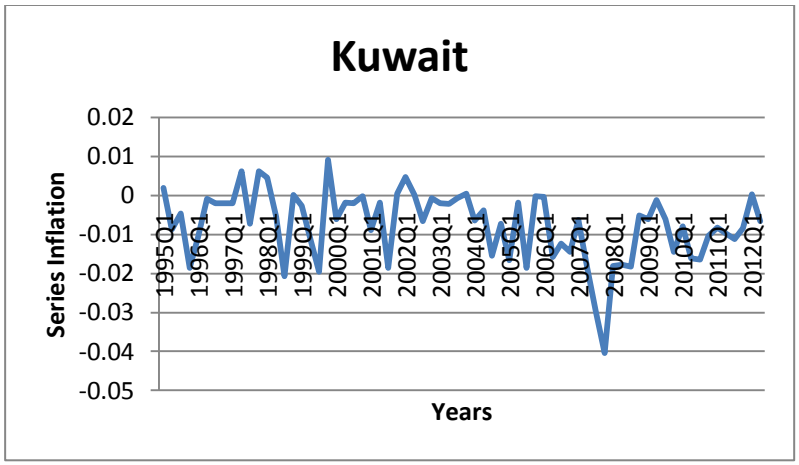
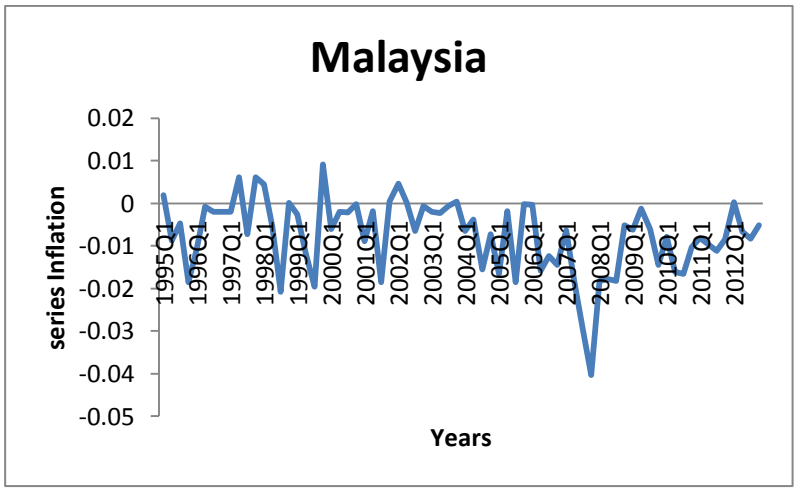

United States
series GDP
25.7
25.6
25.5
25.4
25.3
25.2
25.1
25
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

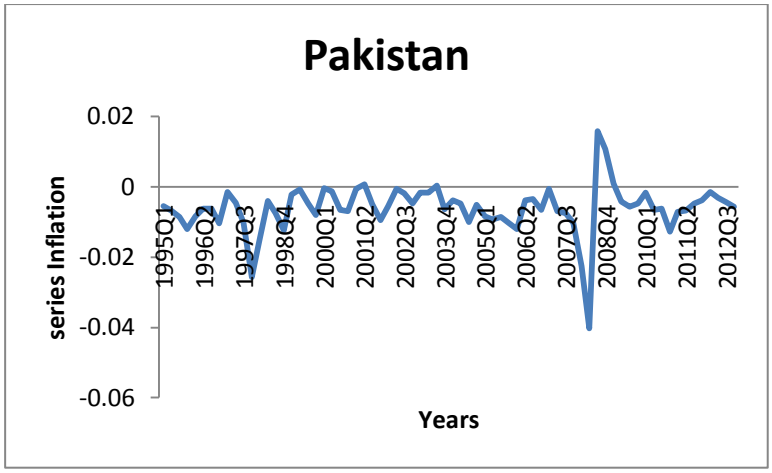
Figure 2: Grapes of Inflation of different Countries

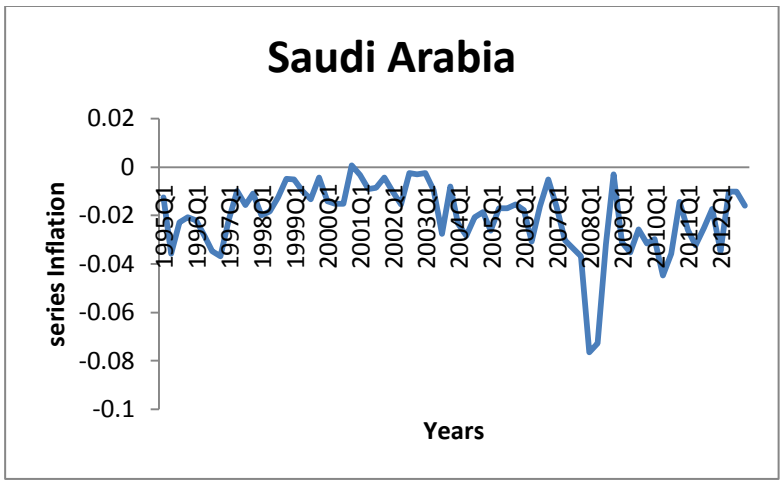


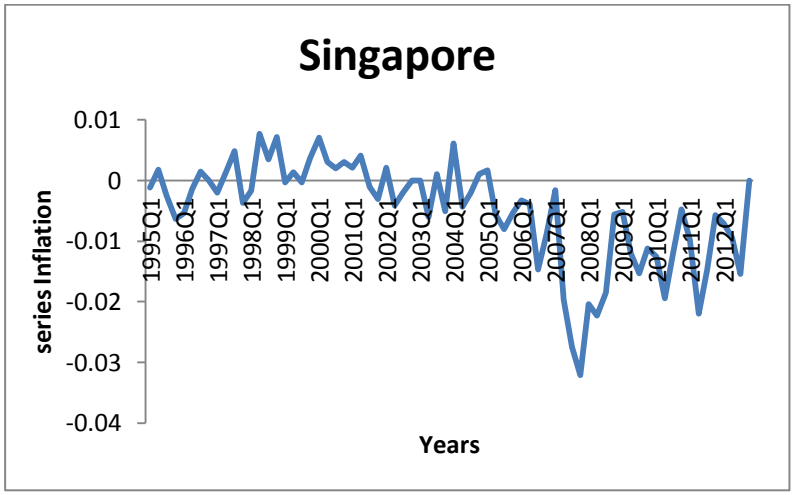

Japan
0.02
0.01
0
-0.01
-0.02
-0.03
series Inflation
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

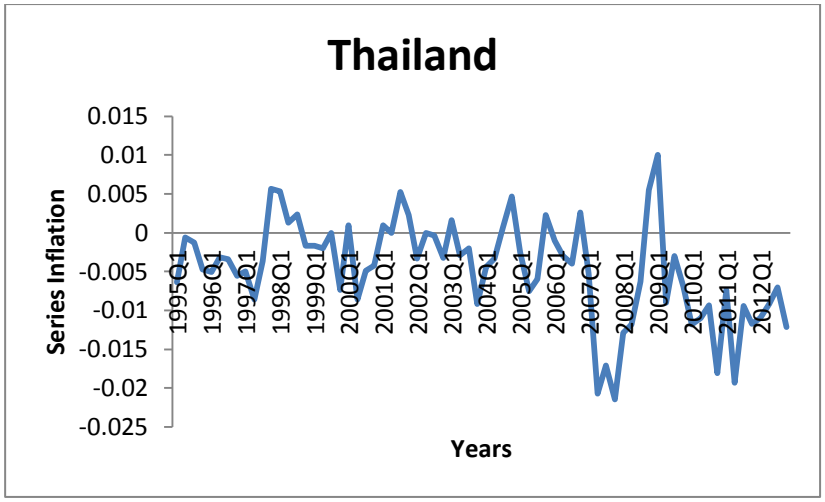

Kuwait
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
Series Inflation
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

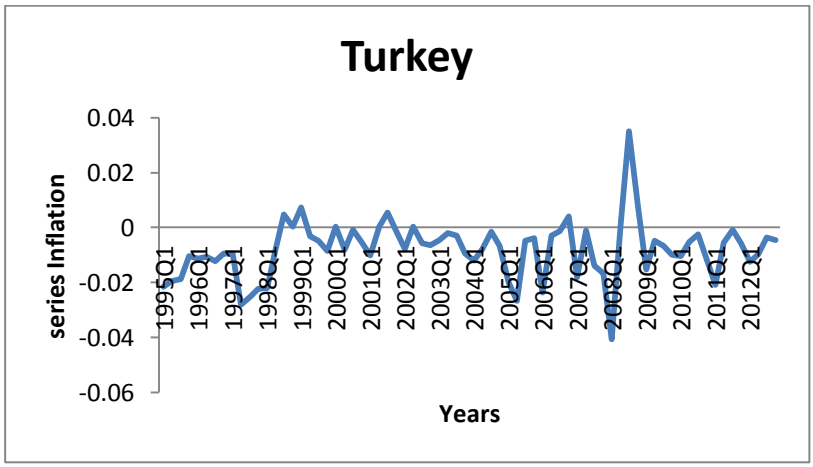

Malaysia
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
series Inflation
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Pakistan
0.02
0
-0.02
-0.04
-0.06
series Inflation
1995Q1
1996Q2
1997Q3
1998Q4
2000Q1
2001Q2
2002Q3
2003Q4
2005Q1
2006Q2
2007Q3
2008Q4
2010Q1
2011Q2
2012Q3
Years


Saudi Arabia
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
series Inflation
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Singapore
0.01
0
-0.01
-0.02
-0.03
-0.04
series Inflation
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Thailand
Series Inflation
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Turkey
series Inflation
0.04
0.02
0
-0.02
-0.04
-0.06
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

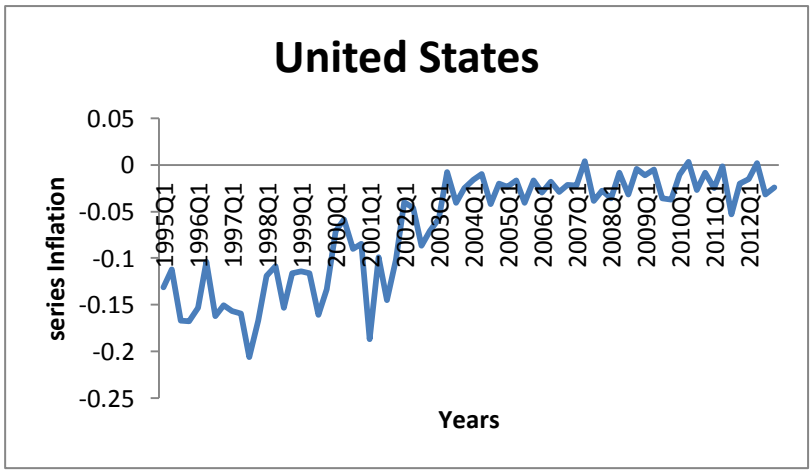
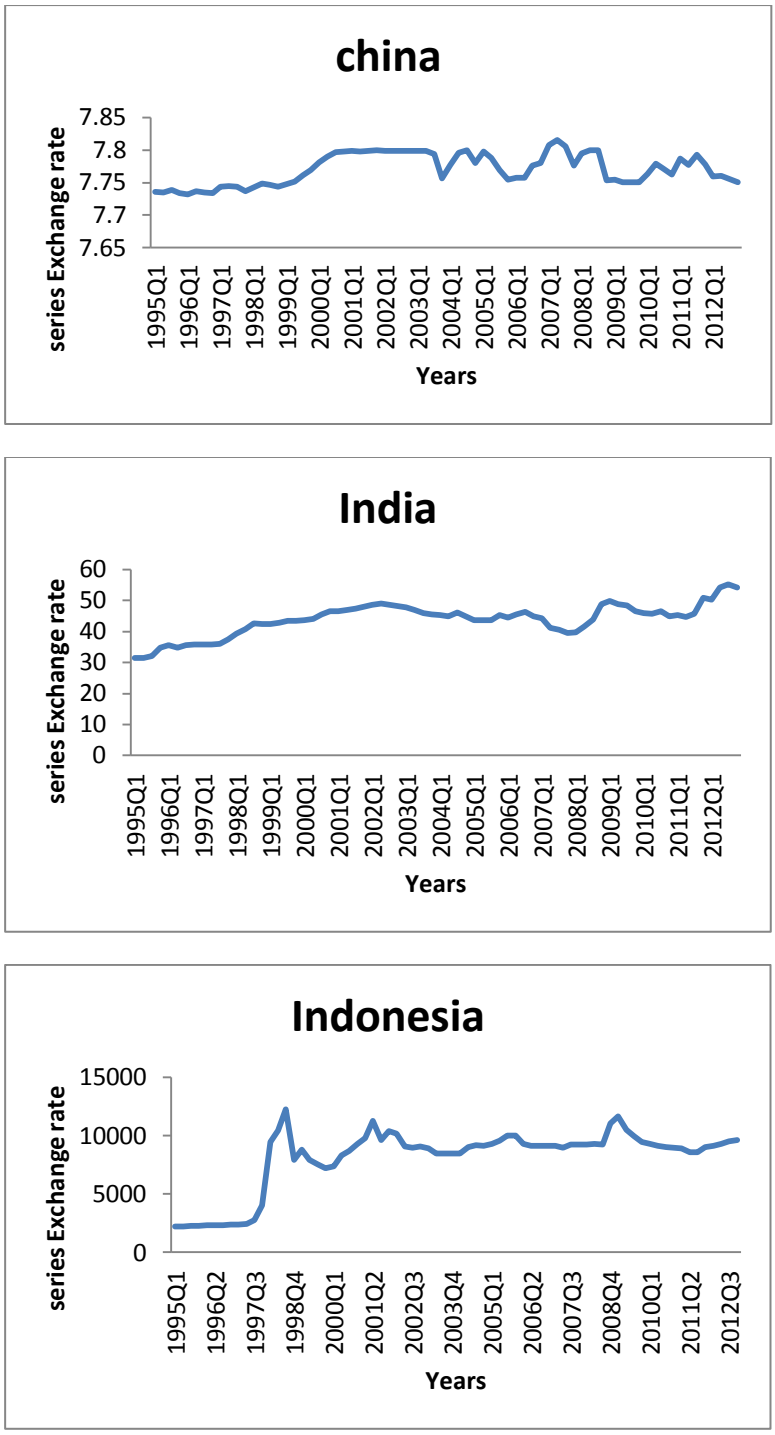
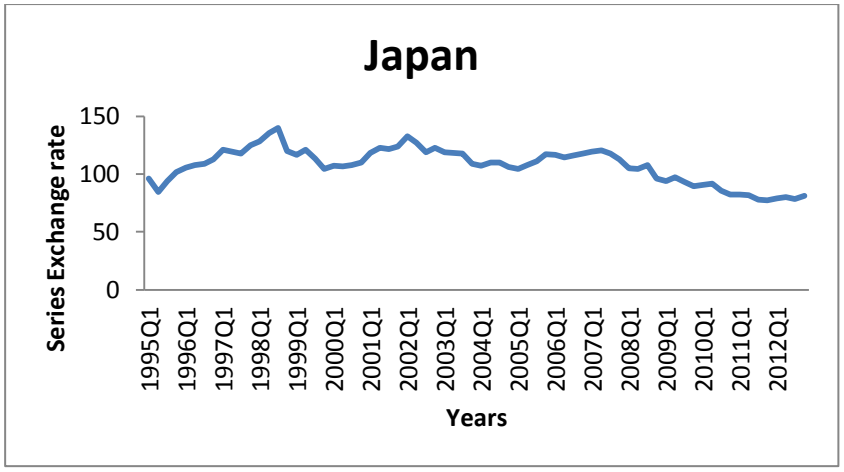
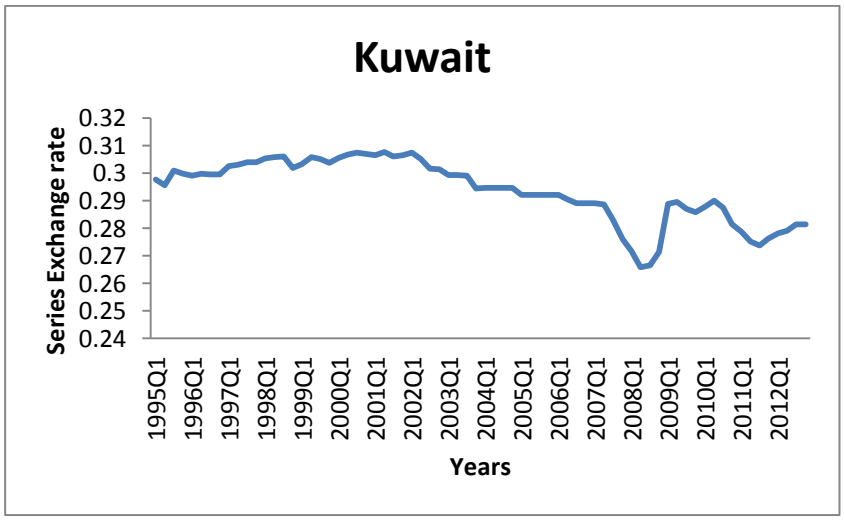
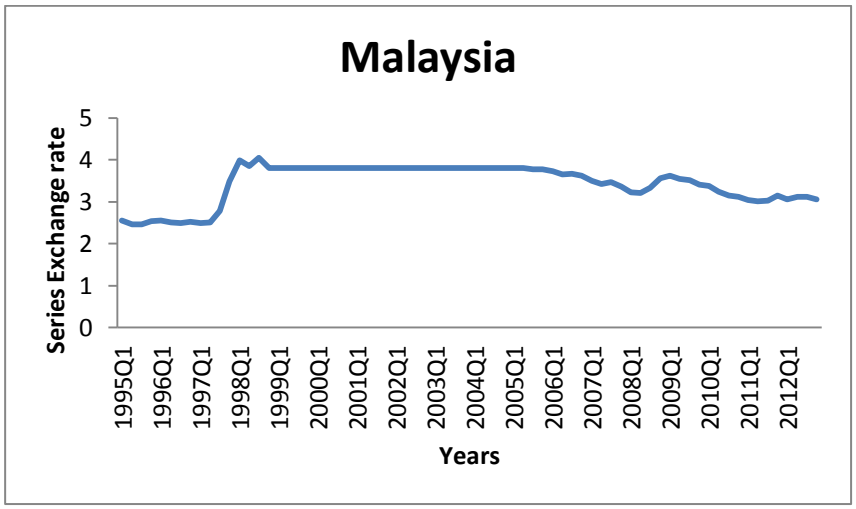

United States
series Inflation
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

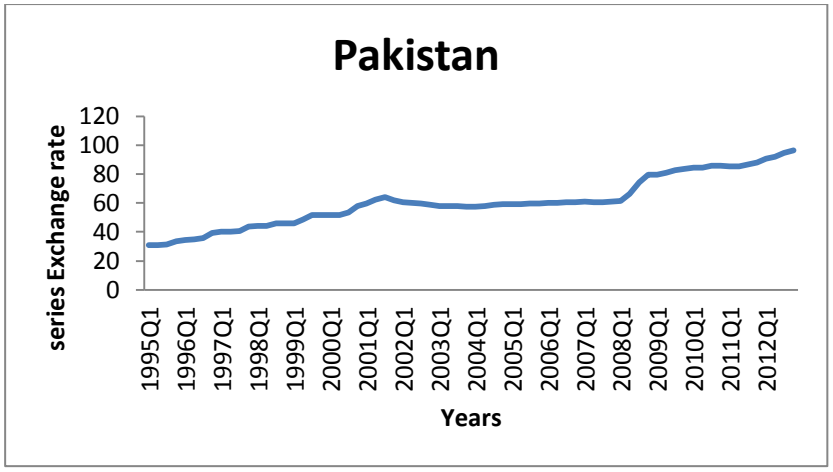
Figure 3: Grapes of Exchange Rate of different Countries

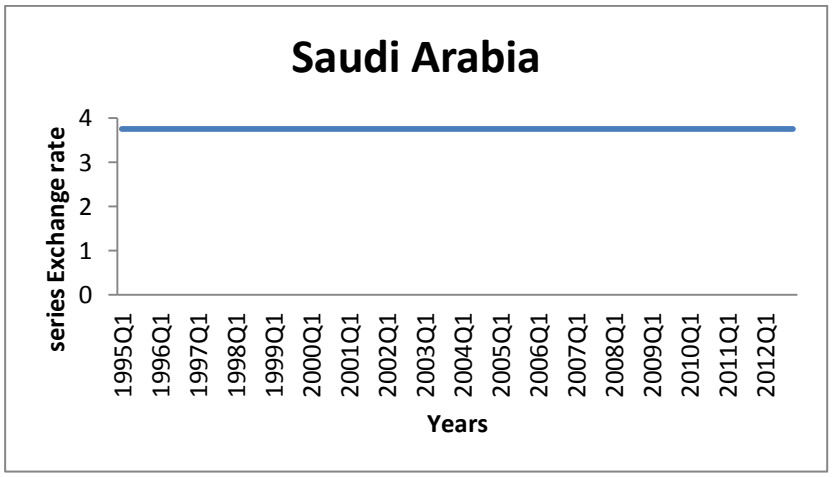


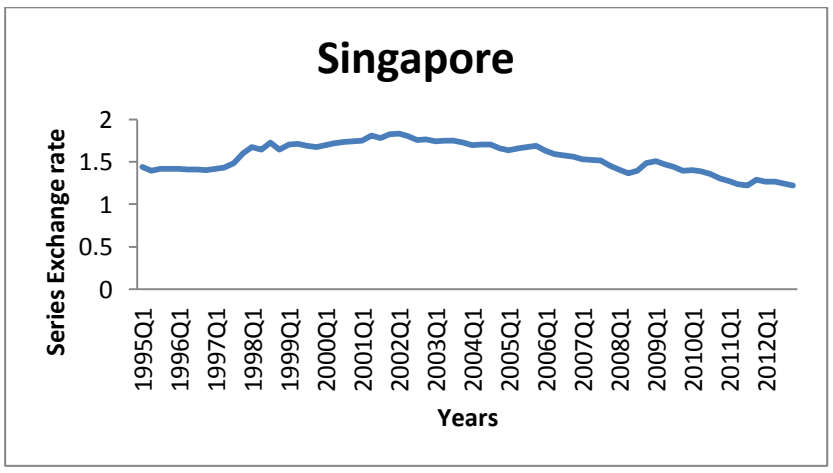

Japan
Series Exchange rate
150
100
50
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

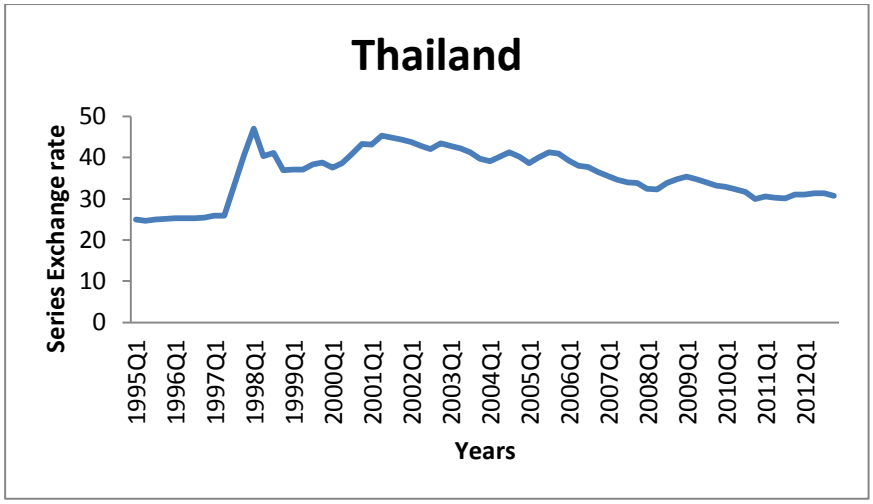

Kuwait
Series Exchange rate
0.32
0.31
0.3
0.29
0.28
0.27
0.26
0.25
0.24
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Malaysia
Series Exchange rate
5
4
3
2
1
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Pakistan
series Exchange rate
120
100
80
60
40
20
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Saudi Arabia
series Exchange rate
4
3
2
1
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Singapore
Series Exchange rate
2
1.5
1
0.5
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Thailand
Series Exchange rate
50
40
30
20
10
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

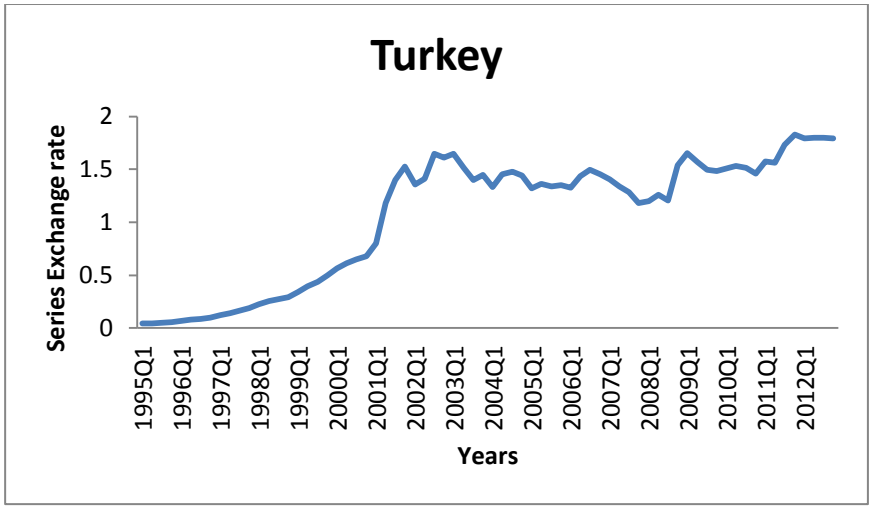
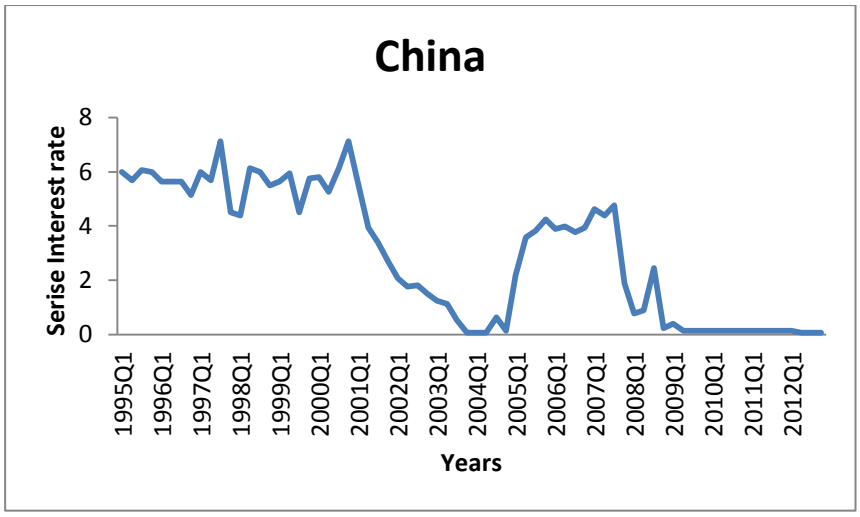
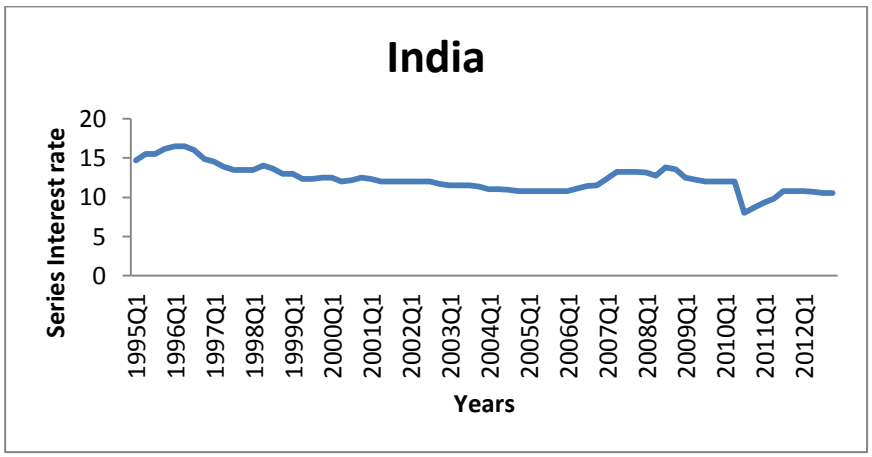
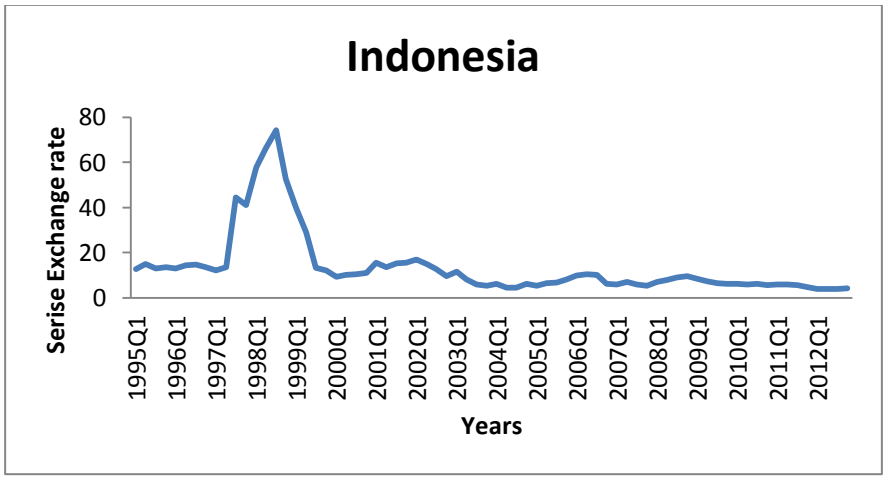
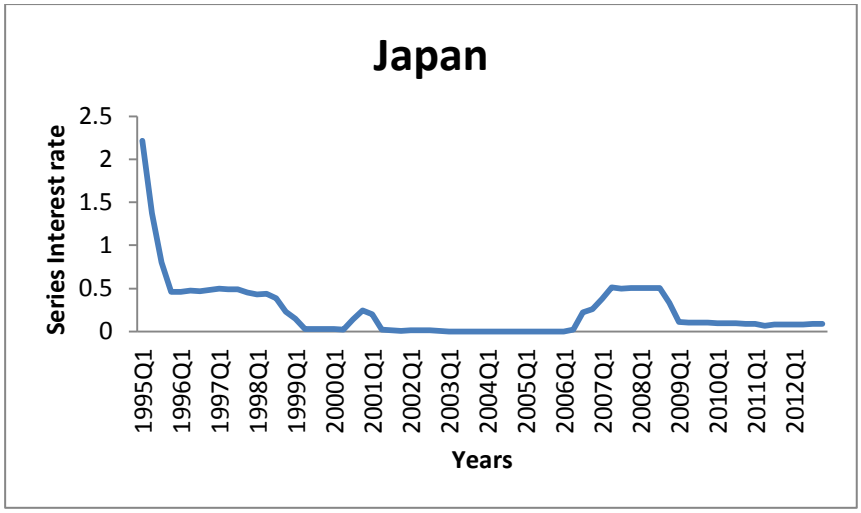

Turkey
Series Exchange rate
2
1.5
1
0.5
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

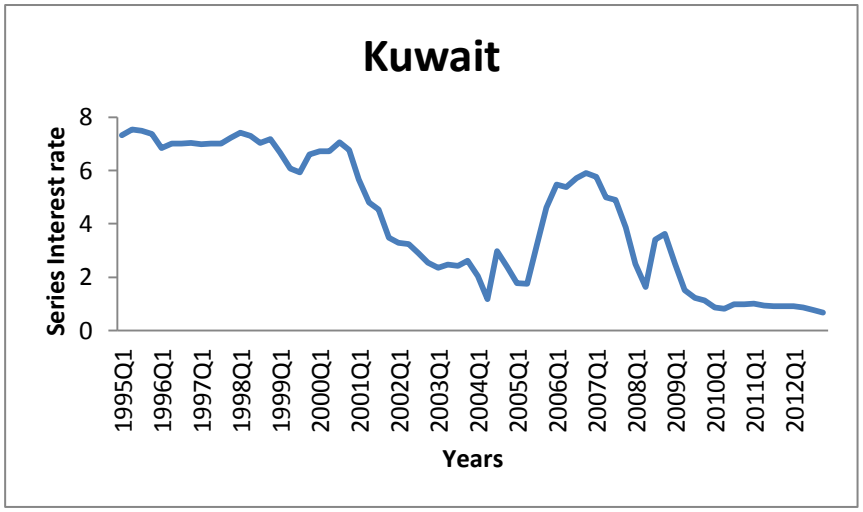
Figure 4: Grapes of Interest Rate of different Countries

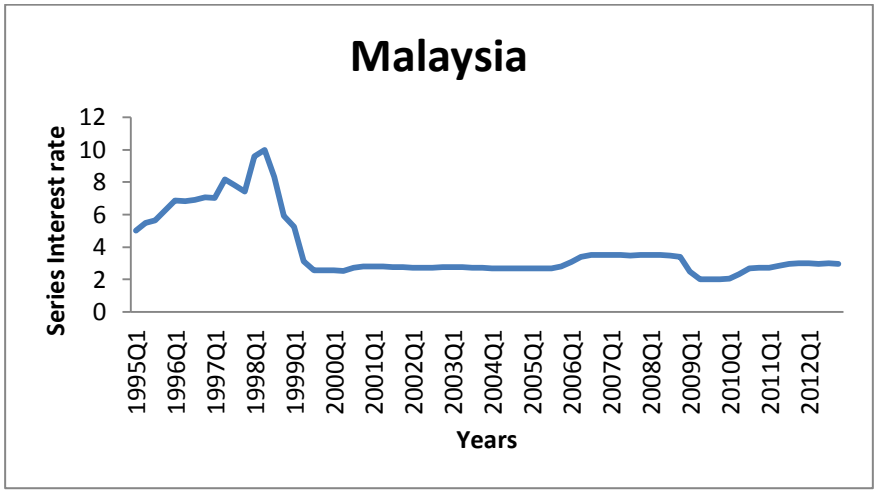


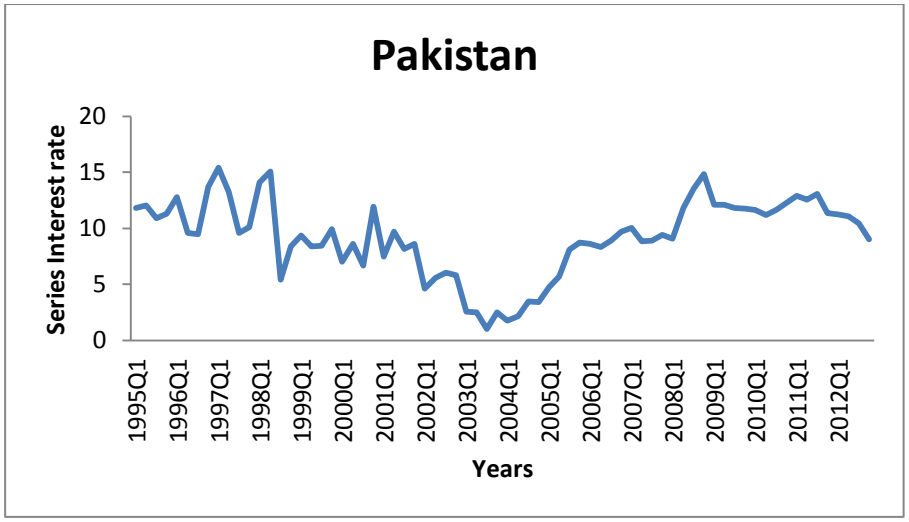


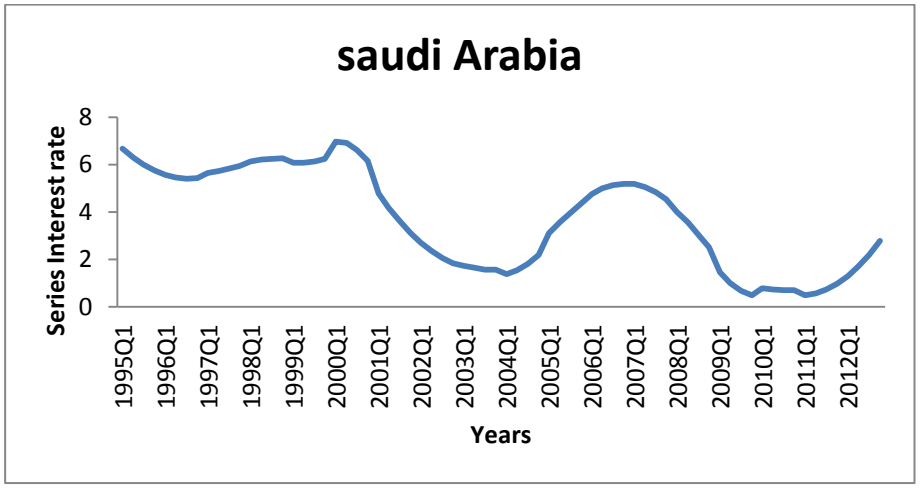


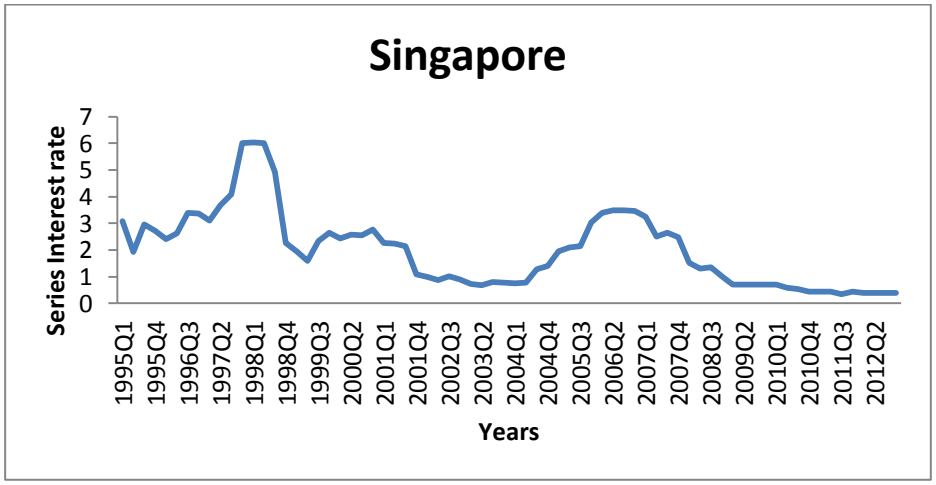

Japan
Series Interest rate
2.5
2
1.5
1
0.5
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

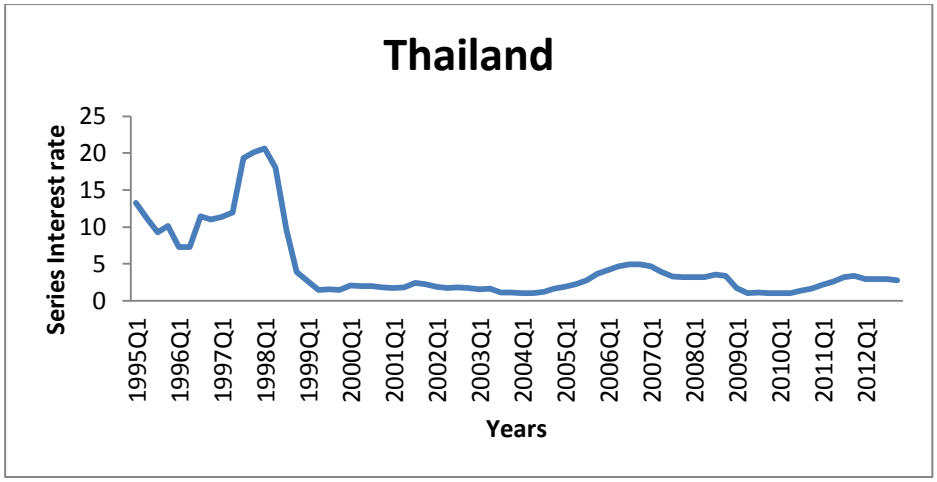

Kuwait
Series Interest rate
8
6
4
2
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

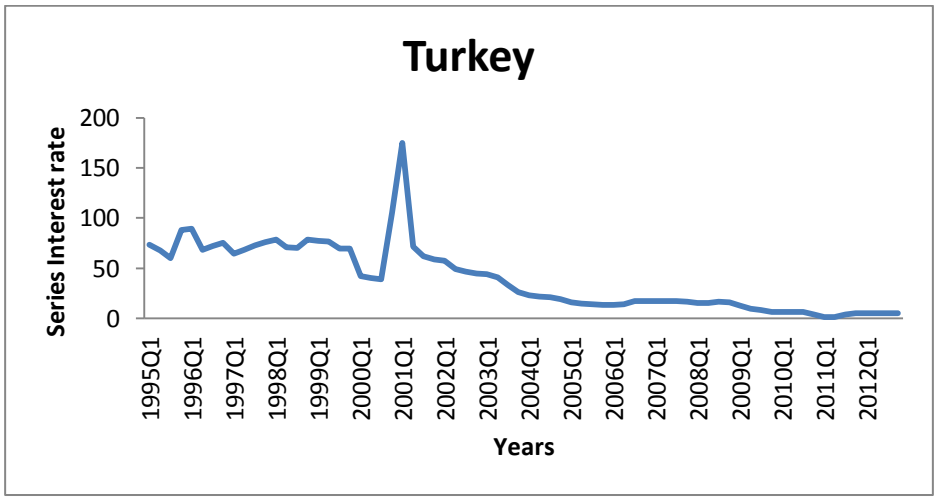

Malaysia
Series Interest rate
12
10
8
6
4
2
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Pakistan
Series Interest rate
20
15
10
5
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


saudi Arabia
Series Interest rate
8
6
4
2
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Singapore
Series Interest rate
7
6
5
4
3
2
1
0
1995Q1
1995Q4
1996Q3
1997Q2
1998Q1
1998Q4
1999Q3
2000Q2
2001Q1
2001Q4
2002Q3
2003Q2
2004Q1
2004Q4
2005Q3
2006Q2
2007Q1
2007Q4
2008Q3
2009Q2
2010Q1
2010Q4
2011Q3
2012Q2
Years


Thailand
Series Interest rate
25
20
15
10
5
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years


Turkey
Series Interest rate
200
150
100
50
0
1995Q1
1996Q1
1997Q1
1998Q1
1999Q1
2000Q1
2001Q1
2002Q1
2003Q1
2004Q1
2005Q1
2006Q1
2007Q1
2008Q1
2009Q1
2010Q1
2011Q1
2012Q1
Years

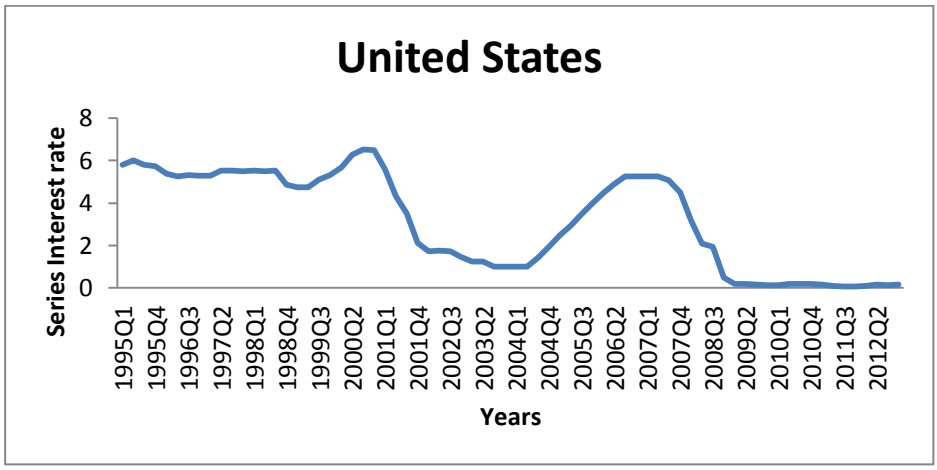

United States
Series Interest rate
8
6
4
2
0
1995Q1
1995Q4
1996Q3
1997Q2
1998Q1
1998Q4
1999Q3
2000Q2
2001Q1
2001Q4
2002Q3
2003Q2
2004Q1
2004Q4
2005Q3
2006Q2
2007Q1
2007Q4
2008Q3
2009Q2
2010Q1
2010Q4
2011Q3
2012Q2
Years

Figure 5: Grapes of World Commodity Price of different Countries