IMPACT OF EXCHANGE RATE INTERVENTION AND TRADE OPENNESS ON THE ECONOMY OF BRICS COUNTRIES

A Thesis Submitted to the Pondicherry University for the Award of the Degree of

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In
COMMERCE

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CERTIFICATE

This is to certify that the Ph.D Thesis entitled **"Impact of Exchange Rate Intervention and Trade Openness on the Economy of BRICS Countries"** is a bonafide record of research work done by **DIVYASREE P P** and submitted for the award of the degree of Doctor of Philosophy in Commerce of the Pondicherry University. The thesis is her original work and has not previously formed the basis for the award of any Degree, Diploma, Associateship, Fellowship or other similar title of this or any other University. This Thesis is entirely an independent work on the part of the candidate.

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DECLARATION

I hereby declare that the Ph.D Thesis entitled **"Impact of Exchange Rate Intervention and Trade Openness on the Economy of BRICS Countries",** submitted by me for the award of the degree of Doctor of Philosophy in Commerce is a record of research work done by me and that the thesis has not previously formed the basis for the award of any Degree, Diploma, Associateship or any other similar title.

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(Divyasree P P)

DEDICATED TO MY FAMILY

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ABBREVIATIONS

ADF	:	Augmented Dickey Fuller
ARCH	:	Autoregressive Conditional Heteroscedasticity
ARDL	:	Autoregressive Distributed Lag
ARIMA	:	Auto Regressive Integrated Moving Average
ASEAN	:	Association of Southeast Asian Nations
ASP	:	Average Share Price
BOT	:	Balance of Trade
BRIC	:	Brazil, Russia, India, China
BRICS	:	Brazil, Russia, India, China, South Africa
BRL R	:	Brazil Real
BSE	:	Bombay Stock Exchange
CAGR	:	Compound Annual Growth Rate
CAR	:	Contingent Reserve Arrangement
CBI	:	Central Bank Independence
CO	:	Corbae-Ouliaris
CPI	:	Consumer Price Index
CV	:	Co-efficient Value
DF- GLS	:	Dickey- Fuller Generalized Least Square
DSGE	:	Dynamic Stochastic General Equilibrium Modeling
DSGE	:	Dynamics Stochastic General Equilibrium
EGARCH	:	Exponential Generalized Autoregressive Conditional
FDI	:	Foreign Direct Investment
FIIs	:	Foreign Institutional Investor
FMOLS	:	Fully Modified Ordinary Least Square
FOB	:	Free On board
FOREX	:	Foreign Exchange
G7	:	Group of Seven
GARCH	:	Generalized Autoregressive Conditional Heteroscedasticity
GATT	:	General Agreement on Tariffs and Trade
GDP	:	Gross Domestic Product

GLS	:	Generalized Least Squares
GMM	:	Generalized Method of Moments
HAC	:	Heteroskedasticity and Autocorrelation Consistent Heteroskedasticity
HP	:	Hodrick–Prescott
IFS	:	International Financial Statistics
IIP	:	Index of Industrial Production
IMF	:	International Monetary Fund
INR	:	Indian Rupee
IT	:	Inflation Target
JSE	:	Johannesburg Stock Exchange
KPSS	:	Kwiatkowski-Phillips-Schmidt-Shin
LIBOR	:	London Interbank Offered Rate
LR	:	Likelihood Ratio
LSDV	:	Least Squares Dummy Variables
MA	:	Moving Average
M-GARC	:	Multi-Variate Generated Auto Regressive Conditionality Heteroscedasticity
MS-AR	:	Markov switching VAR model
NASDAQ	:	National Association of Securities Dealers Automated Quotations.
NATO	:	North Atlantic Treaty Organization
OECD	:	The Organization for Economic, Co-operation and Development
OLS	:	Ordinary Least Square
PEX	:	Palestine Exchange
PP	:	Phillips-Perron
PPP	:	Purchasing Power Parity
RBI	:	Reserve Bank of India
REER	:	Real Effective Exchange Rate
RUB	:	Russian Ruble
SAARC	:	South Asian Association for Regional Cooperation
SICs	:	Severely Indebted Countries
SR	:	Sacrifice Ratio

STCC-GARCH	:	Smooth Transition Conditional Correlation-Generalized Autoregressive Conditional Heteroscedasticity
SVAR	:	Structural Vector Autoregressive
TFP	:	Total Factor Productivity
TSE	:	Tokyo stock exchange
UK	:	United Kingdom
UN	:	United Nations
UNCTAD	:	United Nations Conference on Trade and Development
US$	:	United State Dollar
USA	:	United State of America
VAR	:	Vector Auto Regressive
VECM	:	Vector Error Correction Models
WB	:	World Bank
WDI	:	World Development Indicators
WPI	:	Wholesale Price Index
WTO	:	World Trade Organization
YUAN	:	Renminibi
ZAR	:	South African Rand

CHAPTER ONE

INTRODUCTION AND RESEARCH DESIGN

CHAPTER STRUCTURE

1.1 Introduction:

Today the global economy is interdependent and intertwined like never before. This dependency is only going to get even more complex and deeper in the years to come. It is therefore imperative for nations to develop strategies, build mechanisms and collaborate at all levels to keep them competitive and relevant in this highly competitive and uncertain economic world. After observing a boom of rapid economic growth in the initial years of globalization, the global economy has slow downed after the financial crisis in 2008. Globally, economies have off late shown contrasting trends, the growth rate of emerged economies are very low at an average of 2 to 4 percent and developing nations are growing at an average of 6 to 9 percent GDP per year. The changing trends are not only limited to growth terms, but also observed in case of external debts and forex reserves. The developed nations are facing growing public debts and external payments, on the other hand developing nations are reducing their external debts and accumulating more foreign reserves to protect the economies from any kind of external disturbances in future.

The global economy is struggling to gain momentum after global financial crisis. The current global growth is 2.6 percent in 2014. This slow growth is especially because of the developed economies like, the United States and most European Union countries which are not yet raised from the great financial crisis and are trying hard to retain the normal sustained growth; on the other hand developing nations are growing at a much faster pace. However, the unfettered global economic interdependence requires nations to work together to grow and develop in a sustainable manner. In the current situation the growth of the world economy is driven by the developing economies. The current GDP growth rate of developed countries is 1.8 percent in 2014 and the developing countries are 4.4 percent in 2014.

The growth of these developing nations is mainly because of international trade. In the last two decades, the average growth of the world trade was around six percent per year. The increasing tendency of forming groups for economic co-operation is also one factor in their rapid development. Few countries like China, India, Russia, Indonesia, Turkey and Brazil etc. to list out some are playing a major role in the growth of global economy. It may not be far when these emerging economic giants surpass the

developed ones and prevail over the global economy. Among these developing countries based on the forecasting of economic analysts, five countries namely Brazil, Russia, India, China and South Africa are projected and formed in to one economic group called BRICS. Since the formation, it has increased the economic co-operation among the group and with other countries to become a power house to the global economy and future hope of the world in sustained global growth and development.

1.2 . BRICS Economies – A Background:

"BRIC"- Brazil, Russia, India and China, have become a brand destination for the investors around the globe. The prediction of Jim O'Neill in 2001 has come true and made every nation to look into the reality. The acronym was first mentioned in his paper entitled "Building Better Global Economic BRICs". He predicted the investment opportunities in these emerging economies which together represented a significant share of the world's production. Jim O'Neill kept working on this concept and in 2003, his team produced another paper called "Dreaming with BRICs: The Path to 2050". It boldly declared that by 2039 the BRICs group could overtake the largest western economies in scale. Since 2008, the leaders of BRIC countries have met annually to discuss the issues of global importance. At their third summit in China in 2011, the leaders invited South Africa to join, thus becoming the BRICS.[1]

For easy understanding the position of BRICS nations a brief description about their physical, demographic, political and economical facts and figures are written in the tables drawn below.

[1] Hau,M., Scott,J., & Hulme, D. (2012) . Beyond the BRICs: Alternative Strategies of Influence in the Global Politics of Development. *European Journal of Development Research*, 24(2), 187–204.

Table: 1.1

Facts and Figures of BRICS Nations

	Country	Official Name	National Flag	Surface Area	Population	Currency	Capital	Language	Political System
1	Brazil	Federative Republic of Brazil		8,515,767 km^2 (5^{th} largest)	202,768,562 (5^{th} largest)	Real (BRL) (R$)	Brasília	Portuguese	Presidential System
2	Russia	Russian Federation		17,098,242 km^2 (1^{st} largest)	143,975,923 (9^{th} largest)	Russian Ruble (RUB)	Moscow	Russian	Federal Republic
3	India	Republic of India		3,287,590 km^2 (7^{th} largest)	1,210,193,422 (2^{nd} largest)	Indian Rupee (INR)- ₹	New Delhi	Hindi	Federal Republic
4	China	People's Republic of China		9,596,961 km^2 (3^{rd} largest)	1,339,724,852 (1^{st} largest)	Renminbi (Yuan)- ¥	Beijing	Standard Mandarin	Communist State
5	South Africa	Republic of South Africa		1,221,037 km^2 (25^{th}largest)	51,770,560 (18^{th} largest)	South African Rand (ZAR)	Pretoria	Afrikaans	Constitutional Republic

Source: Developed by researcher from various sources.

Table: 1.2
Current Economic Status of BRICS Nations

S. No	Country	Economic Reforms stated in the year	GDP (PPP) (Trillion of US$)	GDP(Nominal) (Trillion of US$)	Current Exchange Rate System	Inflation (Percentage)	Foreign Exchange Reserve (Million of US$)
1	Brazil	1994	$2.416 (as on 2013)	2.25 (as on 2013)	Floating Exchange Rate Regime	6.20% (as on Dec 2013)	365,547 (as on Feb, 2015) – 6th Position
2	Russia	1991	$2.553 (as on 2013)	2.10 (as on 2013)	Managed Floating Exchange Rate Regime	6.76% (as on Dec 2013)	352,900 (as on Mar 20, 2015) – 8th Position
3	India	1991	$4.99 (as on 2013)	1.88 (as on 2013)	Managed Floating with no predetermined path for the Exchange Rate to floating	10.91% (as on Dec 2013)	335,730 (as on Mar 13, 2015)- 9th Position
4	China	1978	13.39 (as on 2013)	9.24 (as on 2013)	Managed Floating Exchange Rate based on market demand and supply with reference to a baskets of currency	2.63% (as on Dec 2013)	3,945,932 (as on Sep 2014) – 1st Position
5	South Africa	1994	0.59 (as on 2013)	0.35 (as on 2013)	Floating Exchange Rate Regime	3.31% (as on Dec 2013)	49,102 (as on Dec 2014) – 38th Position

Source: Developed by researcher from various sources.

1.2. a) Current Status of BRICS:

BRICS is the most reverberating economic acronym in the last one and half decade. Since the inception of this block in 2008, the economic analysts around the globe started observing the changing patterns of economy in these countries from time to time. From then the leaders of these countries are annually meeting to discuss the issues of global importance. This emerging economic block is gradually gaining control in the global governance. The role of the BRICS in the international politics, international trade is growing year by year. Even though this group of economies is economically, socially and politically different some commonalities brought them under one group. Since its inception in 2008 all the group members yearly were conducting summits to take major developmental decisions in all the spears. From its inception to till date a total of six BRICS summits were held. In July 2015, the group is going to meet in its 7^{th} consecutive summit, which is to be held in Ufa, Russia. The detail list of important issues discussed and resolutions taken in all the summits are given below in a **Table 1.3**.

The current population of BRICS is 2.99 billion comprising of 41.6 percent share of total population and with a combined GDP of $15.8 trillion comprising 19.8 percent share of world GDP that grow more than 300 percent in the last decade. BRICS nations with total share of 16.9 percent in world's total trade proved as worlds emerging market. Though these nations are contributing much in the development of global economy, they have a very little role in the international institutions. The developing nations got frustrated over the domination of western in IMF and World Bank, so the BRICS launched new financial institutions to serve as alternatives to World Bank and IMF. The main aim of the new development bank with $100 billion is to invest in infrastructure development activities in developing nations and the Contingent Reserve Arrangement (CAR) will hold the reserves to stabilize the nations in balance of payments crisis. This will help the BRICS nations to get the economic independence from the US dominated banking system and to play a significant role in the global governance with the German, Indonesia move to join the new BRICS bank it grabbed the attention of the western world.

Table: 1.3
List of BRICS Summits

No	Summit No	Year	Chairman	Host City & Country	Resolutions
1	BRIC Summit I	16th June 2009	Dmitry Medvedev	Yekaterinburg Russia	Announced the need for a new global reserve currency.
2	BRIC Summit II	15th April 2010	Luiz Inacio Lula da Silva	Brasilia, Brazil	Discussed Iran and nuclear weapons, reforms of financial institutions and issues of global governance.
3	BRICS Summit III	14th April 2011	Hu Jintao	Sanya, China	1. South Africa joined as 5th member in the group. 2. Early conclusion of UN general assembly Convention on terrorism. 3. Cease of U.S. dollars in mutual trade payments & started to give credits to one another in their national currencies. 4. Against NATO strikes in Libya civil war.
4	BRICS Summit IV	29th March 2012	Manmohan Singh	New Delhi, India	Creation of new development bank, reforms in multilateral institutions.
5	BRICS Summit V	26th-27th March 2013	Jacob Zuma	Durban, South Africa	Announced $100 billion for new development bank.
6	BRICS Summit VI	14th to 16th July 2014	Dilma Rousseff	Fortaleza, Brazil	Signed agreements between BRICS export credit agencies and agreement of cooperation on innovation.
7	BRICS Summit VII	8th -9th July 2015 (to be held)	Vladimir Putin	Ufa, Russia	About the action plan for new development bank and BRICS universities league.

Source: Developed by researcher from various sources

1.2. b) Strengths of BRICS:

The BRICS represents about 40 percent of the world population; encompass over 25 percent of the worlds land coverage and comprise huge natural resources. Inter-trade between these countries growing by 30 percent per year, this is the key view, it's the biggest economy in the world if these countries start to implement a closed inter trading system among themselves.

1.2. c) Summary of Each Country Economy:

➢ Brazil Economy:

With abundant natural resources and a population of 190 million, Brazil is one of the 10 largest markets in the world. The Brazilian economy relied mainly on the export of agricultural products such as sugar, coffee and precious minerals. After the World War II Brazil undergone rapid industrialization and technological advancement in the period 1968-1973 and the expansion in the export capacity of manufacturing goods were took place in the 1974–1980 period. Due to world oil crisis Brazil faced many difficulties in the period between 1981 and 1994, and it was fuelled by many other external and internal reasons like low GDP growth, increased external debts, and internal failure in inflation stabilization programs and also political instability in 1992.

With a change in the political system in 1994, government brought reforms in the monetary policy, more liberalized open economy and encouraged systematic privatization of government owned companies. As part of the changes the Real Plan was implemented, and this plan was used as catalyst to reduce the inflation rate from more than 5,000 percent to 20 percent in 1996 and eventually brought back the annual inflation rate in the range of 5 percent. Since 2003 the Brazilian economy started growing rapidly, influenced by the world trade boom. The Asian crisis affected the Brazil economy and the growth was very low of 0.04 percent and it was followed in subsequent year with 0.26 percent, from 2000 the growth rate was steadily increasing and reached 6.10 percent in 2007. In 2008, the economic growth reduced to 5.2 percent. Nevertheless, the stunning drop in world demand has affected the domestic economy. The GDP growth after the crisis was low but stable till date.

➢ Russian Economy:

Russia has come across many painful ways in its transition period in the early 1990's. After collapse of Soviet Union in 1991, Boris Yeltsin has taken power and introduced radical economic reforms. Russia is the chief exporter of oil products and natural gas. The economic growth is completely dependent on the demand and supply of the natural resources. The Russia's export revenues from oil and natural gas rose by 164 percent during the period from 1998 to2003. During 1993-94 privatization program took place, 70 percent of the Russian economy was moved into their hands. Drop in oil prices, Ruble crisis, and Asian crisis pushed the country to go for IMF which helped them to quickly set back the economy. The economy of Russia is highly volatile to the external shocks and it was observed negative growth rate during 1998 and 2009. At present its growth rate is slow compared to the other developing nations.

➢ Indian Economy:

India is the second most populous nation and is one of the fastest growing economies in the world. India economy is the 10^{th} largest (real GDP) and 3^{rd} largest by purchasing power parity (PPP). Since independence in 1947, the country tried to get self-sufficient and started implementing five year plans from 1950. Initially Indian economy was completely dependent on the agricultural and exports of raw materials. Later on heavy industries were established and green revolution also helped the economy. After the fall of Soviet Union, which was India's largest trading partner and the gulf war in 1991, India pushed into serious external debt crisis with rising inflation. In that situation the International Monetary Fund extended help on condition that India should liberalize the economy to international trade. India's economic reforms began in 1991 followed by the crisis which was triggered by above mentioned reasons. With the implementation of liberalization, privatization and globalization, Indian economy has grown as one of the fastest growing developing countries. The trade liberalization has changed the economic structure of India. The FDI has encouraged, privatization has increased and tertiary and service sectors were extensively developed. The last two and half decades the growth rate of India saw its peaks and troughs. The first decade from 1992-2002 the average growth rate was around 6 percent. Next one half decade was observed average growth rate of 6.9 percent. After the financial crisis the economy of

India has slow downed. Prior to the crisis it has reached above 9 percent annual growth rate in 2006 and 2007. India is the only country among BRICS showing consistent growth after the crisis also.

➢ Chinese Economy:

With the introduction of capitalistic free market reforms under the dynamic leadership of Deng Xiaoping in 1978, the China's economy has transformed and emerged as an economic super power and the fastest growing economy in the world. Once the China's economy was completely isolated from the global economy, centrally controlled and it was completely showed stagnant growth but now the scenario is completely opposite, fastest growing economy, highest average growth rate, highest reserves, leading the global economy. In this past three and half decades China observed an average GDP growth rate of 10 percent and became the 2nd largest economy in the world. The countries economy is mainly driven by the manufacturing goods and availability of cheap labour is another reason for its growth. Even though growth was achieved in numbers many other developmental things are pulling down in the country. According to estimates of World Bank, still 200 billion people are in below poverty line in China. At present, the growth of the China was slow downed and a shift in the macroeconomic policy towards balancing the growth and development.

➢ South African Economy:

South Africa is the second largest economy in Africa after the Nigeria. The South African economy has faced a number of headwinds in the past. After a long period of sanctions by the outside world, South Africa was welcomed by the global economic world in the mid 1990's. The country was successful in reinserting its economy with rest of the world. After new government took charge in 1994, it has faced many problems in the first decade of its democracy. The most worrying aspect in South Africa's low economic growth is its high unemployment. The GDP has increased to $400 billion and the reserves have increased to $50 billion from a very low of $3 billion. In the initial period of democracy from 1994 to 1997 there was an uncontrolled inflow of capital investment, depreciation of Rand and increased export pushed the economic growth of country. During 1997-98, the economic growth was dwindled to a low of 0.5 percent because of many reasons like Asian crisis, decrease of gold prices, and

appreciation of Rand to list out some. The steady depreciation of Rand helped to gain from exports and growth stands at 4.5 percent during 2000. Later up to 2003 there was a less demand for South African products and rise in inflation caused low growth. Again after 2003 the South Africa brought reforms and more liberalized on current account, from then to till date the country observed sustainable growth except during 2008 financial crisis.

1.2. d) Commonalities and Differences among BRICS Nations:

Moreover, these countries are different from one another in many aspects like different in their culture, political system, background, languages, demographics, the structure of their economies and the integration with the world market. China economy is based on manufacturing sector, Indian economy is based on service sector, Russian economy is based on oil and natural gases, and Brazil economy is based on raw material export and manufacturing goods, finally South African economies is based on export of raw materials. In recent times there was a lot of criticism on the stand of BRICS nations in the UN Security Council voting on Syria. The heads of the nations announced that, they are committed to the development of the group interests and to play a significant role in the global decision political order.

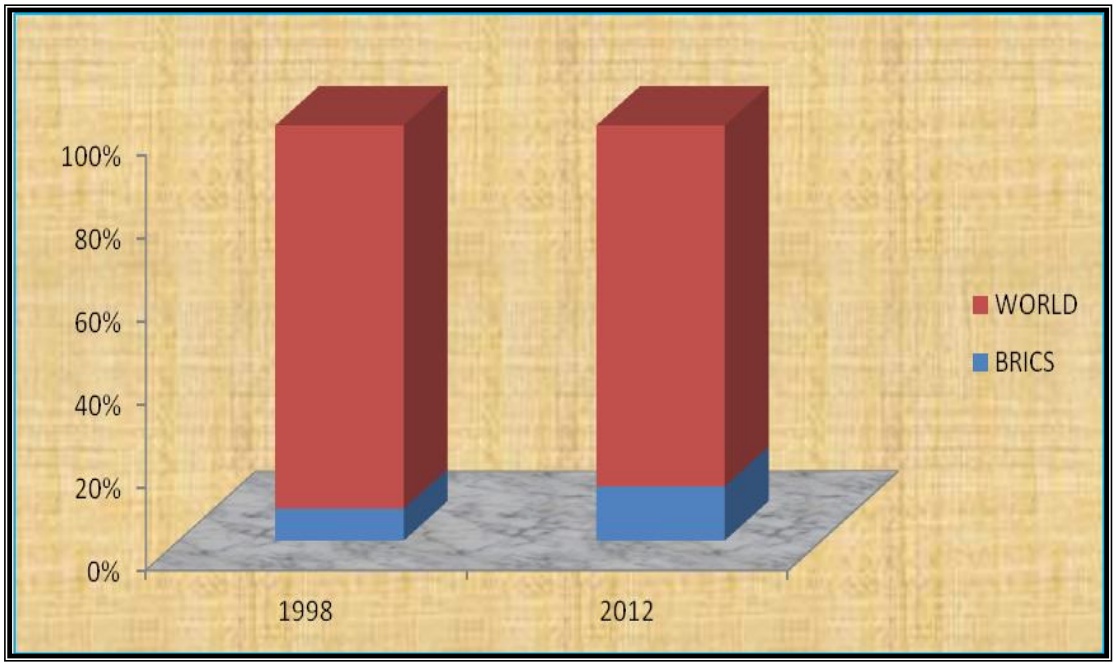
Apart from diversities, these countries possess some commonalities like growing middle income population, vast surface area with abundant natural resource, all are developing nations, and governments are greatly opened up their economies to squeeze the global market and are committed to the growth and development of their nations. Among these the GDP growth rate and population are the most important parameters taken to predict the future of this emerging block by the Jim O'Neill. Following paragraphs describe in depth about these variables.

1.2 e) GDP of BRICS in World Economy:

Starting with a share of little over 10 percent in world Gross Domestic Product (GDP) and less than 4 percent in world trade in 1990, BRICS (with the recent inclusion of South Africa to the forum) now constitutes about 25 percent of world GDP in terms of PPP(Purchasing Power Parity), and 17 percent of world trade. The increase in GDP implies that the economic size of BRICS in terms of its share in world GDP has expanded by 150 percent in the past two decades, and they also estimated that the GDP of these countries may cross 47 percent of the world GDP, and will emerge as strong economic power in the world, and they contribute one fifth of the global economic output. The change in GDP of BRICS nations is given in diagrammatic representation in **Figure: 1.1.**

Figure: 1.1

Change in GDP of BRICS over the time period (1998-2012)



Source: World Bank, 2013.

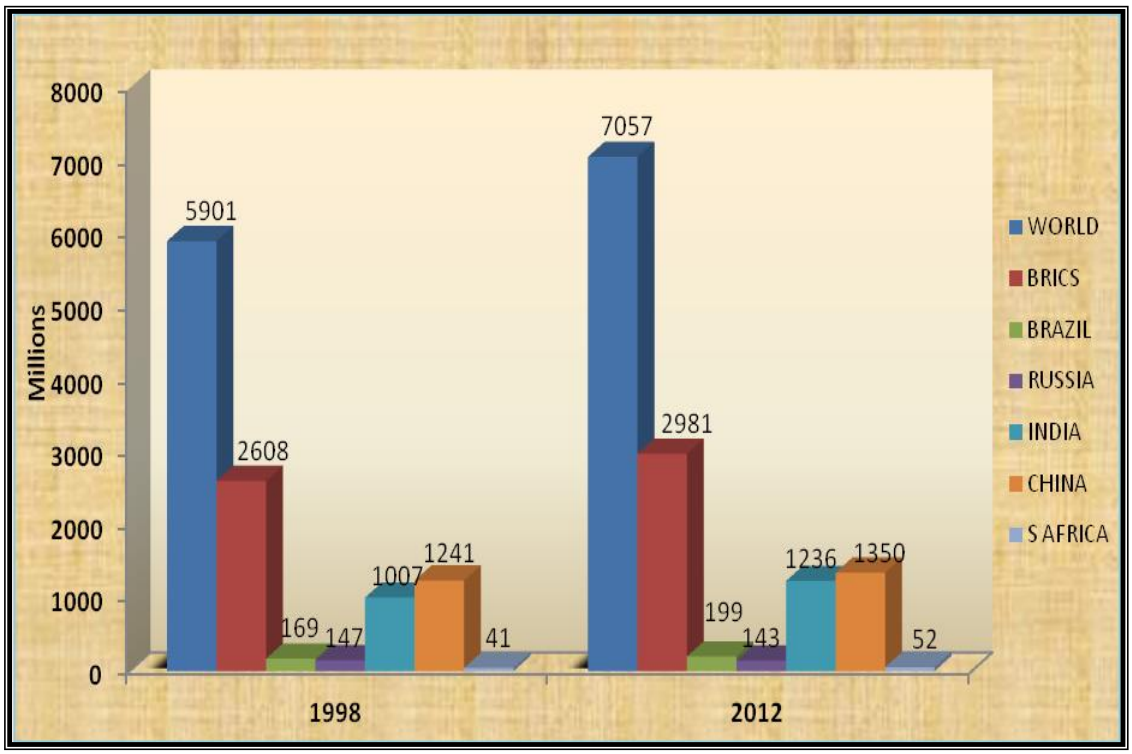
1.2 f) Population in BRICS:

The overall population of BRICS accounts for 40 percent of the world population. The most populous nation's China and India shares a major part in the

group. China population is 1357 million (as on 2013), India population is 1211 million (as on 2011 census), Russia population is 144 million (2013), Brazil population is 201 millions but economically active population is more in this country accounts for 65.9 percent as on 2012 and finally the south Africa population is 52 million with low economically active population accounts for 35.4 percent as on 2012. At present the demographic advantage is very high in China, the working population of the china is its most valuable resource. In the next two decades India will have these demographic features. Brazil and South Africa are currently observing rapid growing of middle income population and Russia is facing the problem of ageing. The growing middle income population in Brazil and India are the welcoming feature of these nations to gain the demographic advantage. The changing trend in population of each country is given in Figure 1.2.

Figure: 1.2.

Population (in Millions)



Source: World Population Data Sheet, 2012 & World Bank, 2013.

1.2. g) Description of Variables under Study:

At present the economy of each and every country is trapped in interdependent global economic web. They are mutually dependent on one another's in imports, exports, fiscal and monitory stability. This brought great challenges and opportunities to the emerging economies. These countries have greater trade openness to the international trading and are more affected by inflation. According to **Axel Dreher, Roland Vaubel (2009)[2],** more open countries are expected to hold more reserves as they are more vulnerable to external shocks. That means if there is high changes in exchange rate, the reserves level are likely to be volatile, which leads the countries to accumulate more reserves. To correct this volatility in exchange rates the central banks intervene by selling the foreign currency accumulated by it or the central bank taken some monetary policy to increase the capital inflows to domestic country**. Roland Vaubel (1991, 2005)[3]** also pointed that exchange rate intervention[4] can be used to reduce the volatility in exchange rate. Many other broad macro economic variables play a key role in the country's economic development. This study focused on the role of exchange rate intervention (Exchange rate and Forex reserves) and trade openness on the economy of BRICS countries, and the share price movement, inflation, GDP and sacrifice ratios are considered as proxy variables to see the growth of economy of BRICS nations.

The BRICS economies operate under varied monetary policy frameworks. Brazil and South Africa have inflation targeting regimes, while other countries follow multiple indicator frameworks. There are various other indicators, such as trends in inflows and outflows of foreign direct investment, trade openness, current account balance, forex reserves and economically active labour forces that could make BRICS a formidable force to reckon with in future.

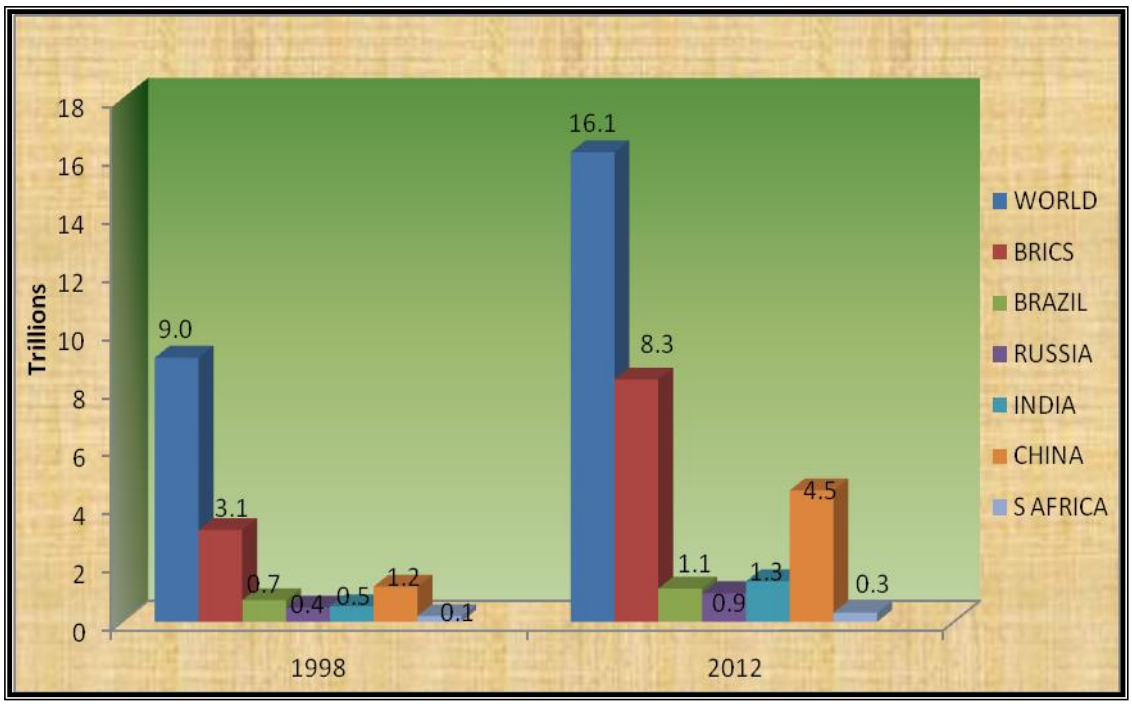
[2]Dreher.D & Vaubel.R (2009), Foreign exchange intervention and the political business cycle: A panel data analysis, *Journal of International Money and Finance*, 28(5), 755-775.
[3]Vaubel.R (2005), Foreign exchange accumulation by emerging and transition economies: An explanation and critique", Aspekte der internationalen Ökonomie, 77-84.
[4]Exchange rate intervention means percentage change in the reserves of a country in the disinflation process.

1.2.h) Real GDP in BRICS Nations:

The real GDP of the world during 1998 is 9 trillion US dollars and the BRICS nations comprises one third of the total world share that is 3.1 trillion US dollars. In one and half decade the world real GDP has increased to 16.1 trillion US dollars and the BRICS real GDP also increased more than 150 percent of its 1998 GDP and this production is more than half in the total world real GDP. China alone constitutes half of the BRICS Gross Domestic Production and one fourth of the total World Production. Among the five BRICS nations China has seen tremendous growth in the study period nearly four times growth was observed, starting from 1.2 trillion US dollars in 1998 to 4.5 trillion US dollars in 2012. Remaining four countries except South Africa was at the same level of production nearly one trillion US dollars.

Figure: 1.3.

Real Gross Domestic Product (GDP) of World and BRICS Countries (Trillion USD)

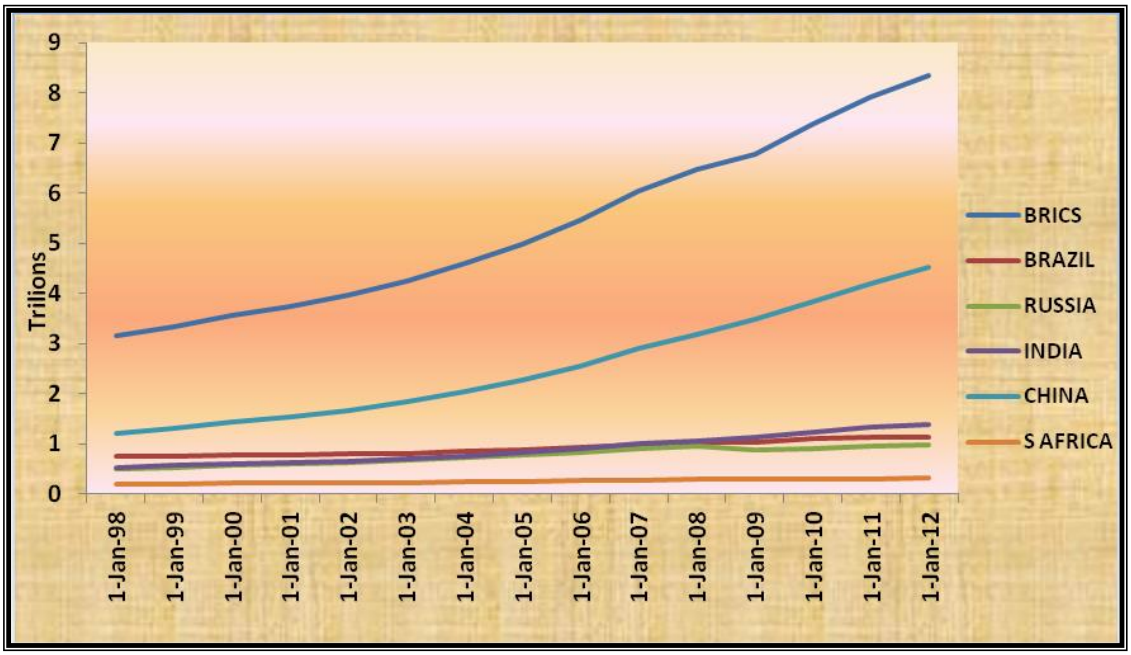


Source : World Bank, 2013.

The changing trends of the real GDP in the sample period was shown in **Figure: 1.4.** Monthly wise data of real GDP was used in plotting the graph.

Figure: 1.4.

Real GDP of BRICS Countries (1998-2012, Trillion USD)



Source: World Bank, 2013.

1.2. i) BRICS - Exchange Rate:

Exchange rates were playing a major role in the nation's economy; we observed that in past most of the international capital market related crises were somehow involved a fixed or pegged exchange rate regime, the countries with floating exchange rate were avoided the same crisis. To list out some, in 1994 Mexico and in 1997 Thailand, Indonesia and Korea, in 1998 Russia and Brazil, in 2000 Argentina and Turkey, has affected with capital market crisis with pegged exchange rate system. At the same time countries that did not have pegged exchange rate system like South Africa, Israel in 1998, Mexico in 1998 and Turkey in 1998 were able to avoided crises successfully. So it is imperative in this highly interconnected economic regime growing international trade to have a good exchange rate for economic development and stability in the dynamic economic world.

➢ The Dynamics of Exchange Rates:

Exchange rate between currencies have been highly unstable since the collapse of Bretton Woods System of fixed exchange rates, which lasted for 27 years, i.e., from 1946 to 1973. Under the Bretton Woods System, the exchange rates were fixed at levels

determined by governments. Under floating exchange rate in vogue since 1973, exchange rates are determined by people buying and selling currencies in the foreign-exchange markets. By the late sixties Friedman's view had become widely acceptable by economists, many businessmen and bankers. Therefore, concern over the instability of floating exchange rates was replaced by an appreciation of the greater flexibility that floating rates would give to macroeconomic policy. The main advantage was that nations could pursue independent monetary policy and adjust easily to eliminate imbalances in payments and offset changes in their international competitiveness. This change in attitude helped to pave the way for the abandonment of fixed rates in 1973.

Since then most of the developing nations were adopted floating exchange rate system. Based on the condition of their economy the BRICS nations have following different exchange rate systems. The present exchange rate system of each nation is described in below paragraphs.

- To control the high inflation caused by the internal policy failure and increasing external debt forced Brazil to adopt floating exchange rate system. It removed all sanctions on current account transactions in 1999. The exchange rate of Brazilian currency Real against the US Dollar is at an average of $2.26 till the end of 2010.

- In 1996 Russia agreed to the IMF obligation to ease the restrictions on current account transactions. Russian's exchange rate system has adopted other managed arrangements to overcome the oil crisis in 1998 and in exchange market steadily appreciation of Russian currency Russian Ruble against the dollar till 2008 global recession. With this Russia adopted managed floating exchange rate system at the end of 2008 and it eased all restriction in the foreign transactions both in capital and current accounts.

- At present the Indian currency Rupee is losing against Dollar. It is following managed floating with no predetermined path for the exchange rate to float. Frequent RBI interventions helps to check the volatility in the exchange rate system in India and it removed restrictions on transactions in 1994.

- China in 1996 accepted the IMF obligation to remove the restrictions in transactions on current account. With a largest export market China adopted

managed floating exchange rate system based on the demand and supply of the market with reference to a basket of countries since 2005. Sometimes china devaluated its currency in order to increase the exports. The Chine's currency used against US dollar is Renminbi.

- South Africa has adopted flexible exchange rate system in order to come out the high inflations caused by external financial sanctions and internal policy failures. Excess capital flow forced to reduce the value of Rand in some cases. In 1973 South Africa agreed to IMF obligation to remove the restrictions on transactions in current accounts.

Table: 1.4.

Growth Rate of Domestic Currency against USD

Nominal Exchange Rate (Domestic Currency Vs Dollar)					
Year	**Brazil**	**Russia**	**India**	**China**	**South Africa**
1998	1.21	19.99	42.55	8.28	5.89
1999	1.84	26.8	43.48	8.28	6.15
2000	1.96	27.97	46.75	8.28	7.64
2001	2.36	30.09	47.92	8.28	11.6
2002	3.63	31.84	48.14	8.28	8.95
2003	2.92	29.44	45.59	8.28	6.5
2004	2.72	27.92	43.98	8.28	5.71
2005	2.28	28.81	45.64	8.08	6.35
2006	2.15	26.29	44.64	7.82	7.04
2007	1.79	24.57	39.44	7.37	6.81
2008	2.39	28.13	48.63	6.84	9.97
2009	1.75	29.94	46.63	6.83	7.48
2010	1.7	30.85	45.16	6.65	6.84
2011	1.83	31.45	52.67	6.33	8.18
Mean	**2.18**	**28.15**	**45.80**	**7.71**	**7.51**
SD	**0.61**	**3.11**	**3.14**	**0.74**	**1.68**
CV (%)	**27.93%**	**11.04%**	**6.86%**	**9.59%**	**22.34%**
CAGR	**3.23%**	**3.55%**	**1.65%**	**-2.04%**	**2.56%**
t-value	**-.374^{NS}**	**1.752^{NS}**	**1.169^{NS}**	**-7.263*** **	**0.306^{NS}**

Source: Developed by researcher in this study by using Federal Reserve's data.
***** - Significant at 1 percent level**
NS - Not Significant

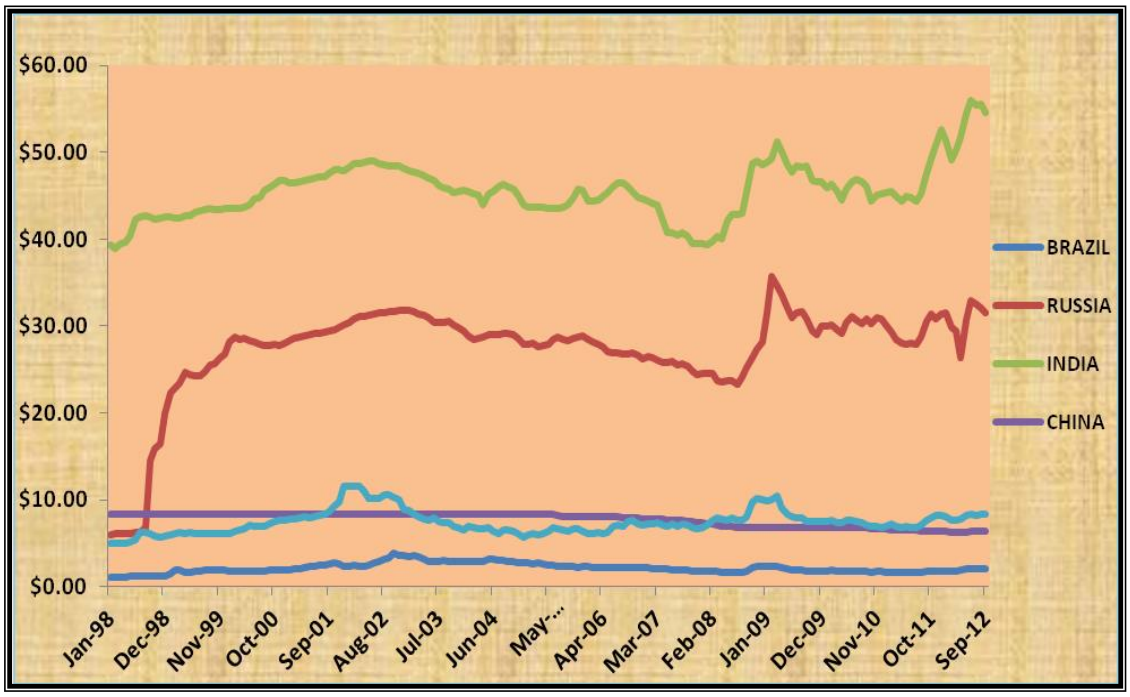
The growth rate of nominal exchange rates are calculated and placed in the **Table: 1.4.** It explains the growth variations from 1998 to 2011. Among the five nations

Russia possessed highest compound annual growth rate of 3.55 percent, following it Brazil growth rate observed as 3.23 percent. India and South Africa growth rates are 1.65 percent and 2.56 percent respectively. Only China exhibits negative growth rate of -2.04 percent. It means the exchange rates of all currencies with dollar are increasing except China currency Renminbi. Till 2005 the exchange rates of Renminbi are constant and later gradually decreased with the affect of global slowdown. High fluctuations were observed in South African exchange rates in the study period. Indian rupee is losing over the time period. The result of t value shows the growth rate of China is significant and positive. It indicates that China has maintained the exchange rate system in a frequent manner and all remaining countries in this group are not significant meaning that no sufficient growth variation to their domestic currencies.

Figure: 1.5

Trends of Exchange Rates of BRICS Nations

(Domestic Currency Vs Dollar 1998-2012)



Source: Federal Reserve,2013.

1.2.j) BRICS - Forex Reserves:

The growth rate of Foreign exchange reserves are calculated for all the BRICS nations and placed in **Table 1.5.** Maintaining forex reserves indicates the capacity of the nation to withstand the external shocks. This economic block has increased the capacity of its reserves over the last decade and suppressed the developed nations in terms of reserves. The t-value of BRICS (8.825) indicates the positive and significant growth in the reserves. Highest growth rate was observed in China, after 2003 it has observed exponential reserves growth. Over the period the compound annual growth rate of BRICS is 16.44 percent and for individual country the Russia observed highest CAGR with 34.23 percent. The financial crisis in August 1998 in Russia made them to devaluate the Ruble in 1998, so the reserves were depleted in 1999. With reforms from then till mid 2008 it observed economic growth. It has observed negative growth rate in 2009 because of global financial crisis in 2008 from then it is slowly accumulating the reserves. In India the reserves are increasing year by year in the study period except 2009 and 2010 followed by global crisis in 2008. The change in government in 2003 helped to encourage new economic reforms and facilitated accumulating reserves more. The CAGR value of India is 20.17 percent and Brazil and South Africa also observes two digit significant growths with 14.3 percent and 18.25 percent respectively. The CAGR value of China is less in the BRICS group with 8.72 percent. During the study period among to BRICS Counties, if we consider t-value, Indian foreign exchange reserve growth is the highest ($t=20.17$, $p<0.001$) followed by South Africa ($t=9.33$, $p<0.001$), Russia ($t=7.68$, $p<0.001$), China ($t=5.53$, $p<0.001$) and Brazil ($t=5.28$, $p<0.001$). When compares to BRICS together ($t=8.82$, $p<0.001$), India ($t=11.528$, $p<0.001$) and South Africa ($t=9.33$, $p<0.001$) are showing higher average growth and China ($t=5.53$, $p<0.001$), Russia ($t=7.68$, $p<0.001$) and Brazil ($t=5.28$, $p<0.001$) shows less than average growth.

Table: 1.5
Growth Rate of Foreign Exchange Reserves for BRICS Nations

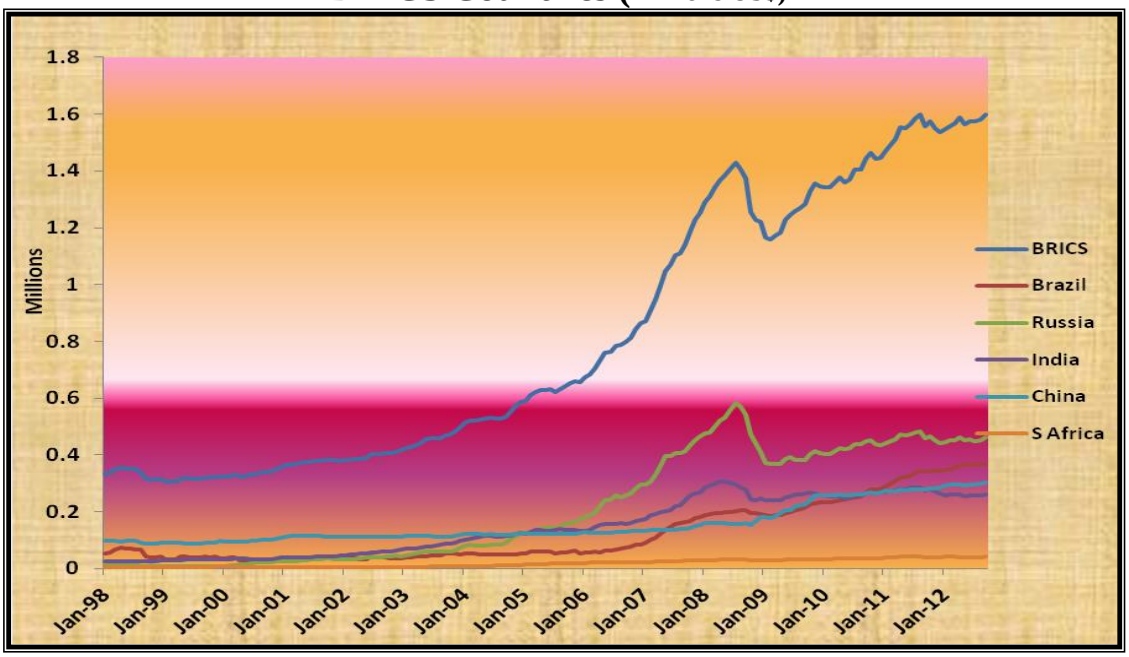
Foreign Exchange Reserves (Millions US$)						
Year	**Brazil**	**Russia**	**India**	**China**	**South Africa**	**BRICS**
1998	689745	120459.5	305291	1124311	54661.2	2294468
1999	455818.7	87812.4	361248	1083741	58413.73	2047034
2000	376535.2	209233.8	407282	1182638	71446.7	2247136
2001	431189.2	365471.8	494474	1362323	69483.29	2722941
2002	435850.6	465157.4	671504	1336594	68117.23	2977223
2003	551443.7	701274	970882	1368728	71495.1	3663823
2004	603349.6	1086804	1356462	1453239	113112.2	4612966
2005	695160.1	1761075	1605045	1473135	190531.5	5724947
2006	807336.2	2877596	1853393	1542636	255381.4	7336343
2007	1703085	4664996	2624848	1675666	310539.8	10979135
2008	2359550	6077947	3374466	1936263	362795.5	14111022
2009	2463294	4623753	3041114	2570287	376103.6	13074552
2010	3042402	5130930	3097587	3135429	416684.6	14823033
2011	3921056	5529811	3326927	3332701	483227.3	16593722
Mean	**1124212.25**	**2167116.15**	**1551045.85**	**1634230.00**	**186058.91**	**6662663.31**
SD	**929437.92**	**2214100.16**	**1144714.13**	**597902.14**	**139494.01**	**4876194.82**
CV(%)	**82.67%**	**102.17%**	**73.80%**	**73.80%**	**36.59%**	**73.19%**
CAGR	**14.3%**	**34.23%**	**20.17%**	**8.72%**	**18.25%**	**16.44%**
t-value	**5.283*** **	**7.684*** **	**11.528*** **	**5.537*** **	**9.334*** **	**8.825*** **

Source: Developed by researcher in this study by using IFS data.
***** - Significant at 1 percent level**

All the BRICS nations accumulated significant share of international reserves since the last decade. These reserves are used in the future balance of payment crisis. Though the external debt increased in all these countries the magnitude is declining. The reserves of the BRICS comprises more than 50 percent share in total global reserves. It observed a tremendous growth in last two decades, from a total of 4.2 percent share in 1990 to 40.1 percent share in 2010. China with highest reserves in the world holding nearly $4 trillion as on 2014, contributes major share in the BRICS countries. China alone contributes more than 30 percent of world reserves share. Among the BRICS only South Africa is having fewer reserves $38.4 billion remaining three countries Brazil, Russia, India together constitute $1 trillion reserves contributing 10 percent of the world total reserves. The second opening of international trade in 2003 boosted the accumulation of reserves in all the BRICS nations. There was a fall in the reserves during the year 2009 and 2010 in Russia and India in view of 2008

financial crises Brazil, China and South Africa shows increasing foreign exchange reserve even during and followed by financial crises 2008.

Figure: 1.6
Trends showing Foreign Exchange Reserve of BRICS Countries (Millions US$)



Source: International Financial Statistics (IFS), 2013.

1.2. k) BRICS - Trade Openness:

The concern for any government in the world is economic growth of their countries. The literature point's, international trade as a key source of economic growth and the degree of exposure to international trade is referred as its trade openness. **Chang et al., 2009** and **Lee et al., 2004** define trade openness as the ratio of the sum of imports and exports to GDP. Since the concept of trade openness is not a single dimensions to calculate with trade alone there are many other factors which influence the trade openness but the sum of imports and exports are directly related to GDP growth rate. In 1990s the World Bank observed that, the increase in trade to GDP ratio made an increase in per capita income of people so it concluded that countries which are open up will increase their growth. The International Monetary Fund (IMF) considers that lower the degree of trade makes countries more volatile to external debt crises; it is because of low export revenues by these countries. From the past experiences all nations who are internationally connected has come to form international institutions in order to protect their economies.

After series of crisis around the globe, in 1948 GATT was established to decrease the quotas and tariffs in the trade and UNCTAD (United Nations Conference on Trade and Development) which was established to liberalize the trade between countries. WTO (World Trade Organization) which was formed instead of GATT in 1995 used as catalyst in the openness of the countries to the world trade. In other way countries are imposing restrictions on trade by increasing the invisible barrier both to protect the interest of the domestic industries and to increase the nation's income. The relation between trade openness and economic growth is still an empirical question in the economic analytical world. Many economist like **Dollar (1992), Ben-David (1993), Sachs and Warner (1995), Edwards (1998), Frankel and Romer (1999) and Hakura and Jaumotte (1999)** proved that there is link between trade openness and economic growth. Many cross country studies were done by them especially on developing and emerging economies which are open to the international trade.

Table: 1.6
Growth Rate of Trade Openness for BRICS Nations

Trade Openness (Millions US$)						
Year	**Brazil**	**Russia**	**India**	**China**	**South Africa**	**BRICS**
1998	0.0001476	0.000275	0.000144	0.000267	0.000291	0.000221
1999	0.0001314	0.000222	0.000143	0.000274	0.000272	0.000211
2000	0.0001443	0.000264	0.000156	0.000333	0.000292	0.000249
2001	0.0001462	0.000261	0.000148	0.000334	0.00027	0.000249
2002	0.0001339	0.000268	0.00016	0.000371	0.000258	0.000266
2003	0.0001498	0.000316	0.000181	0.000461	0.000314	0.000324
2004	0.0001839	0.000387	0.000226	0.000566	0.000395	0.000402
2005	0.0002182	0.000474	0.000285	0.000628	0.000433	0.000465
2006	0.0002493	0.000564	0.000325	0.000692	0.000482	0.000527
2007	0.0002893	0.00064	0.000377	0.00075	0.000544	0.000589
2008	0.0003599	0.000808	0.000493	0.000804	0.00059	0.000675
2009	0.000275	0.000567	0.000374	0.000631	0.000452	0.000519
2010	0.0003471	0.000711	0.000466	0.000774	0.000556	0.000642
2011	0.0004267	0.000892	0.000577	0.000866	0.000657	0.00075
Mean	**.00022876**	**.00047493**	**.00028964**	**.00055364**	**.00041471**	**.00043493**
SD	**.000097657**	**.000224343**	**.000147895**	**.000210749**	**.000135624**	**.000185419**
CV(%)	**42.69%**	**47.24%**	**51.06%**	**38.07%**	**32.70%**	**42.63%**
CAGR	**8.51%**	**9.47%**	**11.27%**	**9.47%**	**6.46%**	**9.86%**
t-value	**8.192*** **	**8.637**** **	**9.622*** **	**11.260**** **	**7.990*** **	**11.549*** **

Source: Developed by researcher in this study by using World Bank & OECD data.
***** - Significant at 1 percent level**

The changes in trade openness in BRICS nations during the sample period from 1998 to 2011 were observed by calculating the compound annual growth rate and't-value'. Among the nation's highest compound growth rate was observed in India with 11.27 percent followed by China 9.47 percent, Russia 9.47 percent, Brazil 8.51 percent and South Africa 6.46 percent if we consider CAGR. The overall annual compound growth rate of BRICS was observed as 9.86 percent. This growth rate was affected by all the BRICS Nations in 2009, 2010 followed by global financial crisis in 2008. The development of any nation is dependent on the degree of trade openness shown by the nation to the world. All the BRICS nations are open to the international trade and show a highly significant growth in the study period. If t-value of BRICS Nations together considered, this was t=11.55, p<0.001, and China was having highest t-value with 11.26, p<0.001 during the period. This is almost equal to average of BRICS Nations. India was followed by China t=9.62, p<001, Russia followed by India t=8.64, p<0.001, and Brazil t=8.19, p<0.001, and South Africa t=7.99, p<0.001 are followed by India respectively. In variably the trade openness was affected by all BRICS Nations due to financial crises 2008. All other nations are having t-value around eight. The growth rate of trade openness is also gradually increasing with greater monitory control over the international trade and capital inflows. The Federal Reserve's data was used to calculate values of growth rate of each country are given in tabular form in **Table 1.6.**

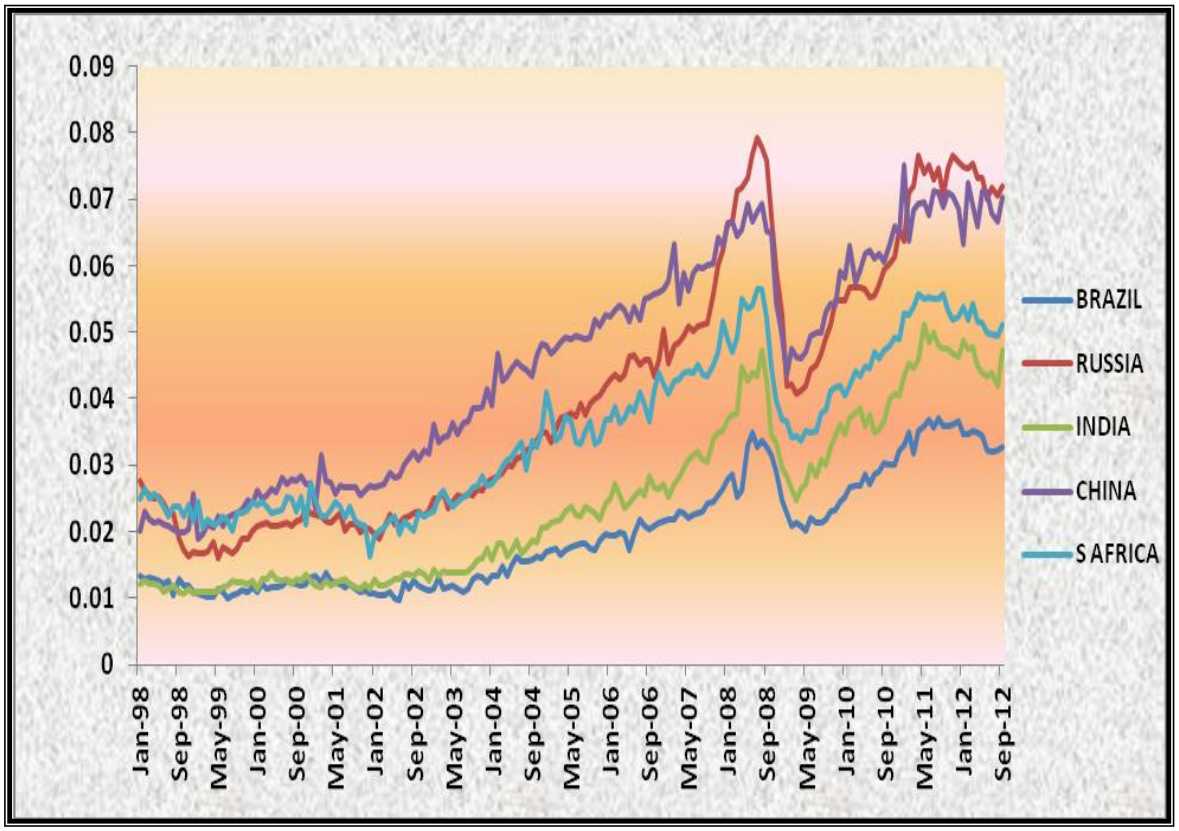
With increased integration into the world economy these developing economies has become much more important in the world trade. The share of developing countries in the world trade has increased from 29 percent in 1995 to 41 percent in 2010 and similarly the decline in the share of developed economies from 69 percent to 55 percent in the same time period indicates the important role of developing nations in the world trade. Among the developing countries BRICS nations are contributing a large part in the world trade. The combined trade constitutes around 15 percent of the world trade. The importance of trade in the country's economic growth can be observed in China, the trade in goods and services has increased from 32 percent to 66 percent in the country's GDP since 1990. The trade openness of each BRICS nation is showed below in the graphical representation. We can observe a steady increase in the trade openness of all five nations from 2003 and because of the global financial crisis in 2008 there was a deep fall in the openness in all countries, these nations took measures to overcome

the financial crisis and was able to overcome gradually. The trends of trade openness in BRICS nations are shown in **Figure 1.8**

Figure:1.8.

Trends of Trade Openness for BRICS Nations

(In Billion 1998-2012)



Source: OECD (Export and Import) , World Bank (GDP).

1.2.l) BRICS- Share Price:

Table: 1.7

Growth Rate of Share Price for BRICS Nations

Share Price						
Year	**Brazil**	**Russia**	**India**	**China**	**S Africa**	**BRICS**
1998	403.70	84.69	543.08	789.48	562.33	2383.28
1999	481.00	167.05	674.11	1060.90	593.90	2976.96
2000	707.50	349.06	749.74	1341.77	684.90	3832.97
2001	611.48	318.53	565.84	1052.58	742.37	3290.8
2002	500.33	506.04	529.86	875.32	848.96	3260.51
2003	627.88	712.35	626.80	859.59	741.23	3567.85
2004	972.02	961.43	904.79	1080.42	905.69	4824.35
2005	1200.00	1200.01	1200.01	1200.02	1200.00	6000.04
2006	1659.87	2305.11	1859.47	1412.93	1700.96	8938.34
2007	2318.53	2892.99	2595.28	1939.44	2259.31	12005.55
2008	2408.84	2372.87	2491.93	1749.05	2097.77	11120.46
2009	2298.75	1708.51	2331.96	1507.55	1137.32	8984.09
2010	2929.90	2380.65	3027.40	1797.78	1157.58	11293.31
2011	2679.90	2669.46	2947.52	1792.93	1263.97	11353.78
Mean	**1414.26**	**1330.63**	**1503.41**	**1318.55**	**1135.45**	**6702.31**
SD	**931.49**	**1023.73**	**985.05**	**388.84**	**540.63**	**3707.15**
CV (%)	**65.86%**	**76.94%**	**65.52%**	**29.49%**	**47.61%**	**55.31%**
CAGR	**14.48%**	**27.95%**	**12.84%**	**6.03%**	**5.96%**	**11.80%**
t-value	**10.112*** **	**7.689*** **	**8.482*** **	**4.936*** **	**3.085*** **	**80.04*** **

Source: Developed by researcher in this study by using IFS data.

***** - Significant at 1 percent level**

The growth rate of share prices are calculated for all the BRICS Nations and placed in above **Table:1.7.** Share prices are considered as most crucial in the development of nation's economy. Especially in developing countries which are open to the international market, the share market is considered as key factor for international

investors. Over the period the compound annual growth rate of BRICS is 11.80 percent and the individual country, Russia observed highest CAGR with 27.95 percent followed by Brazil 14.48 percent, and India 12.84 percent. The CAGR of China and South Africa observed lowest rate at 6.03 percent and 5.96 percent respectively. During the study period if consider the t- value all the country has shown significant growth in the stock market. (Brazil t=10.11, p<0.001, India t=8.48, p<0.001, Russia t=7.69, p<0.001, China t=4.94, p<0.001 and South Africa t=3.09, p<0.001).

1.2.m) BRICS- Real Gross Domestic Product (GDP):

Table: 1.8
Growth Rate of GDP for BRICS Nations

Real Gross Domestic Product (GDP)						
Year	**Brazil**	**Russia**	**India**	**China**	**South Africa**	**BRICS**
1998	0.74	0.48	0.53	1.22	0.19	3.16
1999	0.74	0.52	0.58	1.32	0.20	3.36
2000	0.77	0.57	0.60	1.42	0.20	3.56
2001	0.78	0.60	0.63	1.53	0.21	3.75
2002	0.80	0.63	0.66	1.67	0.22	3.98
2003	0.82	0.67	0.71	1.84	0.22	4.26
2004	0.86	0.72	0.76	2.03	0.24	4.61
2005	0.88	0.77	0.83	2.27	0.25	5
2006	0.93	0.83	0.91	2.55	0.26	5.48
2007	0.98	0.90	1.00	2.91	0.28	6.07
2008	1.02	0.94	1.04	3.20	0.29	6.49
2009	1.03	0.87	1.14	3.50	0.28	6.82
2010	1.10	0.91	1.25	3.86	0.29	7.41
2011	1.13	0.95	1.33	4.22	0.30	7.93
Mean	**.90**	**.74**	**.86**	**2.39**	**.25**	**5.13**
SD	**.13**	**.16**	**.26**	**.99**	**.39**	**1.58**
CV (%)	**14.44%**	**21.62%**	**30.23%**	**41.42%**	**156.00%**	**3.80%**
CAGR	**3.07%**	**5.00%**	**6.79%**	**9.27%**	**3.32%**	**6.79%**
t-value	**18.766*** **	**16.156*** **	**17.566*** **	**16.801*** **	**19.263*** **	**20.55*** **

Source: Developed by researcher in this study by using World Bank data.
***** - Significant at 1 percent level**

The GDP growth rate during the sample period are mentioned in the **Table :1.9.** when compare to BRICS (6.79) China compound annual growth rate was the highest as 9.27 percent, followed by India 6.79, Russia 5.00 percent, South Africa 3.32 and

Brazil 3.07 percent. Referring to t- value, South Africa observed hifhest growth (t=19.26,p<0.001), followed by Brazil (t=18.76, p<0.001), India (t=17.57, p<0.001) and lowest value obseverd in China (t=16.80, p<0.001) and Russia (t=16.16, p<0.001).

1.3 Justifications of the Study

1. Recently the IMF announced that there is a slight downgrade in the economic growth of BRICS countries when compared with the expected global economic growth. As these five countries together account around 25 percent of world GDP, the study is very relevant in the global economic market.

2. In this present global economic condition, the developing countries are forced to open their economy to the outside world. This brings high interdependence between the countries. And they are highly dependent on exchange rate, forex reserve and the international trade.

3. After the failure of Bretton Wood fixed exchange rate system, the economists trying to find the relationship between exchange rate fluctuations and trade openness and in addition to this the role of Forex reserves also important in the developing countries, in particular the BRICS nations. So it is very relevant to study the relationship between these variables and their impact on economy of BRICS countries.

4. The abnormal fluctuations in exchange rate are generally controlled by the central bank through exchange rate intervention for stable economic conditions. As the exchange rate intervention requires these two key variables, exchange rate and forex reserve, it is important to study on this system.

5. All these developing countries to some extent depend on the outside world, in order to fulfill the social needs, infrastructure development and the demand for goods and services of people. These countries need huge investments to develop the economic and social conditions of the nation. In this process they undergo changes like high openness, grater fluctuations in exchange rate, inflations, forex reserves, share price movements etc. So to understand one country economic system we need to know the behaviour of variables such as

share price, inflation, GDP and sacrifice ratio, which are proxy to the economy.

6. In a developing economy the investments inflows takes place through investment in share of the firms in host countries share market. The more the value of share price, the more will be the GDP. The frequent fluctuation in the stock price which is highly connected to outside world brings a challenge to stabilize the share prices for a better economic progress. It gives a greater relevance in this economic block.

7. The open economy of the countries faces frequent fluctuations in the exchange rate, which shows an impact on share price. So it is necessary to study the relation between these two in order to be maintained a stable economic environment in the country.

8. As BRICS countries are open to the international trade, there is a high chance of getting frequently affected by the inflations. So in order to find the variables like exchange rate, forex reserve and trade openness in controlling inflation is a highly important to understand the economy of BRICS nations.

9. GDP is highly important variable to understand the economic condition of any nation. The BRICS group got such importance because of its stable growth rate in its GDP, It is mutually interdependent with other macro and micro economic variables. So to study the overall economy of the country is GDP it is necessary to know the behavior of other variables over a long time period.

10. At this juncture it is very important and relevant to know each and every country of the BRICS how they are following disinflationary practices and find out the role of sacrifice ratio in controlling the inflation.

1.4 Underlying Concepts

1.4.1 Exchange Rate Intervention

Exchange rate intervention means any official sale or purchase of a foreign currency against domestic currency in the foreign exchange market by the central bank of a country. Such interventions are done to contain persistent fluctuation in the forex market in an attempt to stabilize the domestic currency vis-à-vis major international currencies such as the dollar.

Intervention is based on accurate measurement of the current exchange rate as well as prediction of future exchange rate movements based on the current trend and global economic conditions. Exchange rate of a domestic currency is mainly measured against the greenback, which is the most of the circulated and promising global currency. Therefore the central banks of most countries maintain reserves comprising mainly the greenback which is then used for calibrated intervention in the currency market. Here, for analysis and discussion the term exchange rate intervention is the term used for two individual variables namely exchange rate and forex reserve and sees how these two variables are influencing the economy of BRICS countries.

1.4.1.a) Exchange Rate: In the ongoing process of globalization, it is very important to study the interaction of exchange rates and the overall economy of the countries. The international trade (exports and imports) of any country is dependent on the exchange rate system they follow. There are two types of exchange rates, one is fixed/ pegged exchange rate system and second one is floating exchange rate/market adjustment system. The exchange rate determines the decision of investors. In general, countries with high exchange rate faces high demand for exports and less demand for imports, consequently less demand for domestic products and countries with low exchange rate have more demand for export products. So production in the country will increase, which can boost the economy. The exchange rate is measured as per countries currency with US$ since US$ is used as a reference currency in the world economy.

1.4.1.b) Foreign Exchange Reserve: Foreign exchange reserve refers to the foreign convertible currency that a country's monetary authority holds, and that are used for the foreign payments. Forex reserve is used to intervene in exchange markets and to

withstand against the exigencies in the economy. Forex reserves are called as reserve assets in the balance of payments and are located in capital account. In this study forex reserve employed as foreign currency assets in terms of US dollar.

1.4.2 Trade Openness

Trade is the life blood of the country's economy. Trade openness is the real exports and imports to real GDP, as outcomes measures on openness of international trade of goods and services. The equation which described the calculation of trade openness is as follows:

Trade openness = Exports + Imports / GDP.

Trade openness plays a significant role in the economy of the country, especially in the developing nations. It brings more capital inflows into the country in the form of investments. Foreign investment helps the country to improve the domestic production of goods and services at low cost. It improves the production of export goods in efficient manner, which helps to improve the economy of the countries.

1.4.3 Share Prices

Share price movements are an important indicator to see the health of an economy. The developed economies generally have well established as well as deep stock market. Besides, a movement in stock prices gives first hand information about trends in the economy and they can used to gauge the pulse of an economy**.** Through this we can understand the future investment trends into the market. It is highly volatile in nature as the movements in share prices are caused by many factors like policy changes, exchange rate, trade restrictions etc. Therefore, a share price movement is taken as proxy variables to see the growth of economy.

1.4.4 Inflation

The inflation is described as general increase in price levels. The inflations are very common in developing economies as they are more open to international trade; there is a high chance of fluctuations in exchange rates due to liberal policies. Hence higher inflation rates, the central bank more frequently makes price adjustments (as inflation has higher variance). In normal stage inflation is comfort, when it is at 4 - 5 percent. At the same time economic accuracy is effecting the investment and slow down in the economy. So inflation is the important and opted indicator to explain the structure of economy.

1.4.5 Gross Domestic Product (GDP)

Gross Domestic Product has the ability to give an overall picture of the state of the economy. Through this we can predict whether the economy contrasting or expanding and we can also understand the depressions and inflations through GDP. The general definition of GDP is the total no of goods and services produced with in the country in a specific period of time. Real time GDP was employed in the study to know the proxy of the economy. It is usually calculated on an annual basis but to understand the changing pattern of GDP in real time basis we can use monthly GDP.

1.4.6 Sacrifice ratio

The monitory policy of the emerging economies is giving importance to control the inflation. Such measures come with a cost; the cost of reducing inflation can be quantified by the sacrifice ratio. The cost of reducing inflation includes a short term and long term loss. The short term loss defined as output loss, but long term loss is beyond the trough. The sacrifice ratio derives a relation between output loss and trend inflation.

Methods to Estimate the Sacrifice Ratio:

Ball (1994) developed a model to calculate the sacrifice ratio in different disinflation episodes during the time period. The most prominent method used as alternative to the linear **Philips curve (1958)** approach to calculate the sacrifice ratio is Ball's episode specific models (1994), According to him; the sacrifice ratio is computed as the ratio of the sum of deviations between trend output and actual output, to the

change in trend inflation over the disinflation episode. It allows variation in the sacrifice ratio by disinflation episodes even within the same country over time. Thus, it allows comparison of efficiency and effectiveness of the central monetary authority in disinflating the economy. To observe the fluctuations in the inflation, Ball (1994) has given the acceptable level of normal inflation as 1.50.

For calculating sacrificing ratio the following formula is used:

Sacrifice Ratio = (Actual Output - Potential Output)/Average Trend Inflation

- **Actual Output:** Actual output is measured as the actual amount occurred during the production of goods and services, as opposed to the amount that it could produce if they were to run at full theoretical capacity.

- **Potential Output:** Potential output is the maximum amount of goods and services produced by an economy in an efficient way at its full capacity. Often, potential output is referred to as the production capacity of the economy.

- **Trend inflation:** The moving average of actual inflation rate from the peak of inflation to trough over the period of disinflation.

- **Peak** inflation is a point in time where trend inflation is at its higher level.

- **Trough** inflation is a point in time where trend inflation is at its lower level.

- **Disinflation Episode** is the time range that starts with an inflation peak and ends at an inflation trough with an annual rate at least two points lower than the peak. The sacrifice ratio is lower when the disinflation episode is quick and increases with long disinflation episode.

1.5 Statement of the Problem and Research Questions

In this globalized world, the economy of each country is depends on one another, the failure of one country economic planning is affecting other countries economy. The key macroeconomic variable which plays a great role in shaping the economic development of the nations are need to be concentrated while framing the monetary policy of nations. Most of the economic slowdowns in the world are due to failure in monitoring theses important variables. The recent economic slowdown in

2008 affected almost all countries in the world but the BRICS block surprised the world by overcoming the economic slowdown at that instance but after two, three years the GDP growth rate was started declining. The problems are to identify and see the relationship between the major economic variables and its impact on GDP of the nations.

The research question is how these macroeconomic variables (exchange rate, forex reserve and trade openness related to the economy of BRICS countries (share price, inflation, GDP and sacrifice ratio).

1.6 Objectives of the Study

In order to address the above mentioned research issues the present study focuses on the following specific objectives.

1. To study the exchange rate intervention and trade openness on share price movements.

2. To evaluate the impact of exchange rate intervention and trade openness on inflation.

3. To evaluate the long term relationship between exchange rate intervention and trade openness with GDP.

4. To examine the exchange rate intervention and trade openness on sacrifice ratio.

1.7 Hypotheses

From the research questions and followed by objectives, the following research hypotheses were developed and tested as alternative form.

1. **Ha1**:The exchange rate intervention and trade openness affect the share price movements

2. **Ha2:** The exchange rate intervention and trade openness have any impact on inflation.

3. **Ha3**: There is a long term relationship between exchange rate intervention and trade openness with output

4. **Ha4:** There is a relationship of exchange rate intervention and trade openness with sacrifice ratio.

1.8 Methodology of the Study

1.8.1 Nature of study: The methodology of the study is an empirical one with fully depends up on the secondary data.

1.8.2 Sources of data: Data were collected from various databases such as Central Bank of Brazil, Central Bank of Russia, Reserve Bank of India, People Bank of China, South African Reserve bank, International Financial Statistics (IFS), Federal Reserve (the Central Bank of United States.), The Organization for Economic, Co-operation and Development (OECD) and World Bank.

1.8.3 Period of the study: The sample period of study was fifteen years from 01st January 1998 to 31th September 2012. The reason for limiting this study till 2012 September, because the recent data is not updated and the data collection was done at the end of year 2013.

1.8.4 Structure of data: Panel and Time series data were used for this study. For Panel data total number of observation is 885 for one variable but in Time Series total number of observation is 177 for each variable (it vary on the bases of estimating sacrifice ratio for each country).

1.8.5 Variables and its description

The following table shows the main variables used in the study

Table: 1.9

Variables Studied and their Description

Sl. No	Variables	Description
	Independent variables	
1	Exchange Rate	Nominal Exchange Rate of domestic currency (Brazilian Real, Russian Ruble, Indian Rupee, China Yuan and South African Rand) v/s US dollar.
2	Forex Reserve	Foreign Currency Assets in term of US dollar accumulated by the countries.
3	Trade Openness	Trade Openness is the ratio of international trade (Exports + Imports) divided by GDP.
	Dependent variables	
4	Share Price	Share price index of International Financial Statistics (IFS) updated.
5	Inflation	Percentage of Consumer Price Index (CPI)
6	GDP	The amount of goods and services produced with in the country. Annual GDP converted by monthly with Interpolates method.
7	Sacrifice Ratio	The ratio calculated by Ball method (1993) as actual – potential output / average inflation

1.8.6 Statistical Tools Used

The following are the main statistical tools were used to examine the above said objective and also testing the hypotheses

Table: 1.10

Statistical Tools used and their Purpose

Sl. No	Name of the Statistical Tools	Purpose
1	Panel Unit Root	For stationary checking
2	OLS Regression	For examining the relationship of exchange rate, forex reserve and trade openness on sacrifice ratio.
3	Fixed or LSDV Effects Model	For determine the individual intercept, but intercept does not vary over time (time invariance)
4	Random Effects Model	For estimating the common mean value of intercept and are not correlated with X, but making lack efficiency in the model
5	Hausman Test	For comparing fixed effects or random effects is appropriate
6	Wald Test	For comparing Fixed Effects with dummy or Pooled Regression Model is appropriate
7	GMM Method	For exploiting the Panel data to check both time and cross-sectional dimensions.
8	Pedroni Co-integration	For overall long-term relationship with GDP
9	FMOLS Method	For examining the individual effect of Least Square Regression (Exchange rate, Forex reserve and Trade openness) with GDP

1.8.7 Objective wise Hypotheses, Methodology, Statistical Tools and Findings

1.8.7. a) Procedure for 1st objective:

Research question: ***Does Exchange rate, Forex reserves and Trade openness affect the economy of BRICS countries?***

Objective: To study the exchange rate intervention and trade openness on share price movements.

Hypothesis (Ha1): The exchange rate intervention (exchange rate and forex reserve) and trade openness affect the share price movements.

Variables:

Endogenous **:** Share Price Movement.

Exogenous **:** Exchange Rate, Forex Exchange Reserve, and Trade Openness.

Econometric Models : Fixed Effect or LSDV Model, Random Effects Model, Hausman Test, Pooled OLS Regression Model and Wald Test.

The first objective is related to identifying impact of exchange rate intervention (Exchange rate and Forex reserves) and trade openness on share price movements. The study used Monthly data for the sample period from January 1998 to September 2012. Thus the study is very keen to address the relation between the exchange rate, foreign exchange reserves and trade openness (export + import / GDP) with stock price movement which is proxy to the growth of the economy of BRICS.

At this point, data sets are typically used as panel, all observations on a cross-section and time series entities such as countries, stock price, exchange rate, foreign exchange reserves and trade openness. The primary advantage of such a data stems from the large number of observations that become available and this leads to a greater reliability of parameter estimation. A panel data model can be written in the following form.

$$st_{it} = \beta_0 + \beta_1 ex_{it} + \beta_2 res_{it} + \beta_3 to_{it} + \varepsilon_{it} \quad \textbf{(1)}$$

For $i = 1,...,N$ and $t = 1,...,T$, where N and T design the cross-section and the time dimensions of the panel. Here i subscripts denotes the entities and't' denotes the time periods. There are N individual and T time periods in a typical panel. Thus st is a $NTx1$ stacked matrix of the dependent variable, ex, res, to are the $NTxK$ stacked matrix of the K independent variables, β is the $Kx1$ vector of the unknown parameters and ε_{it} is the error term. Thus $ex_{it}, res_{it}, to_{it}$ are the it^{th} observation on the K explanatory variables. The individual effect, β_{it}, is constant over time t and specific to the individual cross-sectional unit i. ε_{it} is assumed to have zero mean and constant variance and to be independently distributed overtime and individuals.

Findings:

- It is very interesting to note that the exchange rate fluctuations in all the five countries during the study period from 1998 to 2012 is almost insignificant in all the countries except China. Even in China also there is a significant change in the exchange rate, but negatively. This indicates during the study period all the five countries maintained/lowered (China only) their exchange rate in order to compete with world market and develop healthy financial atmosphere for investments. Further this shows they all marching together against other international markets.

- As per as forex reserve is concerned, no single country's forex reserve has declined during the study period. Invariably all the five countries forex reserve has improved **significantly,** particularly India (11.5) and South Africa (9.3) forex reserve has improved more than the increased growth of BRICS Countries together (8.8), other countries like Brazil (5.2), Russia (7.7) and China (5.5) their growth may be less than the BRICS countries as a whole but their growth is highly significant. This is also one of the reasons their domestic countries currency have not changed significantly.

- The trade openness refers to exports plus imports divided by GDP. When trade openness increases, correspondingly there will be increase in the international trade.

Here trade openness shows highly increasing trends in all the BRICS Countries during the study period. However China leads in this group with a t- value of 11.26 followed by India (9.62), Russia (8.64), Brazil (8.19) and South Africa (7.99). Except China all other countries trade openness t-value is close to 8, it indicates all countries except China their contribution towards international trade market is almost equal.

- In response to significant increase in foreign exchange reserve and trade openness in all the BRICS countries, their foreign exchange rate against USD have not increased much during the study period. All the BRICS Nations maintained their exchange rate at more or less same level. As a result of the above the stock market indices which is considered to be the proxy variable to see the growth of economy of BRICS nations has been increased significantly. In respect to "t" value Brazil shows highest t value of 10.11, which is considered to be first country in the group of nations and followed by India (8.48), Russia (7.69), China (4.94) and South Africa (3.09). Compound annual growth rate also shows the same trend.

- The share price movement is explained by 90 percent of independent variables (Exchange rate, Forex reserve and Trade openness).

- The exchange rate, forex reserve and trade openness coefficient value shows a positive relationship with share price movements.

- The exchange rate (CV 0.48, $p<0.01$) and forex reserves (CV 0.63, $p<0.01$) show highly significant beta coefficient value on share price movement. They indicate that countries with good monetary policy regarding exchange rate and forex reserves have positive impact on share prices.

- The trade openness also shows a high positive relationship with share price movements compare to exchange rate and forex reserve. It indicates every one unit changes in trade openness leads to 1.21 changes (CV 2.55, $p<0.01$) in share price. It shows that when BRICS nations open to the international trade there is a possibility of huge investment which ultimately increases the share prices of the firms.

- The result with dummy variables show that a significant relation between share price movement and other independent variables, when Brazil is taken as a reference and it is giving a mixed relation among the BRICS nations. They show a positive significant relation in Brazil and South Africa and negative significant relation in Russia, India and China.

- This result can also be verified by using dummy variables where stock prices of Brazil and South Africa are more than the other three countries, Russia, India, and China.

- Over the period of time the forex reserve has increased in all the five countries with less fluctuation. Increased reserve due to encouragement of FDI, FIIs, and Export etc. Though all the countries have more or less same level of forex reserve, the nature of inflow is different. Therefore the usage of these reserves may be different in individual country. This can be evidenced through exchange rate with stock prices and trade openness with stock prices. Out of the five countries, South Africa and Brazil has used the reserve for better growth potential than Russia, India and China and they out performed during the study period.

1.8.7. b) Procedure for 2nd objective:

Research question: ***Do exchange rate intervention (exchange rate and forex reserve) and trade openness have any relationship with inflation?***

Objective: To evaluate the impact of exchange rate intervention and trade openness on inflation.

Hypothesis (Ha2): The exchange rate intervention and trade openness affect the inflation.

Variables:

Endogenous **:** Inflation

Exogenous **:** Exchange Rate
Foreign Exchange Reserve
Trade Openness

Econometric Models : Panel Data, Generalized Method of Moments approach (GMM)

Our study also uses the Generalized Method of Moments (GMM) estimator by **Arellano and Bond (1991)[5], Holtz-Eakin et al. (1990)[6] and Arellano and Bover (1995)[7].**The Panel estimator has included instrumental variables based on past realization. We can write general model of GMM

$$in_{i,t} - in_{i,t-1} = (\beta - 1) in_{it-1} + \beta' X_{it} + \eta_i + \varepsilon_{it} \quad \textbf{(1)}$$

Where inflation is the log of variable, X (exchange rate, foreign exchange reserves and trade openness) represents set of explanatory variables, η is an unobserved country-specific effect, ε is the error term.

Findings:

- Through these empirical results we assumed that there is a positive correlation between exchange rate, forex reserve and trade openness on the inflation which is a proxy variable of economy of BRICS countries.

- Trade openness and exchange rate are highly influencing the inflation when compared to the forex reserve. Increased trade openness ratio indicates increased foreign trade when GDP is constant and it is good for any country and bad if it is reverse. In our result trade openness shows positive significant, ($p<0.05$) and high coefficient (8.35) relationship with inflation.

- In the international financial market the individual country currency can depreciate and appreciate depends upon its strength. When the country currency appreciate, that shows a possibility of decreasing the inflation on the other hand it depreciate, there is possibility of increasing the inflation. In our results dollar exchange rate

[5] Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58, 277-297.

[6] Holtz-Eakin,D., Newey, W., & Rosen, H.S. (1990). Estimating vector auto regressions with panel data. *Econometrica*,. 56 (6), 1371-1395

[7] Arellano, M., & Bover, O. (1995). Another look at the instrumental-variable estimation of error components models. *Journal of Econometrics*, 68, 29-52

positively highly significant ($p<0.01$) with inflation stating that for every one unit dollar rate increases in the international market (depreciation) the inflation increases by 4.21 unit. This is always happening in the growing economies. But the degree of inflation increases is debatable and can been seen in the fourth objective.

- When Forex reserve increases in any country there is a high degree of possibility of investments and increased number of transaction thus accelerate the growth of GDP, as a result increase the inflation at lower/higher level depend upon the domestic monetary policy. In our results the forex reserve is positively, significantly ($p<0.001$) with inflation meaning that for every one unit of forex reserve increases the inflation increases by 1.41 unit. As a whole in the BRICS the inflation increases as a result of increased Forex reserve. In the home country (India) also during the study period the same situation, we have witnessed.

- In BRICS countries, the study gives a positive correlation between exchange rate, forex reserve and trade openness on the inflation. The common feature of these countries is, all are developing nations and controlling inflation is one of the main points in monitory policy of almost all countries, because these countries are highly open to international trade. When there is a good exchange rate the countries will be more open through this they can maintain reserves. Thus this trade openness brings high investments, which accelerate the growth of the countries economy. As a result there is an increase in the inflation is observed in the BRICS nations.

1.8.7. c) Procedure for 3rd objective:

Research question: ***Have exchange rate intervention and trade openness responds on output?***

Objective: To evaluate the long term relationship between exchange rate intervention and trade openness with GDP.

Hypothesis (Ha3): There is a long term relationship between exchange rate intervention and trade openness with output.

Variables:

Endogenous **:** Output

Exogenous **:** Exchange Rate

Foreign Exchange Reserve

Trade Openness

Econometric Models: A Panel Co-integration Approach.

1. Panel Unit Root (Breitung)
2. Pedroini
3. FMOLS (Fully Modified Ordinary Least Square Regression)

Third, we estimate the parameter of the GDP by considering the long run relationship with variables, such as exchange rate, forex reserve and trade openness. In order to examine the panel series properties of our data and assess the appropriate methodology, first we conducted panel unit root test [described in Breitung (2000)] to accept the alternative hypothesis which indicating the data is non stationary. Then we choose Pedroni and FMOLS models to test the long term co-integration. Pedroni (Engle- Granger based) shows whether the overall co-integration among the variables in panel data or not. Through FMOLS model the individual effect of exchange rate, forex reserves and trade openness with GDP are known.

Findings:

- Annual Compound Growth Rate (ACGR) of GDP for all BRICS Nations together was 6.79 percent. China growth rate was 9.27 percent followed by India 6.79 percent, Russia 5 percent, south Africa 3.32 percent and Brazil 3.07 percent. India's GDP growth rate (6.79 percent) was almost equal to BRICS Nations together GDP growth rate (6.79 percent) China and India were the more beneficiary than country like Brazil, South Africa and Russia.

- The empirical analysis shows that all the three variables such as exchange rate, forex reserve and trade openness combines together have a long term relationship with GDP in BRICS nations. This is a good sign for the BRICS country with respect to the predictions of the economist Jim O' Neill to achieve 47 percent of world GDP by the year 2050. This strengthens the economy of BRICS to play a dominant role in the world economy.

- The exchange rate is positively (CV 0.088, $p<0.01$) associated with GDP, meaning that for every one unit of exchange rate increases, the GDP increases by 0.08 unit.

The study found that there is a long term relationship between exchange rate and GDP, which indicate there is a possibility of inflow of FII and FDI that will generate more GDP in the economy. The high exchange rate enables the capital inflow, which helps in domestic production and exporting of goods and services. Thus the GDP of the country will get strengthen.

- The forex reserve is also positively (CV 0.082, $p<0.01$) associated with GDP. It explains when reserve increases the investment also increase in the form of production, infrastructure development, transport facility, etc. When the countries have more reserves they can invest in domestic and in more foreign markets. A country having huge investment, its growth will increase. Thus the reserves of a country are directly influencing the GDP. The reserves reduce the burden of the government by reducing the external current account debts. The BRICS nations together constitute highest reserves when compared to the world reserves. Accumulation of reserves helps the BRICS nations to improve the GDP in the economy.

- Among the variables (exchange rate, forex reserves, and trade openness) trade openness is highly positive (CV 0.45, $p<0.01$) coefficient with GDP in BRICS countries. Because it brings more investment in these countries through FDI and FII, which helps in reducing the cost of production and increase in the profits through export. These transactions help in improve the nations GDP. All the BRICS nations are open to the international trade with reasonable restrictions. These favorable conditions encouraged the investors to invest in this economic block, thus it helped in improving the GDP through high production of goods and services in the domestic market.

- Overall the BRICS countries GDP has improved during the study period with the help of international trade (exports and imports).

1.8.7. d) Procedure for 4th objective:

Research question: ***Does exchange rate intervention and trade openness have any impact on sacrifice ratio?***

Objective: To examine the exchange rate intervention and trade openness on sacrifice ratio.

Hypothesis (Ha4): There is a relationship of exchange rate intervention and trade openness with Sacrifice ratio.

Variables:

Endogenous **:** Sacrifice Ratio

Exogenous **:** Exchange Rate
Foreign Exchange Reserve
Trade Openness

Econometric Models : Finding Episode, OLS Method

Fourth, it is very clear from the evidence of the previous objectives that described exchange rate intervention and trade openness on share price movement, inflation and GDP by panel data analysis in overall BRICS countries. Hence, the fourth objective is to explain the time series basis, how far the combination of exchange rate intervention and trade openness influence on sacrifice ratio. In order to fulfil this objective, we follow Ball (1994) approach. We start from who proposed first sacrifice ratio by the Ball (1994). He suggested the procedure to measure the sacrifice ratio is output loss due to drop in inflation rate. Assumed that actual output equal to the potential output if it is come under the equilibrium *(0)* otherwise disequilibrium. The countries monetary policy had tightened otherwise domestic economics affected by the external shocks. The potential output has measured used by the Hodrick–Prescott filter (H-P) from its actual output. Next, the trend inflation period is (t) the average inflation from $(t-n)$ through $(t+n)$ ($n=1$ for the annual data, $n=4$ for the quarterly data and $n=12$ for the monthly data). Finds peaks and through from trend inflation data from $(t-n \quad to \quad t+n)$, centered nine quarter moving average follows log linear between the two points. The sacrifice ratio is calculated by output loss with trend inflation. We can see the following mathematical formula for computing sacrifice ratio.

$$SR = \frac{y^{a} - y^{po}}{\pi^{P} - \pi^{t}}$$

Where y^a is the actual output, y^{po} is potential output; π^p is the trend inflation peak and π^t trend inflation through. Change in output corresponding the change in the trend inflation.

Ordinary Least Square - How exchange rate, foreign exchange reserves and trade openness influences on sacrifice ratio.

$$sr_t = \beta_0 + \beta_1 ex_t + \beta_2 res_t + \beta_3 to_t + v_t \quad \textbf{(1)}$$

Where sr_t is sacrifice ratio and ex_t is exchange rate, res_t foreign exchange reserves and to_t trade openness. We have used OLS to estimates the relationship between the sacrifice ratio and rest of the explanatory variables. The results were explained below; the results had come with mixed relationship.

Findings:

Brazil:

- In Brazil out of 177 monthly observations in the time series data starting from 1998 to 2012, 67 disinflation observations were identified and it consists of seven disinflation episodes during the study period. It accounts for five years seven months. Out of the 7 disinflation episodes, episode one (17.07, August 1988 to October 1999) and episode three (7.98, January 2002 to December 2002) falls on high disinflation episodes.

- All the episodes are identified when the inflation are above to the level of 1.50. (The acceptable level of inflation according to Ball (1994) is 1.50). When the inflation is increases the sacrifice ratio decreases and on the other hand inflation decreases, the sacrifice ratio increases (both the variables are inversely related). Accordingly the inflation increases the sacrifice ratio decreases as a result the output loss decreases. Thus during the period from August 1998 to October 1999, January 2002 to December 2002 Brazil country suffered heavy output loss when compared to other episodes because during this period the inflation level raises from 2.54 to 17.07 when it accepted level is 1.5 (Ball,1994). This was happened when Russia has withdraw her currency from emerging markets, and the minimum inflation was

observed in December 2009 to May 2010 (Episode 6), this is due to slashing interest rate by Central Bank to overcome the 2008–2009 economic crisis (European economic crisis).

- In Brazil, the increased exchange rate (depreciation of domestic currency) positively associated (CV 0.01, $p<0.05$) with sacrifice ratio. From the data we observed an increase in exchange rate in 2002-2003, this is due to change in government and its new economic policy to control inflation and stabilize exchange rates. The government has increased interest rates, tighten fiscal policy, foreign capital returned in 2003. To reduce the inflation, the Brazil has gone for devaluation of her currency at 2002. This was very helpful to strengthen Brazil's balance of payment to its crisis at 2002. The exchange rates are high when Brazil devaluated its currency in 2002, which increased the output losses and pushed the increased sacrifice ratio (output inflation tradeoff) and in 2008 Brazil used reserves to control the inflation which reduces the output losses and sacrifice ratio.

- The forex reserves is also positively associated with sacrifice ratio (CV 0.02, $p<0.01$). In general the reserves are used to reducing the output losses caused by inflation but in Brazil till 2008 recession the reserves are accumulate and inflation is controlled through tightening fiscal, monitory policy, exports are restricted in the disinflation episode period to control the inflation. But to overcome the 2008 economic slowdown Brazil used its reserves to overcome the inflation, in that period the sacrifice ratio has increased. So the increase in reserves leads to increase in sacrifice ratio and vice-versa.

- The trade openness in Brazil shows high negative beta coefficient and highly significant (CV -0.79, $p<0.01$) with sacrifice ratio. When there is one unit increase in trade openness, there is -0.79 units decrease in sacrifice ratio. After 1998 Brazil shifted to the floating exchange rate system, which encouraged the country to be more open to the international trade. Greater trade openness brings high inflation, when the rate of inflation was high the sacrifice ratio also lower.

- Over all the Brazil data shows that, the country started more open to the international trade from 1998, as a result the inflation was increased. Further, it has changed from pegged exchange rate system to floating exchange rate system and

started accumulating reserves. It is observed that whenever the exchange rate and forex reserves are increasing the sacrifice ratio also increasing, and when inflation is high due to trade openness and the sacrifice ratios decreasing.

Russia:

- In Russia out of 177 monthly observations, 42 disinflation observations are identified. Out of the five disinflation episodes, episode one (54.80, February 1998 to November 1998) falls a high disinflation. This is because of currency crisis in that year, and the minimum inflation episode was observed in March 2010 to October 2010(1.55). Among all five countries Russia has less number of disinflation episodes (five) covering a shorter period of 42 months. When compared to Brazil (seven episodes) the Russia is having lesser episodes (five).

- The exchange rate shows negative (CV -0.07) and low beta coefficient ($p<0.01$) with sacrifice ratio. For every one unit increase in exchange rate (appreciation of Russian Ruble), the sacrifice ratio decreases by 0.07 units. In Russia more importing firms benefitted than exporting firms and try to increase the growth potential and as a result inflation increases. (The forex reserve ($p>0.10$) and trade openness ($p>0.05$) are not influencing with sacrifice ratio)**.**

- The data explicit that the reserves (CV =0.01, $p>0.10$) and trade openness (CV 0.13, $p>0.05$) are not influencing the sacrifice ratio. The reason for negative influence of exchange rate and no influence of forex reserves on sacrifice ratio due to the Russian bank frequently intervene and make corrections in the exchange rate and the inflation is controlled through internal measures like increase in the interest rates by Russian bank.

India:

- In India 90 disinflation observations are identified during the study period. This consists of twelve disinflation episodes and it accounts for seven years five months. Out of the twelve disinflation episodes, episode two (43.65, March 1999 to February 2000) falls on high disinflation episodes and the minimum inflation was observed in episode eleven (1.5, September 2008 to August 2009). Among all the five countries India has more number of episodes (twelve).

- The exchange rate shows negative (CV -0.01, $p<0.05$) relationship with sacrifice ratio. When every one unit increase in exchange rate, the sacrifice ratio decrease by 0.01 that means when exchange rate increases, the general price levels will rise, and there will be possibility of inflation. Then the theory will apply high inflation with low sacrifice ratio (an inverse relationship).

- The forex reserve is positively (CV 0.01, $p<0.05$) associated with sacrifice ratio, countries with high reserves can overcome the sudden fluctuations in economy. Most of the economic disturbances in India are caused due to external factors, so these external shocks are controlled through the reserves. In India internal monetary policy is very effective to control the inflation so the increase in the forex reserves increases the sacrifice ratio.

- The trade openness and sacrifice ratio shows a negative (CV -0.07) relationship with high significant ($p<0.01$). In India more number of importing firms was benefitted and improved their growth potentials and tries to increase the international trade as a result inflation increases and sacrifice ratio reduces. (Inverse relationship of inflation and sacrifice ratio).

China:

- In China out of 177 monthly observations in the time series data starting from 1998 to 2012, 84 disinflation observations were identified and this was more or less at par with Indian disinflation episodes. It consists of seven disinflation episodes during the study period. This seven disinflation episode time period accounts for seven years. Out of seven disinflation episodes, episode six that is from July 2009 to May 2011 falls on high disinflation episode (67.25) and the minimum inflation was observed in February 2001 to January 2001 (1.75) and during the period how the selected variables affected the sacrifice ratio is given below.

- The exchange rate shows negative sign (CV -0.01) and low beta coefficient ($p<0.01$) with sacrifice ratio. Because China was using fixed exchange rate system and with a strong export market. The country stabilizes the inflations by reducing output cost (that shows low sacrifice ratio).

- The forex reserves also shows negative (CV -0.04, p<0.01) sign with sacrifice ratio. Because the Chinese government did not depend on the forex reserves and they continued to be fixed exchange rate system even in the inflation periods. They used the inflation for its growth; through exports they were able to manage the low output loss which gives low sacrifice ratio. To overcome the 2008 economic slowdown, the Chinese government implemented a large economic stimulus package and an expansive monetary policy. These measures boosted domestic investment and consumption and helped prevent a sharp economic slowdown in China.

- Trade openness is not influencing (CV 0.03, p<0.10) the sacrificing ratio, since China is self sufficient to overcome any financial turbulences. Chinese economy mostly depends on the export and the country is having sufficient reserves and savings to overcome any external shocks.

South Africa:

- In South Africa, there are 94 disinflation observations were identified and it consists of eight disinflation episodes during the study period. The total disinflation time period accounts for seven years ten months. Among the BRICS countries, South Africa has longest disinflation episode. Out of the eight disinflation episodes, episode five (July 2003 to November 2004) falls on high disinflation, this is because the value of Rand depreciated during 2001 to 2003 and the banks started to accumulate the reserves by buying foreign exchange reserves on a spot basis, and the minimum inflation (1.70) was observed during June 2001 to June 2002.

- The exchange rate shows a high positive sign (CV=0.02, p<0.01), with low beta value. This is because the main target of monitory policy of South Africa was to reduce inflation. The increased exchange rate allowed extensive capital inflow in to the country. The increase in exchange rate, depreciate the value of Rand which leads to high output cost.

- The forex reserves are negatively (CV -0.05, p<0.01) influencing the sacrifice ratio, the time period between 2003 and 2005. There is huge accumulation of foreign

reserves in South Africa, but the sacrifice ratio is low in that period, the internal fiscal policy and underperforming of countries exports against global trend forced to increase the output cost of production so the sacrifice ratio is gone to negative.

- The trade openness in South Africa showed highly positive beta coefficient and highly significant (CV 0.22, $p<0.01$) with sacrifice ratio. The trade openness brought high capital inflows over the time period in South Africa, which brought the frequent inflations, along with the increasing unemployment and underperformance of exports forced the country to take more disinflationary measure, so the sacrifice ratio is high in the stipulated time period in South Africa.

1.8.8 Conclusion:

This study is an attempt to document the evidence of exchange rate intervention (Exchange rate and Forex reserves) and trade openness on the economy of the BRICS countries. The share price movement, inflation, GDP and sacrifice ratio are considered as a proxy variables to see the economy of BRICS Nations. A sample of fifteen years panel and time series data were taken to study the changing patterns of the BRICS economy.

The selected independent variables explicit a positive relation with share price movement. Among these three variables trade openness is highly influencing the share price movement in BRICS Nations. To check the relationship of individual country, the study employed with dummy variables and Brazil was taken as reference, the result shows that Brazil and South Africa having positive relation with stock prices and remaining three countries shows negative relationship. In the study period Brazil and South Africa are focused on accumulating the forex reserves in-order to reduce the inflation and they are open to international trade, these leads huge capital inflows into these countries so the share price also increased.

The BRICS Nations are highly open to the trade for their economic development and the international trade is completely depends on the exchange rate. These two variables are directly influencing on inflation in these developing economic block.In the study period, these independent variables (exchange rate, forex reserve and trade openness) individually correlate with the GDP of BRICS Nations. To know the

individual effect of these variables on GDP, the study employed FMOLS. That gives trade openness is highly influencing the GDP than other two variables. It implies that the exchange rate and forex reserves in these countries are mostly using for reducing inflation, so the influence on GDP is low in BRICS nations.

The Overall result shows the exchange rate, forex reserves and trade openness are positively associated with share price, inflation and GDP. Out of these three independent variables trade openness has high degree of association with proxy variables of economy of BRICS nations. The nations with high trade openness brings more investment to the country and the share prices increases and monetary policy of the country will be liberal which allows fluctuations in the exchange rates of the nations, the exposure to the international trade give competitiveness to the domestic export products, helps to increase the GDP.

These developing economies which are open to international trade are frequently affected by the inflations, so it is necessary to take measures to control the inflation and the sacrifice ratio is used as disinflationary process. The study gives an important insight on the sacrifice ratio of BRICS nations. In the study period all BRICS nations observed high inflation and low sacrifice ratio in 1998-2000. Because all these countries changes their economic system and made liberal policies in order to overcome inflation caused by series of crisis around the globe (example: Asian crisis, Russian currency crisis etc) and during the economic slowdown in 2008-2010 all BRICS nations are taken very long disinflation period which gave high sacrifice ratio.

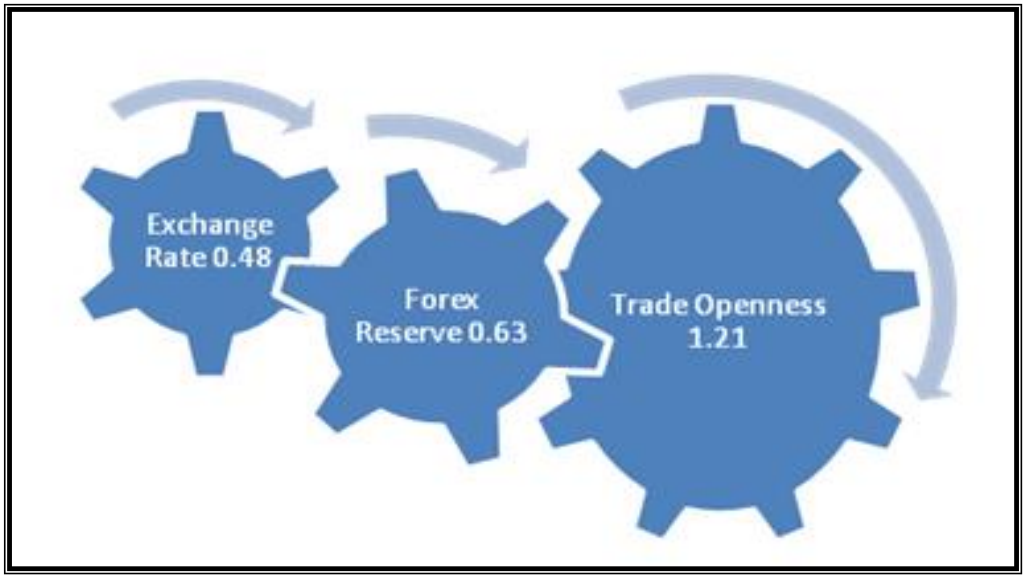
1.9 Major Contribution of the Study

1. In this study the empirical results explicit that the exchange rate, forex reserves and trade openness are positively influencing the share price movement. The overall increased exchange rate (depreciation of BRICS currency value) positively associated with share price movement but with low beta co-efficient value (0.48).This indicates exporting firms are more benefited than importing firms and this has given way to increase in accumulating the forex reserves. The forex reserve also shows a positive influence on share price movement (0.63) slightly higher than the exchange rate. This result indicates that the forex reserves in all the five countries possess more or less equal amount of reserves. It seems the utilization of these

reserves was may be differ by individual country. This can be evidenced through influence of exchange rate and trade openness on share price movements.

Out of the five countries, South Africa and Brazil has used the reserve for better growth potential than Russia, India and China. This we have witnessed in graphs (exchange rate to share price and trade openness to share price). As a result the positive influence of exchange rate and forex reserve on share price movements. The trade openness (International trade) also shows a positive relation and high beta co-efficient (1.21) on share price movement. This is possible because of increased capital inflows in BRICS countries in the form of FDI and FII increases the international trade. The trade openness of BRICS nations enabled them to get more investments through FII which influence directly on share price movements. The above discussion can be summed up as the increased exchange rate leads to increased forex reserves and thus increases the international trade. Therefore the share price is showing positively relation in the long run. The relationships of these variables are shown in the following figure.

Relationship among Exchange Rate, Forex Reserve and Trade Openness in BRICS.



2. The exchange rate, forex reserves and trade openness are positively associated with inflation. With the increased exchange rate (BRICS currency value depreciates) the cost of production of goods will increase in the domestic market and the general prices levels will also increases. In the same way when the reserve increases, the inflation will also increases. It indicates that the accumulated reserves are generally used to control the inflation. When exchange rates are high the accumulation of reserves through exports are costly so it leads to inflation. Among these independent variables trade openness shows a highly positive relation with inflation because the trade openness facilitated by liberal monetary policy which leads to high inflation. Next important point is if there is any sudden rise in inflation or any crisis the BRICS countries can overcome by understanding the changing behaviour of the variables in the past episodes.

3. In general, BRICS exchange rate, forex reserves and trade openness shows a long term relationship with GDP. A general concept is when exchange rate increases the value of currency will depreciate as a result huge investments comes into country to produce at low cost so the output will increase, this concept can be applicable in our study, the study also accepted the general phenomenon when the exchange rate increase as a result there is an inflow of FII, FDI that will increase the GDP of the BRICS nations. During the study period the reserves was positively influencing on GDP that indicates when the countries have more reserves they can invest in domestic and in foreign markets. The same results were identified with the proxy variable of share price movement in the BRICS countries. However the reserve on GDP shows less influence than the reserves on share price movement, this is because the reserves can be identified in two different forms, one in the form of FII and the other is FDI. The FII can't have impact on GDP but FDI is directly influencing on GDP. This is the reason when reserve show high relation with share price as same compare to GDP. The increased exchange rate and forex reserve helping the international trade to boost the GDP. The results are more or less same when we see the influencing variables to share price movement which is another proxy variable. Therefore the researcher is happy about results obtained.

4. The developing countries are highly connected with the international trade and there is a possibility of frequent inflations in their development process. The study gives

an empirical support to the BRICS nations regarding the sacrifice ratio. Through this one can understand the disinflationary trends in the series of episodes. By studying the sacrifice ratio for each and every individual episode helps in understanding disinflation process and the other factors (use of reserves, Govt. intervention, and monetary policies during the episode time) which are influencing the disinflation and in framing the better monetary policy to control the inflation.

In Brazil exchange rate and reserves are showing positive relationship with sacrifice ratio where as trade openness was showing negative relationship with sacrificing ratio. This is because the monetary policy of Brazil is to reduce the inflation through accumulation of reserves. The accumulated reserves were used to reduce the balance of payments of the country but internal measures are lacking in controlling the inflation so sacrifice ratios is low in this country.

In Russia exchange rate showing negative relationship with sacrificing ratio and rest of the variables forex reserve and trade openness are not influencing with sacrifice ratio. The disinflation periods are long with low sacrifice ratio because the country focuses on the currency accumulation and it is highly dependent on export of oils and natural gas.

In India exchange rate and trade openness shows negative relationship with sacrifice ratio and exchange rate shows positive relationship on sacrifice ratio. Because of the strong monetary policy, the country used its reserves to reduce the output losses in the disinflation period.

In china exchange rate and forex reserve shows negative relationship on sacrifice ratio. But trade openness shows positive relationship on sacrifice ratio. The disinflation measures are very reflexive in china. The export market in china is very strong and the reserves are used for other purposes.

In South Africa exchange rate and trade openness shows positive relationship on sacrifice ratio but forex reserve shows negative relationship on sacrifice ratio. South Africa is have more debts when they open to international trade, the reserves accumulated are used to reduce the balance of payments and investments are used to improve the export productions, the sacrifice ratio is low when reserves are high.

1.10 Scope for further Study

- There is a large scope for future research in the study area. The same study can be done in other economic group of nations such as SAARC; G7 etc. these blocks are also contain developing countries like BRICS.

- To know the role of share price movement in the economic growth of the country, the researcher can use different indices instead of using common indices for each country.

- The effect of these independent variables (exchange rate, forex reserve and trade openness) can be studied individually in each country in detail connecting its policies. It gives effective results to understand the changing patterns of variables in each country at different time periods in respect to their policies.

- In developing countries the disinflation periods are either very short or very long; it is purely depend on the monetary policies of the government. With these independent variables (exchange rate, forex reserves and trade openness), the sacrifice ratio is not showing similar effect when same condition happened in all countries (BRICS). So in further study can identify other variables which are more influencing on sacrifice ratio.

- There is a large scope to study the behavior of the selected variables in short periods especially during the economic slowdown of the nations.

1.11 Limitations of the Study

The data is not normally distributed more trouble shooters are needed in analyzing the panel data. Each country is having their own limitations (pros and corns), therefore sophisticated statistical tools are applied in the panel data. The analysis and interpretation of panel data is different from time series data. The researcher have taken more painful in understanding the importance, identifying the requirements of the objectives and to check the hypothesis with different tools for different objectives in order to achieve the accuracy of the results.

1. As an international study, there may be differences in the calculation of indices of share prices among different countries in the study. In order to avoid this, data has been collected from IFS which maintain an index on its own ensuring a common base.

2. The recent data is not updated to current period because the data collection was done at the end of year 2013.

3. Since, some countries monthly data is not available, the annual GDP has been converted into monthly with the help of interpolates method in origin software.

4. As it is a panel study, it cannot be applied any common model in the analysis. Thus, selected models have been used in the analysis.

5. Since the study is based upon the secondary data, all the limitations inherent to the secondary data will also be applicable to this study.

1.12 Chapter Scheme of the Study

This section provides a brief outline about the chapter structure of the thesis. The thesis is organized into four chapters starting from introduction and research design continued with next chapter review of literature, analysis and finally ends with summary, findings and conclusion. The brief description of each chapter is as follows.

Chapter one is titled as introduction and research design, it provides a foundation of the study by introducing the background of the thesis and followed by research design of this thesis. The introductory part of the chapter has briefly mentioned the BRICS economies – a background with current status and its strength and summary of each economy in BRICS nations. The research design of this thesis covers the justification of study, underlying concepts of the study, the statement of the problem, research questions, objectives, hypotheses to be tested, data and methodological procedures, and a brief description about statistical tools used by this thesis, then contributions of the current study and the limitations of the study.

Chapter two provides a comprehensive survey of literature of published research work related to exchange rate intervention and trade openness connected with share price, inflation, GDP and sacrifice ratio. The entire reviews of earlier studies are

grouped into five categories based on five research issues focused by such studies. First category of studies related to share prices with exchange rate, forex reserves and trade openness. The second research issue addressed by earlier researchers is that studies of inflation with exchange rate, forex reserves and trade openness. The third category encompasses the studies of Gross Domestic Product with exchange rate, forex reserves and trade openness. The fourth category of reviews related to the studies of sacrifice ratio with exchange rate, forex reserves and trade openness. The fifth and last category of reviews discussed by this thesis is that the studies of BRICS countries. Then the chapter brings out some research gaps from the review of literature, such research gaps have prompted to have this study.

Chapter three documents the empirical analysis and interpretation of the panel data, and it is designed in four sub sections. The first sub section deals with the effect of exchange rate intervention and trade openness on share price movements. To analyze this, the study used fixed effect, random effect and fixed with dummy variable (LSDV). The second sub section as brief out the effect of exchange rate, forex reserve and trade openness on inflation and, the study used GMM method to calculate the simultaneous effects on residuals. The third sub section deals with exchange rate, forex reserve and trade openness on GDP. To know the long term relationship between these variables, the study used Pedroni and FMOLS. The last and final part of this chapter describes the effect of exchange rate, forex reserve and trade openness on sacrifice ratio. In this part the study used time series data to calculate the sacrifice ratio in each country of the BRICS group. Overall the results of all the models are well documented and presented in a lucid form for easy understanding with detailed discussion.

Chapter four gives summary, findings and conclusion of the study. The chapter summarizes the whole study by providing problem of the study, objectives, hypotheses tested, data and sample procedures and statistical methodology used. Then the chapter gives detailed description about major findings, contributions of study, implication and further scope of the study. Finally the chapter ends with a conclusion about the study.

CHAPTER TWO

REVIEW OF LITERATURE

CHAPTER STRUCTURE

2.1 Introduction:

This chapter documents the review of literature related to exchange rate intervention and trade openness on the economy of BRICS countries. The Share price, Inflation, GDP and Sacrifice ratio were considered as the proxy variables to identify the economy of this economic block. In the past decade this block was able to grab the attention of all economists to study and understand the dynamic changes in the economy of these developing nations in the challenging economic environment. The present interdependent nature of the country's economy with other country stressed the need to study macro economic variables like exchange rate, forex reserves and the trade openness. It is very relevant to study the behaviour of these variables in emerging economies like BRICS.

In the context of growing international trade exchange rate is considered as the key economic variable because of its interaction with other internal and external variables of the economy. It determines the competitiveness of the country's currency in the international market. The exchange rates of currencies are become highly unstable after the collapse of Bretton woods system of fixed exchange rates. Almost all developing open economies witnessed the effects of exchange rate fluctuations on their economy.

In order to stabilize the sudden fluctuations in the exchange rate, the central banks of the nations use forex reserves to intervene in exchange rate market and to withstand against the exigency in the economy. Forex reserves are also useful to maintain external values of the currencies at maintainable rates. Besides, these reserves are used to boost the confidence of the country economy market to meet the international payment obligations. In many of the developing countries, accumulation of reserves gained a very important place in the countries' economic policy.

Trade openness is still a matter of discussion in the developing countries to know whether it boosts the economy or not. When countries are exposed to the international market it's GDP is directly connecting with its exports and imports. The economic growth of the nation is dependent on the degree of its openness to the outside world. So it is very relevant to study how it affects the economy of nations.

Thus the influence of the exchange rate, forex reserves and trade openness are greater on the economy of the nations. It is relevant to study these variables effect on the proxy variables of the economy, they are share price, inflation, GDP and sacrifice ratio. This chapter helps to find the research gap in a systematic manner.

This study first focuses to analyse the relationship between exchange rate intervention and trade openness with share price movement. Secondly the study checks the relation of these variables with inflation of the economy. Thirdly this study tries to investigate the exchange rate intervention and trade openness with GDP. Finally the study examines the effect of exchange rate intervention and trade openness on the sacrifice ratio.

The later part of this chapter is designed in such way to understand the review of literature in a simple way. For this the reviews of previous studies are grouped under five different headings.

1. Studies of Share Prices with Exchange Rate, Forex Reserves and Trade Openness.

2. Studies of Inflation with Exchange Rate, Forex Reserves and Trade Openness.

3. Studies of Gross Domestic Product with Exchange Rate, Forex Reserves and Trade Openness.

4. Studies of Sacrifice Ratio with Exchange Rate, Forex Reserves and Trade Openness.

5. Studies of BRICS countries.

The following table presents number of earlier studies reviewed under different category:

Table: 2.1

CLASSIFICATION OF REVIEW OF LITERATURE: Country Wise

Sl.No	Nature of Studies	BRICS	Other Countries	Total
Dependent variables				
1	**Stock Price**	**5**	**27**	**32**
2	**Inflation**	**1**	**16**	**17**
3	**GDP**	**2**	**12**	**14**
4	**Sacrifice Ratio**	**-**	**10**	**10**
5	**Total**	**8**	**65**	**73**

Table: 2.2

CLASSIFICATION OF REVIEW OF LITERATURE: Variable Wise

	Dependent Variables					
Sl.No	**Variables**	**Stock Price**	**Inflation**	**GDP**	**Sacrifice Ratio**	**Total**
Independent Variables						
1	**Exchange Rate**	**23**	**4**	**3**	**2**	**32**
2	**Forex Reserves**	**4**	**2**	**2**	**1**	**9**
3	**Trade Openness**	**2**	**10**	**7**	**4**	**23**
4	**Total**	**29**	**16**	**12**	**7**	**64**

Finally this chapter concludes the entire review of literature and list out the research gaps identified by the researcher that prompted to do this study.

2.2 Studies of Share Prices with Exchange Rate, Forex Reserves and Trade Openness.

This part of the chapter deals with the literature on share price market and real economic activity. It has been believe that share prices are a reliable leading indicator of economic activity of the nations. The share markets are highly volatile in nature and shows immediate effect on the other economic variables at both domestic and international level. After the collapse of Bretton Woods system (1973) of fixed exchange rate there was a growing interest of economists to study the factors influencing exchange rate and its impact on other macro and micro economic variables. The study variables in this section are highly volatile to the external influences, so these reviews gives a clear understanding about the behaviour of these variables in different geographical locations in different time periods.

Mukherjee and Naka (1995)[8] investigated the dynamic relationship between Tokyo stock exchange index and six macroeconomic variables, namely the exchange rate, money supply, industrial production index, call money rates, inflation and long term government bonds. The study period was from January 1971 to December 1990. The monthly data was obtained from International Financial Statistics (IFS) published by International Monetary Fund (IMF) and consisting of 240 monthly data. The study

[8] Mukherjee, T. K., & Naka, A. (1995). Dynamic relations between macroeconomic variables and the Japanese stock market: An application of a vector error correction model. *Journal of Financial Research, 18(2),* 223 – 237.

employed co-integration and Vector Error Correction Models (VECM) to find the co-integration between Tokyo stock exchange index and macroeconomic variables. In the long-term relation they found a positive relationship between Tokyo stock exchange (TSE) and the listed six variables. Further the sample period was divided into two sub-groups (January 1971 to December 1980 and January 1981 to December 1990) to find the short term relationship. The result shows three possible co-integration relations in the first sub period and two in the second sub period.

Friberg and Nydahal (1999)[9] investigated the relationship between stock market to exchange rate in eleven industrialized countries in the post Bretton-Woods period. The study followed **Adler and Dumas (1984)** and applied monthly data for the period from January 1973 to August 1996. The data on nominal exchange rates and local stock market were collected from the Ecowin data base and the Interest rates, long term government bonds, Trade openness, GDP and trade values were collected from IFS data base. The study used OLS and GLS methods to estimate the relationships. They concluded more open the economy leads positive and stronger relationship between stock return and exchange rate.

Phylaktis and Ravazzolo (2000)[10] the study attempted to find the relationship between the stock prices and exchange rates in both short-run and long- run and also identified the channels through which exogenous shocks impact on these markets. The sample for the empirical study was Six Pacific Basin Countries (Hong Kong, Indonesia, Malaysia, Singapore, Thailand and Philippines) over the period since 1980 to 1998. The Cointegration method and multivariate granger causality tests were employed for the analysis. The results implicated that there is no long-run relationship between the real exchange rate and stock markets in each country except Hong Kong. The results of the trivariate system suggest that for all the countries the real exchange rate and the US stock prices are positively related to domestic stock prices for the period of the 1990's.

[9] Friberg, R., & Nydahl, S. (1999). Openness and the exchange rate exposure of national stock markets. *International Journal of Finance and Economics*, 4(1), 55-62.

[10] Ravazzolo, F., & Phylaktis, K. (2000). Stock Prices and Exchange Rate Dynamics.

Nieh and Lee (2001)[11] aimed to find the relationship between exchange rate and stock prices in G7 countries. The study period was from 1st October 1993 to 15th February 1996 with a total of 618 daily observations and was obtained from Dow Jones Inc. For the data analysis the study employed both the Engle-Granger and Johansen's co-integration tests. The results indicate significant short-run relationship and no significant long run relationship between the stock prices and exchange rates. Nonetheless, in some countries, both stock indexes and exchange rates may serve to forecast the future paths of these variables. For example, they found that currency depreciation stimulates Canadian and UK stock markets with a one-day lag, and that increases in stock prices cause currency depreciation in Italy and Japan, again with a one-day lag.

Muhammad and Rasheed (2002)[12] highlighted the long run and short run association between stock prices and exchange rates in four South Asian countries, namely India, Pakistan, Bangladesh and Srilanka. The monthly data was collected from January 1994 to December 2000. To examine the association, the study employed cointegration, error correction modeling and granger causality test. The results found no short run association between stock prices and exchange rate for all four countries and found a bidirectional long-run causality between these variables for Sri Lanka and Bangladesh. The results also explicit no long term relationship exists in India and Pakistan.

Wongbangpo and Sharma (2002)[13] examined the linkages between macroeconomic variables with stock prices in ASEAN countries. Monthly data from 1985 to 1996 was used in this study and employed cointegration, vector error correction model (VECM) and causality analysis for capturing these issues. They found there is a long and short run cointegration between selected macroeconomic variables and stock prices. In addition, they concluded exchange rate and output showed positive relationship but money supply, interest rate and inflation are negatively correlated with

[11] Nieh, C., & Lee, C. (2001). Dynamic relationship between stock prices and exchange rates for G-7 Countries. *Quarterly Review of Economics and Finance, 41(4), 477-* 490.

[12] Muhammad, N., & Rasheed, A., & Husain,F. (2002). Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries. *The Pakistan Development Review* 41(4), 535–550.

[13] Wongbangpo, P., & Sharma, S.C. (2002). Stock market and macroeconomic fundamental dynamic interactions: ASEAN-5 Countries. *Journal of Asian Economics*, 13(1), 27 – 51.

stock price. Finally they mentioned a unidirectional causality from stock price to all major macroeconomic variables in ASEAN countries.

Kasman (2003)[14] empirically investigated the relationship between exchange rates and four stock indices in the Turkish market. The time-series data used daily closing prices of four aggregate indices such as national 100, financial sector index, production sector index and service sector index are obtained from the Central Bank of the Republic of Turkey and exchange rate interim of US dollar. The study applied Johansen cointegration and results found a long run relationship between stock indices and exchange rate; the granger causality test shows bidirectional causality between composite index and exchange rate, financial sector index and exchange rate, service sector index and exchange rate but only unidirectional causality relation exist from the exchange rate to the industry sector index.

Bhattacharya and Mukherjee[15] (2003) their empirical paper investigated the relationship between stock prices and other macroeconomic variables in Indian foreign sector. The study used monthly data series for four variables for the period April 1990 to March 2001. The dependent variable is BSE Sensitive Index and independent variables are exchange rate, foreign exchange reserves and value of trade balance. The data for stock prices was collected from BSE Sensitive Index (base: 1978-79=100), Real Effective Exchange Rate (REER) of the Indian Rupee (36-country bilateral weight with base 1985=100), the foreign exchange reserves (in rupees) and the value of trade balance (in rupees). The data has been compiled from Handbook of Statistics on Indian Economy (2001) published by Reserve Bank of India and various issues of RBI Bulletin. The study used unit root test, co-integration and granger non-causality test to perform the analysis. The result shows that there is no casual linkage between stock prices and the three variables under consideration.

Tabak (2006)[16] this study examined the dynamic relationship between stock prices and exchange rate in the Brazilian economy. The data period expands from

[14] Kasman, S. (2003). The relationship between exchange rates and stock prices: A causative analysis. *Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *5*(2), 70-79.

[15] Bhattacharya, B., & Mukherjee, J. (2003). Causal relationship between stock market and exchange rate. Foreign exchange reserves and value of trade balance: A case study for India Paper presented at the Fifth Annual Conference on Money and Finance in the Indian Economy on January 2003.

[16] Tabak, B. M. (2006). The dynamic relationship between stock prices and exchange rates: evidences for Brazil, *working paper series*, N. 124, 1-37.

August 1, 1994 to May 14, 2002 and obtained from Bloomberg. Daily closing prices in the Brazil Sao Paulo stock exchange index and foreign exchange rate were used in the analysis to capture the effect of short-term capital movements. The study used unit root test, co-integration, linear and nonlinear causality tests. The result shows that there is no long run relationship between the selected variables, but there exists a linear granger causality from stock prices to exchange rates and non linear granger causality from exchange rates to stock prices.

Pan, Fok and Liu (2006)[17] examined the dynamic linkage between exchange rate and stock markets in seven East Asian countries includes Hongkong, Japan, Malaysia, Korea, Singapore, Taiwan and Thailand. The period of study spans from January 1988 to October 1998. The research employed granger causality, vector autoregressive (VAR), a variance decomposition and impulse response analysis for the sample period. The results found a significant causal relationship among exchange rate to stock price for Hongkong, Japan, Malaysia and Thailand. In addition, a significant causal relationship found from stock market to exchange market for Hongkong, Korea and Singapore. While, during Asian crisis showed a significant causal relation from stock price to exchange rate and no causality from exchange rate to stock price for all countries except Malaysia. Finally, the study was concluded that the relationship between stock prices and exchange rate could vary across economy with respect of exchange rate regimes, the trade size and the degree of capital control and the size of equity market.

Adjasi, Harvey and Agyapong (2008)[18] their empirical work looked at the relationship between Stock markets and Foreign Exchange market and determined whether movements in exchange rates have an effect on stock market in Ghana. The sample period extends from January 1995 to June 2005 and the data was obtained from IMF Trade statistics year book, Ghana statistical service for export and import, Ghana stock exchange quarterly publications. EGARCH model was used to establish the relationship between exchange rate volatility and stock market volatility. It was found that there is negative relationship between exchange rate volatility and stock market

[17] Pan, M., Fok, R.C., & Liu, I.A. (2007). Dynamic linkages between exchange rates and stock market prices: Evidence from East Asian markets. *International Review of Economics and Finance, 16(4)*, 503 – 520.

[18] Adjasi, C., Harvey, S. K., & Agyapong, D. (2008). Effect of Exchange Rate Volatility on the Ghana Stock Exchange. *African Journal of Accounting, Economics, Finance and Banking Research,* 3(3).

returns. A depreciation in the local currency leads to an increase in stock market returns in the long run and in the short run it reduces stock market returns.

De Bondt (2008)[19] empirically evidenced the determinants of stock prices at the different level of total market index in twelve countries for a period from January 1978 to September 2005 and the data was collected from Thomson Data Stream and Global Financial Data. Firstly, through ordinary least squares (OLS) points a long run relation between fundamental stock market value on the basis of earnings, long term equity risk premium and a risk free interest rate and further Marquards optimization algorithm for ARCH and GARCH applied in the short run, and the exchange rate, commodity prices, momentum and seasonality were determined the stock prices movement. The study also speaks that risk premium is a significant long and the short run determinant of stock prices and exchange rate is a significant short run determinant for stock prices in all countries except USA.

Rahman, Sidek and Tafri (2009)[20] investigated dynamic linkages between Malaysian stock market index and selected macroeconomic variables. The study used monthly data ranged from January 1986 to March 2008 and applied vector autoregressive (VAR), cointegration and VECM for these linkages. The results documented that all the selected variables have cointegration with stock market index. In addition to that reserves and index of industrial production (IIP) showed positive; money supply, interest rates and exchange rate showed negative relation to Malaysian stock market index. Furthermore, reserves and interest rates showed bidirectional causality with stock market index and unidirectional linkage for other variables.

Sharma and Mahendru (2010)[21] studied a long term relationship of Bombay Stock Exchange (BSE) with macroeconomic variables namely gold price, foreign exchange reserve, inflation rate and change in exchange rate. To determine the relationship weekly data from the period of January 2008 to January 2009 was used.

[19] De Bondt, G. J. (2008). Determinants of Stock Prices: New International Evidence. *The journal of portfolio management*, 34(3), 81-92.

[20] Rahman, A.R., Sidek, N.R.M. & Tafri, F.H. (2009). Macroeconomic determinants of Malaysian stock market. *African Journal of Business Management, 3(3*), 95 -106.

[21] Sharma,G.D., & Mahendru, M. (2010). Impact of Macro-Economic Variables on Stock Pricesin India. *Global Journal of Management and Business Research*, 10(7), 19-24.

The empirical work used multiple regression equation model to determine the relationship among BSE stock prices and macroeconomic variables. The researchers found that there was a high correlation of exchange rate and gold prices with BSE Stock Prices, whereas there was a limited influence of foreign exchange reserves and inflation rate on the stock prices of BSE.

Agrawal, Srivastav and Srivastava (2010)[22] the empirical study was directed to capture the dynamics between exchange rate movement and stock price volatility. Daily data samples were used in the study and data was collected from Nifty returns and Indian Rupee-US Dollar Exchange Rates. The sample period spans from 11th October, 2007 to 9th March, 2009. The study employed normality test, unit root test, ADF test and granger causality test to analyze the distribution of these two variables. Stationary of these two series was checked with ADF test and the coefficient of correlation between the selected variables. The result showed a slight negative correlation between exchange rate and stock price volatility. Finally the Granger Causality test result showed a unidirectional causality running from stock returns to exchange rates, that is, an increase in the returns of Nifty caused a decline in the exchange rates but the contrary was not found to be true.

Zhao (2010)[23] analysed the dynamic relationship between Chinese exchange rate and stock prices with suitable econometric models, namely cointegration test and vector autoregressive (VAR) and multi-variate generated auto regressive conditionality heteroscedasticity (M-GARCH) models using monthly data from January 1991 to June 2009. The result showed that there is no stable long term relationship between exchange rate and stock price. Furthermore, China adopt managed floating exchange rate regime, so no significant linear relationship among stock price and exchange. The study also examined the cross volatility effects between foreign exchange and stock markets by using likelihood statistic ratio and found bidirectional volatility spill over effects between exchange rate and stock price in China.

[22] Agrawal, G., Srivastav, A. K., & Srivastava, A. (2010).A Study of Exchange Rate moments and Stock Market Volatility. *International Journal of Business and Management*, 5(12), 62.

[23] Zhao, H. (2010). Dynamic Relationship Between Exchange Rate And Stock Price: Evidence From China. *Research in International Business and Finance, 24*, 103-112.

Singh (2010)[24] examined the causality between BSE index toward index of industrial production, inflation (WPI) and exchange rate. This study employed granger causality and correlation matrix for a period from 1995 to 2005. The results found that IIP have strong correlated to stock price and inflation respectively, while exchange rate showed no correlation with stock prices. In addition stock price and IIP showed bilateral relation and stock price and WPI showed unidirectional, whereas no causality relation between stock price and exchange rate. The study suggested Indian stock market followed a work form of market efficiency and exchange rate and WPI focused on informational efficiency.

Lee, Doong and Chou (2011)[25] investigated two issues that the spillover effect between foreign exchange market and stock market; and correlation between stock market and foreign exchange market during stock market volatility. The study applied newly developed Smooth Transition Conditional Correlation-Generalized Autoregressive Conditional Heteroscedasticity (STCC-GARCH) model for the period of 2000 to 2008 in six Asian emerging countries. The study found there was a significant spill over effects between stock market and foreign exchange market and also a strong and higher correlation between stock market and foreign exchange except Philippine countries.

Asaolu and Ogunmuyiwa (2011)[26] the study looked into the impact of macroeconomic variables on Average Share Price (ASP) of Nigerian Stock Market. Yearly data on External Debt, Inflation Rate, Fiscal Deficit, Exchange Rate, Foreign Capital Inflow, Investment, Industrial Output, Inflation Rate and ASP of Nigerian Stock Market was used for the analysis and the data period was from 1986 to 2007. The empirical analysis used techniques like ADF test, Granger Causality test, Co-integration and Error Correction Method (ECM). The results identified a weak relationship between ASP and macroeconomic variables of Nigeria and found a long

[24] Singh, D. (2010). Causal Relationship between Macro-Economic Variables and Stock Market: A Case Study for India. *Pakistan Journal of Social Sciences (PJSS)* 30(2), 263-274.

[25]Lee, C., Doong, S., & Chou, P. (2011). Dynamic Correlation between Stock Prices And Exchange Rates. *Applied Financial Economics, 21*, 789-800.

[26]Asaolu, T.O., & Ogunmuyiwa, M.S. (2011). An Econometric Analysis of the Impact of Macroeconomic Variables on Stock Market Movement in Nigeria. *Asian Journal of Business Management*, 3(1), 72-78.

run relationship exists between ASP and macroeconomic variables for the period under study.

Harasheh and Libdeh (2011)[27] investigated the correlation and causality relationships of stock prices in Palestine with variables like Gross Domestic Product (GDP), Inflation Rate, Exchange Rate, LIBOR, and Balance of Trade (BOT). The data was collected quarterly from the Q1-2000 to Q2- 2010. The study applied unit root test on the variables in order to perform a Granger causality test. The analysis rejected any type of causal relationships between studied macroeconomic variables and stock prices of PEX. Regression analysis draws a significant relationship between all macroeconomic variables concerned with stock prices of PEX (Palestine Exchange).

Adjasi, Biekpe and Osei (2011)[28] their study focused on investigating the dynamic relation between exchange rate movement and stock prices in seven African countries namely, South Africa, Tunisia, Ghana, Kenya, Mauritius, Nigeria and Egypt. To know the long and short run relationship between the exchange rates and stock prices, the researcher employed vector autoregressive (VAR) co-integration and impulse response analysis. Co-integration analysis explicit there is no long run relationship between exchange rate and stock prices except in Tunisia but exchange rate depreciation pulls down the stock prices in all the selected countries. To check this condition impulse response analysis was used in this study, and in four countries (Ghana, Kenya, Mauritius, and Nigeria) it shows a reduction in stock returns when they are induced by exchange rate shocks but increased in South Africa and Egypt.

Alam, Uddin and Taufique (2011)[29] their study focused to understand the effect of exchange rate volatility and market efficiency on stock prices in the Johannesburg stock exchange (JSE). The daily price indices of JSE listed securities and the exchange rates of USD-Rand for the period from January 2000 to December 2004 were taken as sample for the study. The study employed unit root test, ADF test and the Granger causality tests. The result shows a long run movement of share price with

[27]Harasheh, M., & Abu-Libdeh, H.A. (2011). Testing for Correlation and Causality Relationships Between Stock Prices and Macroeconomic Variables-The case of Palestine Securities Exchange, *Department of Finance at Birzeit university,Palestine, 1-6.*

[28] Adjasi, C. K.D., Biekpe, N. B., & Osei, K. A. (2011). Stock Prices and Exchange Rate Dynamics In Selected African Countries: A Bivariate Analysis. *African Journal of Economic and Management Studies*, 2(2), 143 – 164.

[29]Alam, M.M., Uddin, M.G.S., & Taufique, R. (2011). The Relationships between Exchange Rates and Stock Prices: Empirical Investigation from Johannesburg Stock Exchange. *Inventi Rapid: Emerging Economics*.

exchange rate and the co integration test shows the stochastic behaviour of variables. The granger causality test draws no traces of causality between the variables and suggests the investors not to use the exchange rate to forecast the stock prices in Johannesburg stock exchange.

Kumar and Puja (2012)[30] the empirical study employed Johansen's co-integration and vector error correction model to investigate the long run equilibrium relationship between the Indian stock market index (BSE Sensex) and five macroeconomic variables (exchange rates, treasury bills, money supply, wholesale price index, industrial production index) for the period from April 1994 to June 2011. The time series data used in the study was obtained from BSE official website and RBI's Handbook of Statistics on Indian Economy. To check the stationarity of the series, the study employed The Augmented Dickey Fuller (ADF), Phillips-Perron (PP), and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The results explicit a cointegration and a long-run equilibrium relationship between stock market and macroeconomic variables. It was observed that the exchange rates are found to be insignificant in determining stock prices. In the Granger causality method, macroeconomic variables cause the stock prices in the long-run but not in the short-run.

Eita (2012)[31] ascertained the relationship between macroeconomic variables and stock market prices in Namibia. The macroeconomic variables are economic activity, interest rate, inflation, money supply and exchange rate. The study used quarterly data for a period of 1998Q1 to 2009Q4 in Namibia. The study applied Vector Auto Regression (VAR) model and Vector Error Correction Model (VECM) for capturing the macroeconomic determinants of stock prices. The study found a positive relationship between stock price and money supply, and economic activity while a negative relationship among inflation and interest rate. The results also indicate that the exchange rate, money supply, price and interest rates move stock market prices away from equilibrium.

[30] Kumar, N. P., & Puja, P. (2012). The Impact Of Macroeconomic Fundamentals On Stock Prices Revisited: Evidence From Indian Data, *MPRA Paper No.38980.*

[31] Eita, J. H. (2012). Modeling Macroeconomic Determinant of Stock Market Prices: Evidence from Namibia. *The journal of Applied business Research, 28(5),* 871-884.

Rjoub (2012)[32] investigated the dynamic of long and short run relationship between Turkish stock price and exchange rate by considering the US stock prices as a world market. The study period spans from August 2001 to August 2009. The analysis used Co-Integration, Granger Causality, Impulse Response Tests and Vector Auto Regression. The study concluded co-integration revealed long run relationship along with Granger Causality showed exchange rate and Turkish stock price are bidirectional relationship and impulse response indicated Turkish stock price, exchange rate and US stock price responded within a short time.

Ray (2012)[33] analysed the effect and causal relationship between macro-economic variables and Indian stock prices. The study used the variables are BSE (Sensex) share price for Indian stock prices with macro-economic variables. The data period was from 1991 to 2011 on annual basis. The study used multivariate granger causality and multiple regressions. The results found no causal relationship between stock prices with interest rate and IIP and unidirectional between stock prices with inflation, FDI, GDP, exchange rate (REER), gross fixed capital formation and bi-directional between stock prices with foreign exchange reserves , money supply, crude oil and whole sale price index. Further the multiple regression explicit that oil price and gold price have negative significant effect on stock prices, and balance of trade, FOREX, interest rate, GDP, IIP and money supply are positively effect in stock price.

Sharma and Mahendru (2014)[34] the study aimed to find the impact of four major macroeconomic variables namely Gold price, foreign exchange reserves, exchange rate and inflation on the stock prices. The analysis was conducted by using weekly data for the period extended from January 2008 to January 2009. Data used for this study was collected from BSE Sensex for stock prices, RBI for inflation and foreign exchange reserves, NASDAQ for gold prices and Federal Reserve statistical release for exchange rate. The empirical result reveals that exchange rate and gold prices are affecting the entire BSE Stock prices. Independent variables except inflation rate and foreign exchange reserve have a significant relation with stock prices. On the other side,

[32] Rjoub, H. (2012). Stock prices and exchange rates dynamics: Evidence from emerging markets. *African Journal of Business Management, 6(13),* 4728–4733.

[33] Ray, S. (2012). Foreign Exchange Reserve and its Impact on Stock Market Capitalization: Evidence from India. *Research on Humanities and Social Sciences, 2(2), 46-60.*

[34] Sharma, G. D., & Mahendru, M. (2014). Impact of Macro-Economic Variables on Stock Prices in India. *Social Science Research Network (SSRN).*

inflation rate and gold price do not show any significant effect on stock returns, which means that inflation rate and foreign exchange reserve don't influence the stock price.

From the above paragraphs it is understood that many of the economic scholars focused on share price market and exchange rate. We can also observe the increased use of panel data estimation in cross country samples. Sophisticated methodologies like cointegration, VAR, GMM, OLS, ARCH, and GARCH etc were used to get robust results. This combination of variables were studied in almost all parts of the world but it was found that BRICS as a developing economic group was not studied.

2.3 Studies of Inflation with Exchange Rate, Forex Reserves and Trade Openness.

Inflation is not a new point of discussion, many of the times each and every country was affected by the inflation. There are many reasons for inflation; it may be because of internal factors or of external factors. In case of developing countries, inflation playing a significant role in the development process. The extensive work has been started after the Romers (1993) proposal that open economies reduces the inflation. Many economists studied this relationship in different parts of the world and other factors which are used to stabilize the inflation are exchange rate and forex reserves were also given importance in present dynamic economic environment.

Ame (1973)[35] the study focused to establish a relation between trade openness and inflation. To analyze the relationship, a sample of 33 less developed countries was used and in this both yearly and five-year average data from 1960–1961 to 1964–1965 was observed. A negative relationship between openness and inflation emerged in a bivariate framework using the method of ordinary least squares. However, when the analysis was extended to a multivariate exercise, the results were not unambiguous. Though the openness variable was not always significant, it always had a negative sign.

Lane (1997)[36] the study examined the time-consistent inflation rate to the degree of trade openness of an economy. The data was collected from 114 countries and a cross-section over time period from the year 1973 to 1988 was observed. The

[35] Ame, I.M. (1973). The Optimal Balance-of-Payments Strategy of a Less Developed Country. *Economic Record*, 49(2), 270–279.

[36] Lane, P.R.(1997). Inflation in open economies. *Journal of International Economics*, 42, 327–347

same examination was done in the OECD group of countries also. The simple correlation between openness and inflation for both the full sample and the OECD is negative and openness and GDP are also negatively correlated. The negative correlation between trade openness and GDP is twice as strong for the OECD group of countries as for the full sample, reflecting the greater incidence of policy-induced degree of openness in the non-OECD economies. The study reports, the country size which was neglected in the Romer regression and the results on openness and country size are even stronger for OECD economies than for the whole sample.

Terra (1998)[37] highlighted the impact of openness on inflation for the whole sample period from 1973 to 1990. The study converted the samples in to pre-debt crisis period (1973- 1981) and for the debt crisis period (1982- 1990). The data was taken from the international financial statistics (IFS). The empirical study used regression and the result found that the significant negative relationship between inflation and openness among Severely Indebted Countries (SICs) during the debt crisis period than pre-debt crisis period.

Temple (2002)[38] the study investigated the link between trade openness and the slope of the output-inflation trade-off or Phillips curve. The study argues that the time consistency theory is an unsatisfactory explanation of the openness-inflation correlation, and that alternative explanations should be considered. In more open economies, the inflation may be relatively costly, because inflation is associated with exchange rate movements which are serious concern for more open economies. This explanation for lower inflation in open economies is compatible with the time consistency hypothesis, but does not rely upon it.

Sachsida, Carneiro and Loureiro (2003)[39] estimated the relation between inflation and trade openness by validating the **Romer (1993)** hypothesis, that there is a negative relation between inflation and trade openness. The penal data of 152 countries was used in this study and data have been obtained from **Summers and Heston (1991),** the time period extends from 1950 to 1992. This study supports the **Romer (1993)**

[37] Terra, C. T. (1998). Openness and Inflation: A New Assessment. *The Quarterly Journal of Economics*, 641-648.

[38] Temple, J. (2002). Openness, Inflation, and the Philips Curve: A Puzzle. *Journal of Money, Credit, and Banking*, 34(2), 450-468.

[39] Sachsida, A., Carneiro, F, G., & Loureiro, P.R.A. (2003). Does Greater Trade Openness Reduce Inflation? Further Evidence using Panel Data Techniques. *Economics Letters*, 81(3), 315–319.

hypothesis, demonstrating that there is a negative relation between openness and inflation. This relation was observed as a whole and is not specific to a group of countries, nor is it specific to a certain time period.

Larrain (2003)[40] the study examined the behaviour of exchange rate and current account or net foreign assets under central bank foreign exchange intervention. The study used current account net foreign assets identity, as well as the long run monetary exchange rate model. The two way causality of this non-linear model is slightly more complex, but is also analytically richer than assuming that exchange rates change solely in a one stop process as targeted by central banks.

Alfaro (2005)[41] found that openness does not seem to play a role in the short run in restricting inflation, but a regime with fixed exchange rate plays a significant role. In a panel data set of developed and developing countries totaling 130 countries from 1973 to 1998 was used in this study. The negative and strong relationship between inflation and a fixed exchange-rate regime is consistent. The result describes a pegged exchange, inconsistent with fiscal and monetary policies can achieve low, long-term and sustainable inflation.

Wang and Lin (2005)[42] the study found the relationship between the inflation rate and the foreign exchange reserves in five East Asian economies: Japan (JPN) and four Tigers namely Hong Kong (HK), Korea (KOR), Singapore (SNG) and Taiwan (TWN). The quarterly data from 1981Q1 to 2003Q4, except from 1994Q1 to 2003Q4 for Hong Kong was used in the study. The data for U.S., Japan, Hong Kong, Korea, Singapore are collected from International Financial Statistics, IMF. For Taiwan, the data are from Financial Statistics Monthly Taiwan District, the Central Bank of China. Cochrane-Orcutt method was employed to estimate the regressions. The inflation rate in Japan has significantly negative trend. And the trends in other four economies are not obvious. The inflation rate of U.S. is positively related to the domestic inflation rate in each economy.

[40] Larrain, M. (2003). Central Bank Account, Intervention, the Current and Exchange Rates. IAER: 9(3).
[41] Alfaro, L. (2005). Inflation, openness, and exchange rate regimes: theQuest for Short Term Commitment. *Journal of Development Economics*,77(1), 229–249.
[42] Wang, J., & Lin, M. (2005). Foreign Exchange Reserves and Inflation: an Empirical Study of Five East Asian Economies. *In 2010 Conference on Economics and Business.*

Hanif and Batool (2006)[43] tested the Romer (1993) hypothesis that inflation is lower in small and open economies for the Pakistan economy and also investigated the possible impact of openness on domestic price growth. The annual time series data for the period 1973–2005 was used for this study. Augmented Dickey-Fuller (ADF) approach is used to check the stationarity and HAC Estimator is used to estimate the proposed model. The results support the Romer (1993) hypotheses that inflation is lower in small and open economies. The study found a significant negative impact on the domestic price in Pakistan.

Lane and Gian (2006)[44] proposed that it is the existence of imperfect competition and the presence of rigid nominal prices in the non-tradable sector that leads to an inverse relationship between openness and inflation. **Lane (1997),** the conventional explanation of how openness influences inflation—that a country with greater openness has less gain from the generation of an inflationary ‘‘surprise’’, due to the deterioration of the terms of trade is limited, for it applies only to countries that are large enough to affect the international relative price structure. Therefore, the author proposes another transmission link to explain the relation between inflation and openness: the existence of imperfect competition and the presence of rigid nominal prices in the non-tradable sector.

Mukhtar (2010)[45] tested the Romer hypothesis, that there is a negative relation between inflation and trade openness for Pakistan. The study used multivariate co-integration and a vector error correction model for Pakistan during 1960–2007. The empirical findings under the cointegration test establish a significant negative relationship between inflation and trade openness in the long-run, which confirms the applicability of Romer’s hypothesis for Pakistan.

Zakaria (2010)[46] examined the laison between trade openness and inflation in Pakistan by using annual time-series data for the period 1947–2007. The dependent variable is inflation rate, which is measured by growth rate of CPI and Other control variables i.e. money supply, fiscal deficit, exchange rate depreciations, foreign

[43] Hanif, M.N., & Batool, I. (2006). Openness and inflation: a case study of Pakistan.

[44] Lane, P.R., Milesi-Ferretti., & Gian, M.M. (2006). The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004.

[45] Mukhtar, T. (2010). Does Trade Openness Reduce Inflation? Empirical Evidence from Pakistan. *The Lahore Journal of Economics*, 15(2), 35–50.

[46] Zakaria, M. (2010). Openness and Inflation: Evidence from Time Series Data. *Doğuş Üniversitesi Dergisi* ,11 (2),313–322.

inflation, terms of trade, foreign debt and democracy significantly affect inflation in the expected directions. The study employed Generalized Method of Moments (GMM) estimation technique, and the empirical analysis showed a positive relation between trade openness and inflation in Pakistan. The results also imply that in the short run, a flexible exchange rate has not served as a commitment mechanism and thereby huge inflation. However, the study did not find robust evidence validating the correlation between trade openness and the standard trade-off measures between product and inflation.

Samimi, Ghaderi and Sanginabadi (2011)[47] provided evidence on the impact of trade openness on the inflation in Iran. The study applied a bounds test approach to test the level relationship within the autoregressive distributed lag (ARDL) model proposed by **Pesaran et al. (2001).** The empirical result shows a negative and significant effect of openness on inflation in the short run but its effect in the long run is not significant.

Samimi, Ghaderi, Hosseinzadeh and Nademi (2012)[48] the study tested the Romer (1993) hypothesis, that inflation is lower in more open economies. The study used the panel data over the last two decades in both developed and developing countries. The data was obtained from the WDI for developed and developing countries during 1990–2009 and economic globalization data was taken from the KOF index of globalization. The study employed penal data regression model, OLS method, fixed effect, Random effect, Chow and Hausaman tests. The results cast a robust and negative relationship between trade openness and inflation. The estimated result regarding the traditional measure of trade openness indicates a positive and significant association between trade openness and inflation which opposes the view of the Romer.

García and González (2013)[49] the study finds the effect of country risk premium and commodity price shocks on monetary policy in small open economies. To measure the monetary policy, the strategy proposed by **Del Negro, Schorfheide,**

[47] Samimi, J. A., Ghaderi, S., & Sanginabadi, B. (2011). Openness and Inflation in Iran. *International Journal of Economics and Management Engineering*, 1 (1), 42–49.

[48] Samimi, A. J., Ghaderi, S., Hosseinzadeh, R., & Nademi, Y. (2012). Openness and Inflation: New Empirical Panel Data Evidence. *Economics Letters*, 117,573–577

[49] García, C.J., & González, W.D. (2013). Exchange Rate Intervention in Small Open Economies: The Role of Risk Premium and Commodity Price Shocks. *International Review of Economics and Finance*, 25, 424–447.

Smets, and Wouters (2007)[50] was applied. The study used the DSGE model to obtain the prior information for estimating a vector auto regression (VAR) model. A Bayesian approach was used first to estimate the DSGE model for an emerging economy. The results indicate that emerging economies face more challenges in designing monetary policy than developed economies. For instance, researchers found that the risk premium shock could explain most of the variability in the real exchange rate. The results also indicate that the real exchange rate causes significant reallocation of resources across sectors in the short run. The Mundell–Fleming–Dornbusch model which explains the devaluation of the domestic currency is an essential element in the mechanism to adjust the economy following a negative external shock.

Berganza and Broto (2012)[51] empirically analyzed the link between exchange rate volatility inflation target (IT) and forex intervention (foreign reserve movements). The panel data set of 37 countries and the sample runs from 1995 Q1 to 2010 Q1 and investigated here is that any terms of deference between exchange rate volatility and forex intervention in 37 inflation target (IT) countries and non-inflation target (IT) EMEs. To estimate the panel data Pooled OLS with time dummy was employed and to tackle the endogeneity issue the study used GMM method. The study highlighted the asymmetric effects of forex intervention and concluded forex intervention has lower the exchange rate volatility in IT countries and not significant in case of non- IT countries. The result showed an asymmetric effect for both negative and positive impact of intervention is different. Furthermore, the total effect of lower intervention on exchange rate volatility increases after crisis in IT countries.

From the above literature it is evident that most of the researchers are very keen on studying the behavior of inflation in the open economies and the results are not the same in all situations. The empirical evidences from the developing nations showed the impact of inflation on domestic prices and other indexes. This piece of literature helps to understand the behavior of trade openness and exchange rate intervention in the BRICS economic block. .

[50] Del Negro., Schorfheide, M. F., Smets, F., & Wouters, R. (2007). On the Fit of New Keynesian Models. *Journal of Business and Economic Statistics*, 25, 123–143.

[51] Berganza, J. C., & Broto, C. (2012). Flexible Inflation Targets, Forex Interventions and Exchange Rate Volatility in Emerging Countries. *Journal of International Money and Finance*, 31, 428–444.

2.4 Studies of Gross Domestic Product with Exchange Rate, Forex Reserves and Trade Openness.

Gross domestic product (GDP) is used as an indicator of countries' economic growth. The following paragraphs list out the literature about gross domestic product (GDP) in the current scenario. This reviews helps in understanding the variables which shows greater influence on GDP. The empirical evidences can give us a clear understanding about the importance of GDP. Moreover the current study on BRICS economy needed to understand the changing behaviour of GDP since this economic block with developing countries was established on the common lines of GDP growth rate. Some of the earlier empirical works are mentioned below,

Dollar (1992)[52] the analytical study examined the sources of growth in 95 developing economies since 1976 to 1985. After examining the different outcomes in Asia and Latin America, the study concluded that "the more important differences seem to center on exchange rate management and on the trade regime. On the basis of real exchange rate distortion and variability, an index of outward orientation can be constructed. This outward orientation measure is highly correlated with per capita GDP growth in a large sample. These results strongly imply that trade liberalization, devaluation of the real exchange rate, and maintenance of a stable real exchange rate could dramatically improve growth performance in many poor countries.

Jonsson and Subramanian (2001)[53] this paper examined the empirical relationship between Trade and Total Factor Productivity (TFP) in South Africa. The cross sectional panel data for the years 1990-1994 and 1994-1998 for 24 manufacturing industries was used and it is shown that trade liberalization had a positive impact on TFP growth during the 1990s. In addition, time-series evidence on macro data supports a positive long-run relationship between TFP and openness. The results indicate that trade liberalization has contributed significantly to augmenting South Africa's long-run growth potential via its impact on TFP growth.

[52] Dollar, D. (1992). Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985. *Economic Development and Cultural Change*, 40(3), 523-544.
[53] Jonsson, G., & Subramanian, A. (2001). Dynamic Gains from Trade: Evidence from South Africa. *IMF Staff Papers*, 48(1), 197-224.

Yanikkaya(2003)[54] the study investigated the relationship between trade openness measures and growth. Two types of openness measures were used namely measures of trade volumes and measures of trade restrictions. The trade volumes measures are trade shares, export shares, and import shares in GDP and measures of trade intensity, which are trade with OECD countries, non-OECD countries, and U.S. bilateral trade figures. The cross country regression was applied to a panel data of over 100 developed and developing countries were observed from 1970 to 1997. The result indicates that restrictions on trade can promote growth, especially of developing countries under certain conditions. The study argues that there is no simple and straight forward positive association between barriers to trade and growth. Further, populations also positively affect growth through increasing trade volumes. Hence, the regression results for trade volumes provide substantial support for the hypothesis that trade promotes growth through a number of channels such as technology transfers, scale economies, and comparative advantage.

Jin (2004)[55] the study aimed to fill the literature gap in economic growth with trade openness using provincial time-series data in China. For each province, annual time-series over the period 1978–1998 are used for the analysis. The provincial data for all prescribed variables were taken from Statistical Year book published in each province. The real gross domestic product (GDP) in each province and this growth has been accompanied by persistent trade openness of the provinces. The result found a positive output effect of openness in short-run and it appears to be consistent with the new growth theories that increased openness raises the output growth in long run.

Dritsaki, Dritsaki and Adamopoulos (2004)[56] the empirical study investigated the relationship between Trade, Foreign Direct Investment (FDI) and economic growth in Greece by using annual data for the period 1960-2002. The data was obtained from the International Monetary Fund. The Johansen co-integration analysis suggested that there is a long-run equilibrium relationship. The results of the Granger causality test showed that there is a causal relationship between the examined variables. Economic

[54]Yanikkaya, H. (2003). Trade Openness and Economic Growth: A Cross-Country Empirical Investigation. *Journal of Development Economics* 72, 57– 89.

[55]Jin, J. C. (2004). On The Relationship between Openness and Growth in China: Evidence from Provincial Time Series Data. *The World Economy*, *27*(10), 1571-1582..

[56]Dritsaki, M., Dritsaki, C., & Adamopoulos, A. (2004). A Causal Relationship between Trade, Foreign Direct Investment and Economic Growth in Greece. *American Journal of Applied Sciences*, 1 (3), 230-235.

growth, trade and FDI appear to be mutually reinforcing under the open-door policy. The study also used vector autoregressive model (VAR) to estimate the causal relationship between exports, economic growth and foreign direct investments.

Gosselin and Parent (2005)[57] the empirical investigation was to estimate a long-run reserve demand function in a panel of eight Asian emerging-market economies. The sample covers China, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, and Thailand. The dependent variable is the log of total reserves minus gold divided by nominal GDP (*res*) and the explanatory variables are import propensity (imports divided by GDP, *imp*) and the volatility of export receipts (10-year moving standard deviation, *v(x)*). For testing the cointegration the study used **Kao (1999)** and **Pedroni (1999)** was used. This model could not explain the very strong pace of reserve accumulation in the past two years. This suggests that, as long as historical relationships continue to exists, a slowdown in the pace of reserve accumulation is likely. This finding implies negative risks for the U.S. dollar. However, the substantial capital losses that Asian central banks would incur if they were to drastically change their holding policy mitigate the risks of a rapid depreciation of the U.S. dollar triggered by Asian central banks.

Dreher and Vaubel (2009)[58] the empirical study is about the acceleration monetary policy before elections. The panel data analysis for up to 149 countries in the span period from 1975 to 2001 was used to test this hypothesis. The dependent variables are the (log) ratio of the domestic component of the monetary base to the foreign component and the log of international reserves to trend GDP. The study measured the pre-election period that is 12 months and one year after election. To test the robustness of the results, the study alternatively includes an election year dummy in the following section. Results explicates that Central banks use foreign exchange interventions to gain leeway for expansionary open-market operations without depreciating the currency at election time and the other hypothesis empirical results did not find a significant correlation between our pre-election index and net private capital flows. Thus, if there is a monetary political business cycle; sales of foreign exchange are especially likely before elections.

[57]Gosselin, M.A., & Parent, N. (2005). An Empirical Analysis of Foreign Exchange Reserves in Emerging Asia Bank of Canada.

[58] Dreher, A., & Vaubel, R. (2009). Foreign Exchange Intervention and the Political Business Cycle: A Panel Data Analysis. *Journal of International Money and Finance*, 28, 755–775.

Baltagi, Demetriades and Law (2009)[59] this study addressed the empirical question of whether trade and financial openness can help in financial development and to find its variation across countries in recent years. The study employed two data sets to estimate, one is a dataset of 42 developing countries where private credit is the dependent variable and another dataset includes both industrialized and developing economies, totaling 32 countries. Utilizing annual data from developing and industrialized countries and dynamic panel estimation techniques (GMM estimation) was applied. The result reveals that the marginal effects of trade (financial) openness are negatively related to the degree of financial (trade) openness, that indicating relatively closed economies stand to benefit most from opening up their trade or capital accounts. Although these economies may be able to accomplish more by taking steps to open both their trade and capital accounts, opening up one without the other could still generate gains in terms of banking sector development.

Fang-Yuan and Jun (2012)[60] empirically studied the effect of GDP and exchange rate on foreign exchange reserves with a quintile regression model. The study period was from 1985 to 2010 and the results shows that both GDP and exchange rate has a greater influence on the volume of foreign exchange reserves and the effect of exchange rate on foreign exchange reserves is higher than GDP at mean, middle, lower place. The results show that both GDP and exchange rate have a remarkable influence on the size of foreign exchange reserve and the effect of exchange rate on foreign exchange reserve is higher than GDP at mean place and middle and lower quintile, smaller than GDP at higher quintile.

Tabas, Mirzaeenezhad and Mohammadi (2012)[61] the empirical study finds the impact of exchange rate movements on macro economic variables (Real GDP, Inflation and Money Supply). The study was on Islamic Republic of Iran during the time period from 1973 to 2007 and the time series data was collected from economic indicators, balance sheets, published magazines and national accounts by Central Bank

[59] Baltagi, B. H., Demetriades, P. O., & Law, S. H. (2009). Financial Development and Openness: Evidence from Panel Data. *Journal of Development Economics*, 89, 285–296.

[60] Fang-Yuan, L., & Jun-Guo, S. (2012). The Empirical Research of the Impact of GDP and Exchange Rate on Foreign Exchange Reserve Scale in China-Based on Quantile Regression Model. *Research Journal of Applied Sciences, Engineering and Technology*, 5(6), 2113-2117.

[61] Tabas, H. M., Mirzaeenezhad, M. R., & Mohammadi, T. (2012). The Effect of the Real Effective Exchange Rate Fluctuations on Macro-Economic Indicators (Gross Domestic Product (GDP), Inflation and Money Supply). *Interdisciplinary Journal of Contemporary Research in Business*, 4(6), 1097-1103.

of the Islamic Republic of Iran and for exchange rate, the International Financial Statistics were used. The study used VAR model, VECM model and HP filter method with Granger causality technique. The results elucidate negative long term relationship between the real exchange rate and real GDP. The observed result of Granger causality shows unidirectional relationship from real GDP toward real effective exchange rate. Over all the real effective exchange rate shock explains the negligible percentage of real GDP and price level.

Mallick, **Pradhan**, **Muthiyan and Das(2013)**[62] the study investigated the relationship between expenditure on education and economic growth in selected 14 major Asian countries (*Bangladesh, China, Hong-Kong, India, Japan, Nepal, Pakistan, Malaysia, Philippines, Saudi Arabia, Singapore, Sri-Lanka, Thailand, and Turkey*) using panel data from 1973 to 2012. Data has been extracted on the basis of GDP growth and collected from World Development Indicators and World Bank. Liner panel model has been applied where the expenditure on education is independent variable and economic growth is dependent variable. The results of Pedroni co-integration test states a long-run equilibrium relationships existence between expenditure on education and economic growth. From the long run elasticity (FMOLS) the study finds all countries have positive impact on economic growth due to expenditure on education in long run. Further the panel Vector Error Correction presents a unidirectional causality running from economic growth to educational expenditure in short-run whereas expenditure on education causes economic growth in long-run.

Danmola (2013)[63] analyzed the impact of exchange rate volatility on macroeconomic variables in Nigeria. The study period was from 1980 to 2010 and the study used correlation matrix, OLS and Granger causality test and result showed positive influence of exchange rate volatility on gross domestic product, foreign direct investment and trade openness and negative influence on inflationary rate. Subsequently exchange rate volatility on GDP and FDI showed unidirectional and trade openness showed bi-directional while inflationary rate are not significant relatively.

[62] Mallick, L., Pradhan, K. C,, Muthiyan, P., & Das, P. K. (2013). On the Dynamics of Expenditure on Education and Economic Growth in Selected Asian Countries: Evidence from FMOLS and Panel VECM Model.

[63] Danmola, R. A. (2013). The Impact of Exchange Rate Volatility on the Macro Economic Variables in Nigeria. *European Scientific Journal*,9(7), 1857 – 1881.

From the above discussed studies we can observe that GDP is playing a pivotal role in the economy of nations. The empirical evidences were observed in almost all parts of the globe. Some studies limited to specific groups such as Asian countries, G-7, ASEAN, developed and developing countries. Most of the studies shows the influence of trade openness on the GDP.

2.5 Studies of Sacrifice Ratio with Exchange Rate, Forex Reserves and Trade Openness.

The inflations caused by series of financial crisis around the globe gives a serious warning to the developing nations, as it hinders the growth of the economy central banks of these nations are targeting the inflation through different mechanisms. After the successful implementation of inflation targeting by New Zealand many countries formally adopted the inflation targeting mechanism in the past two decades. . The inflation brings general increase in the price levels of goods and services, but bringing down the inflation is no free-lunch and is usually associated with non-trivial short run output losses (Ball, 1994). After the works of Ball many economists highlighted the concept of sacrifice ratio, which is generally calculated as the ratio of output loss with trend inflation. The following write-ups discuss some of the studies which observed the inflation targeting mechanisms and disinflation episodes over a period in different parts of the globe. This part also helps us in understanding the concept of sacrifice ration and its changes with other macroeconomic variables like trade openness, exchange rate and forex reserves in a lucid way.

Hušek and Formánek (2005)[64] estimated the sacrifice ratio in Czech economy by using the cost of disinflation policy. The study used time series data for the analysis and the data period was divided into two, one from 1994 to 1998 and other started from 1998 to 2003. The study employed vector auto regression and vector moving average representations. The result of the estimation indicated that the Czech sacrifice ratio coefficient have a relatively low absolute value.

[64]Hušek, R., & Formánek, T. (2005). Estimation of the Czech Republic Sacrifice Ratio for the Transition Period. *Prague Economic Papers*, 2005(1), 51-63.

Daniels, Nourzad and Vanhoose (2005)[65] this piece of empirical work takes into account the degree of Central Bank Independence (CBI) along with the interaction of central bank independence with greater openness, which two of the theoretical arguments we review indicate should play an important role in conditioning the effect of openness on the sacrifice ratio. The study used cross-country data of Temple with a measure of central bank independence, which allows us to account for an interaction between CBI and openness. The empirical results indicate that once this interaction is taken into account, there is an unambiguous positive relationship between openness and the sacrifice ratio. The empirical results gave a clear understanding that greater central bank independence increases the sacrifice ratio. In addition, they show that greater openness lowers the effect of CBI on the sacrifice ratio.

Serju (2009)[66] estimated the output cost of disinflation in selected Caribbran states. The study used quarterly data from January 1981 to February 2008 for the variables of real GDP and inflation. The data series for Jamaica were obtained from the Statistical Institute of Jamaica while the series for Trinidad & Tobago were acquired from the IMF International Financial Statistics CD Rom as well as from the Trinidad & Tobago Central Bank's website. The study employed five methodologies to calculate the sacrifice ratios for the episode-specific model. For the first two episode-specific models, the paper fully adopts Ball's (1994) and Zhang's (2001) procedures, and other two advanced approaches by Nelly and Waller (2001). The study also used SVAR model to identified changes in commodity prices because of sudden shocks to inflation. Finally the study found during disinflation period very low form of sacrifice ratio for Jamaica and Trinidad and Tobago. The main implication of this study was that the relatively small sacrifice ratio makes it beneficial for policy makers to attempt to reduce inflation to single digit without fear of contracting output significantly.

Daniels and VanHoose (2010)[67] considered the impact of exchange-rate pass through and how pass through conditions effect of openness on the sacrifice ratio. The study used simple theoretical model developed in Daniels and VanHoose (2006) for the

[65]Daniels, J. P., Nourzad, F., & VanHoose, D. D. (2005). Openness, Central Bank Independence, and the Sacrifice Ratio. *Journal of Money, Credit, and Banking*, 37(2), 371-379.

[66] Serju, P. (2009). Estimating the Output Cost of Disinflation: An Application to Jamaica and Trinidad & Tobago. *Journal of Business, Finance and Economics in Emerging Economies*, 4(1).

[67] Daniels, J. P., & VanHoose, D. D. (2008). Exchange-Rate Pass Through, Openness, and the Sacrifice Ratio. *Marquette University*, Department of Economics,*Working Papers and Research*, (0805).

variations in extent of exchange-rate pass through and the degree of trade openness and simultaneous impacts on the sacrifice ratio. This model predicted that both exchange rates pass through and degree of openness has effects on the sacrifice ratio.

Adebiyi, Adebayo and Mordi (2011)[68] investigated the possible effect of exchange rate to domestic inflation in Nigeria. They used quarterly data for the period from 1980 to 1998. For the analysis Bayesian frame work of DSGE (Dynamics Stochastic General Equilibrium) model was adopted. They found positive and significant response of inflation to exchange rate in the short run. It showed a small and incomplete pass-through of exchange rate to domestic inflation with pass-through.

Daniels and VanHoose (2009)[69] empirically evaluated the implications of an open economy in which both trade openness and capital mobility variation can influence the sacrifice ratio which also controlling for other important factors central bank independence and wage duration. They employed data sets taken from Ball (1994) regarding sacrifice ratio (SAC) for 58 disinflations for 16 countries from 1960 to 1980s. They attempted the independent variables of trade openness, capital mobility, central bank independence and wage duration on the sacrifice ratio in cross- country data. Overall, the study found that increased trade openness or greater capital mobility can tend to lift up the sacrifice ratio. The participation of central bank independence and wage duration enhanced trade openness with higher sacrifice ratio.

Loungani, Prakash, Razin and Yuen (2001)[70] estimated the determinants of the output- inflation trade off in an open economy. The study used data from the IMF's annual report on exchange arrangements and exchange restrictions over the period of 1950-1986. Further the sample of 35 countries used in the study which was used by Ball, Mankiv and Romer (BMR) bases which was grouped in to four average value of capital index. They found restrictions on capital mobility and have reduced the inflation rate with which a small lose in output.

[68] Adebiyi., & Adebay, M. (2011). A Dynamic Stochastic General Equilibrium (DSGE) Model of Exchange Rate Pass-Through to Domestic Inflation in Nigeria. *Central Bank of Nigeria*, 49p.

[69] Daniels, J., & VanHoose, D. D. (2009). Trade Openness, Capital Mobility, and the Sacrifice Ratio. *Open Economics Review*, 20(4), 473-487.

[70] Loungani, P.A., Razin. A., & Yuen, C.W. (2001). "Capital Mobility and the Output–Inflation Tradeoff," *Journal of Development Economics*, 64(1).255–274.

Loungani, Prakash, Razin and Yuen (2002)[71] investigated the determinants of countries sacrifice ratio, to which capital is internationally mobile. Furthermore, a companion piece which showed that sacrifice ratio also depends on trade and the degree of capital and current account restrictions. They used regressions which were explained from Ball (1993, 1994) and Quinu (1997). The study found that sacrifice ratio are smaller the quicker is the speed measured from disinflation depends on degree of capital and current account restrictions.

Zhang (2005)[72] theoretically and empirically studied the sacrifice ratio with long- lived effects which include the strong and possible effects of persistence and hysteresis in G-7 countries. The study used quarterly output as well as unemployment data from 1960 to 1999. The results found that sacrifice ratio with long- lived are higher than sacrifice ratio which cannot take in to account for long lived effects, subsequently they used a standard method framed by Ball (1994) for calculating sacrifice ratio and has a larger downward bias with strong persistence effects. Furthermore, both random and fixed effects models showed that there is a negative relationship between inflation and sacrifice ratio and explained in 1990 sacrifice ratio are higher than other periods. Finally, the study argued that there is no significant negative relationship between sacrifice ratio and nominal wage rigidities.

De Roux and Hofstetter (2012)[73] investigated the contradictory views of Concalves and carvallio (2009) claimed inflation targeting reduces sacrifice ratios while Brito (2010) disproves that argument. They argued that the inflation targeting reduces sacrifice ratio if the disinflation process is in long run. Indeed, inflation targeting reduces the output losses associated with disinflation. If increase in disinflation, inflation targeting is irrelevant.

From the above reviews we can observed that the sacrifice ratio was influenced by the degree of openness and the length of the disinflation periods and the degree of central bank independence. It was observed from the works of Joseph P. Daniels et al.,(2005) that greater the central bank independence gives greater sacrifice ratio and

[71] Loungani.P., Razin, A., & Yuen, C.W. (2002). Sacrifice Ratios in Closed vs. Open Economies: An Empirical Test, Draft Working Paper.

[72] Zhang, L.H. (2005). Sacrifice Ratios with Long-Lived Effects. *International Finance,* 8(2), 231–262.

[73] De Roux, N., & Hofstetter, M. (2012). Sacrifice Ratios and Inflation Targeting: The Role of Credibility. Documento CEDE No.2012-03.

greater openness reduces the central bank independence so sacrifice ratio will be low. Ball (1994), Temple (1998) reported the calculating methods of sacrifice ratio. Lawrence Huiyan Zhang (2005) studied in G-7 countries, Prudence Serju (2009) studied in Carabbian states and many studies was found in individual countries from Europe and Africa was, so it is very relevant to study the sacrifice ratio in a group of developing countries like BRICS, and it also found that vey less studies were observed on the effects of exchange rate, forex reserves and trade openness on sacrifice ratio.

2.6 Studies of BRICS Countries:

The above four sections in this chapter discussed about the behaviour of selected variables in different countries or group of countries in the world. Here we have given focused attention to the study sample group BRICS namely Brazil, Russia, India, China and South Africa. Some of the important articles are mentioned below

Linnertova et.al (2007)[74] explained why BRIC countries were selected and with a focus on economic and financial aspects in China. The study used economic and financial aspects such as economic size, economic growth, income and demographic, global demand pattern and currency movement. They concluded BRIC countries developed better than prediction of Goldman Sachs. All BRIC countries growth performs are satisfactory, except Brazil because of the economic changes that are occurred in order to establish macroeconomic stability.

Bhar and Nikolova (2007)[75] analyzed the mean and volatility spillover effects of global and regional level of integration on the BRIC countries. The study found that there is a high degree of integration exists between BRIC and respective regions. Further, the mean spillover effects positively from world stock index of BRIC countries while volatility spillover effects positively in Brazil, Russia and India and negative and significant for China. Finally they suggested the existence of portfolio diversification opportunities for international investors and portfolio managers

[74]Linnertová, D., Reuse, S., & Knosová, B. (2008). The Analysis of BRIC Countries Focus on the Situation in China.

[75]Bhar, R., & Nikolova, B. (2007). Analysis of Mean and Volatility Spillovers using BRIC Countries, Regional and World Equity Index Returns. *Journal of Economic Integration*, *22*(2), 369-381.

Gay (2008)[76] explained time series relationship between stock market index prices and macroeconomics variables such as exchange rate and oil price in BRIC countries. The study uses Box- Jenkins ARIMA model [MA (1).MA (3), MA (6), MA (12)] for monthly data from March 1999 to June 2006. The result showed no significant relationship between respective exchange rate and oil prices and no significant relationship between present and past stock market returns.

Hsing (2011)[77] explained the relationship between South Africa stock market index and the selected macroeconomic variables (government budget deficit, the money supply, exchange rate, world stock market index, world interest rate, real output, domestic real interest rate, nominal effective exchange rate, inflation rate or the world interest rate). The study used quarterly data from IFS (International Financial Statistic) on the bases of 1980:02 to 2010:03.The study concluded south Africa stock market index have long run positive relationship with real output and world stock market index and a negative relationship with domestic real interest rate, but not relation to government deficit, M3, the nominal effective exchange rate or world interest rate.

Mallick and Sousa (2011)[78] examined the macroeconomic impact of monetary policy in terms of output and inflation along with monetary growth rate, the exchange rate and the stock price. They found monetary policy shocks as interest rate using modern Bayesian method and panel vector auto regression model along with recent sign restriction approach. The study found that contractionary monetary policy has a negative effect on output, produce a small liquidity effect leads to fall in commodity prices and strong and negative impact on equity markets.

[76]Gay, R. D. (2008). Effect Of Macroeconomic Variables On Stock Market Returns For Four Emerging Economies: Brazil, Russia, India, And China, *International Business & Economics Research Journal*, 7(3).

[77] Hsing, Y. (2011). The Stock Market and Macro Economic Variables in a BRICS Country and Policy Implications. *International Journal of Economics and Financial Issues,* 1(1), 12-18.

[78] Mallick, S. K., & Sousa , R. M., (2011). Inflationary Pressures and Monetary Policy: Evidence from BRICS Economies. available at: www.qass.org.uk/2011-May_Brunel-conference/Mallick.pdf

De Paula (2011)[79] examined the relationship between exchange rate regime, capital account convertibility and economic performance in BRIC countries. The study used the result of economic performance, quality of macroeconomic policy management. They concluded China, India and Russia managed exchange rate regime with restrictive capital account convertibility with succeed the management of macroeconomic policy and to stabilize environment for economic growth.

Da Silva and Peruffo (2012)[80] analyzed the impact of recent international crisis on commercial relations between Brazil and other BRICS countries (Russia, India, China and South Africa).They collected information from government international organization documents and reports on international trade. The study suggested that bilateral trade between Brazil and other BRICS countries are not characterized in a traditional model but as a increasing the importance of trade between Brazil to other BRICS countries.

Maradiaga, Zapata and Pujula (2012)[81] investigated the relationship between volatility in exchange rates, EURO-USD and YEN USD (G-3 Currencies) on agricultural exports of Brazil, Russia, India, China and South Africa (BRICS) using a vector autoregressive model. They collected monthly and annual data from International Financial Statistics (IFS), Organization for Economic Co-Operation and Development (OECD), World Bank and Annual Free On board (FOB) for a period of January 1961 to December 2008. The study found that excluding for the volatility measures all variables expose 1(2) behaviour except for JPY/USD and EUR/USD using Johansen (1997) ECM and modified Wald Test for non causality. In spite the result showed co-integration for some countries but not for others. Subsequently China and Brazil has a significant effect on agricultural exports.

[79] De Paula, L. F. (2011). Financial liberalization and economic performance: Brazil at the Crossroads 85, Routledge.

[80] Da Silva, A. L. R, & Peruffo, L. (2012). The Impact of the International Crisis on Brazil's Trade with the Other BRICS (Russia, India, China and South Africa. *Brazilian Journal of Strategy & International Relation* , 1(2), 169-200

[81] Maradiaga, D. I., Zapata, H. O., & Pujula, A. L. (2012). Exchange Rate Volatility in BRICS Countries. In *2012 Annual Meeting, February 4-7, 2012, Birmingham, Alabama* (No. 119726). Southern Agricultural Economics Association.

Ali, Anwar and Ziaei (2013)[82] revealed that a causal relationship between exchange rates and stock prices in BRIC countries. Weekly data was collected from Data Stream for the period of 5th May 2003 to 6th September 2010. The study period was divided into three sub groups: pre-crisis, during crisis, post- crisis. They used Bivariate Granger causality test, Tado- Yamaneto causality (modified WALD) test and KPSS tests (Kwaiatkowski). The study shows in the pre-crisis period Brazil showed bidirectional and Russia and India shows unidirectional. In the post period Brazil and Russia have stable relationship and the overall result shows that after crisis, exchange rate and stock prices are relationship but in China no relationship exit.

Cakir and Kabundi (2013)[83] examined the co-movement and lead lag relationship of business cycles between South Africa and the BRICS. The dataset are real GDP, consumption, investment, consumer prices, interest rates, exchange rates, monetary aggregates, international portfolio and direct investment flow and international trade along with nominal and financial variables. The study showed quarterly data for 1995Q2- 2009Q4 from IMF's International Financial Statistics (IFS), the Organization for Economic Cooperation and Development (OECD) and the GVAR Toolbox 1.0 database. They used Dynamic Factor Model and Corbae-Ouliaris (CO) along with Dynamic Correlation. Dickey- Fuller Generalized Least Square (DF- GLS) Test of Elliott. KPSS (Kwiatkowski, Phillips, Schmidt and Shin (1992). The study found that different significant level of co-movement between South Africa and BRICS. The dynamics correlation of South Africa is high with Brazil, China and India but low with Russia. In long run Brazil, China and Russia lead South Africa but only India existing during long and short run periods.

Chkili and Nyuyen (2014)[84] investigated the dynamic linkages between the exchange rate and stock market return in BRICS countries. The data set used weekly

[82] Ali, G., Anwar, M. B. A., & Ziaei, S. M. (2013). A Bivariate Causality Test between Exchange Rates and Equity Markets in BRIC Countries. *Middle-East Journal of Scientific Research*, 13(2), 213-219.

[83] Çakır, M. Y., & Kabundi, A. (2013). Business cycle co-movements between South Africa and the BRIC countries. *Applied Economics*, 45(33), 4698-4718.

[84] Chkili, W., & Nguyen, D. K. (2014). Exchange Rate Movements and Stock Market Returns in a Regime-Switching Environment: Evidence for BRICS Countries. *Research in International Business and Finance*, 31, 46–56.

stock prices and US dollar exchange rates for the BRICS nations. They have employed univariate analysis, Markov switching VAR model (MS-AR model) and Likelihood Ratio (LR) test for a period from March 1997 to February 2013. The study revealed through MS-AR model to detect two regime shift behaviour for all stock market, a low volatility regime and high volatility regime and subsequently stock market have more influence on exchange rate during both calm and turbulent periods. Finally the effects of exchange rate on stock returns have insignificant impact while stock price on exchange rate revealed highly significant impact in BRICS countries.

The above literature is mostly on GDP, exchange rate and stock prices, very few studies are available discussing other macroeconomic variables. We found many other variables are also playing a significant role in the BRICS economy, which are not studied in this group so far. On the basis of review of literature we identified the research gaps

2.7 RESEARCH GAP

From the above review of literature it is evident that the combinations of the selected variables are playing a key role in the economic development of the developing countries. There was a huge necessity to study the behaviour of these variables in an emerging economic block like BRICS. It is observed that more studies focused on the exchange rate, share price & trade openness individually, but there is no such study have been conducted by taking together all the three variables (exchange rate, forex reserve and trade openness) on share price movement in BRICS countries.

Another important gap of the study is the pattern of inflation of BRICS nation over a long period of time. Adding to this there is no relevant study on the variables which shows greater impact on inflation.

Another important point is the GDP of BRICS nations were studied extensively but we found a gap in the literature that the long term cointegration of GDP with exchange rate intervention and trade openness in a block of developing economic nations are not studied.

The literature also lags in documenting the disinflation practices through sacrifice ratio in the BRICS nations over a time period. There are few studies about the

sacrifice ratio but no study is available to check the sacrifice ratio with exchange rate intervention and trade openness.

So far, no significant study exists for this emerging group that brings out the relationship between these variables such as exchange rate, forex reserves and trade openness on the economy of the BRICS countries.

CHAPTER THREE

DATA ANALYSIS AND INTERPRETATION

CHAPTER STRUCTURE

3. A **EXCHANGE RATE, FOREX RESERVE AND TRADE OPENNESS ON SHARE PRICE MOVEMENTS**

3. A.1 **Introduction**

3. A.1.1 Exchange Rate, Forex Reserve and Trade Openness on Share Price Movements

3. A.2 **Data and Sample Description**

3. A.3 **Methodology**

3. A.4 **Results and Discussions**

3. A.4.1 Result of Descriptive Statistics

3. A.4.2. The Result of Pooled OLS Model

3. A.4.3 Result of Fixed Effects Model

3. A.4.4 Result of Random Effects Model

3. A.4.5 Results of Hausman Test

3. A.4.6 Result of Fixed Effects with Dummy Variables (LSDV), Country wise

3. A.4.7 Result of Fixed Effects with Dummy Variables (LSDV), Time wise

3. A.4.8 Results of Wald Test

3. A.5 **Findings**

3. A.6 **Conclusion**

3. A.1 Introduction:

Today we are living in a globalised economy, where International trade is taken for granted. This international trade has become one of the key factors for any developing nation in framing their economic policies. Somehow they interlinked directly and indirectly with many macro and micro economic variables of the country. It stimulated many economic variables like trade openness, exchange rate, foreign exchange reserves, share prices, inflation, Gross Domestic Product (GDP) and sacrifice ratio. Since every economist consider these variables as economic health indicators of nations, it is very relevant to study the behaviour of these variables in developing nations, in particular BRICS group of nations. This study helps to understand the behaviour of exchange rate, foreign exchange reserves and trade openness on share price movement. In this part we discussed about the independent variables trade openness and exchange rate and foreign reserves.

In the economically interlinked world, the development of any nation is measured by its degree of trade openness showing with the outside world. In this study trade openness is quantitatively measured with the values of exports and imports to real GDP. High degree of openness brings high exports and imports, exports help the nation in improving its domestic market, high investments will flow into the country, and can gain foreign exchange reserves. The changes in the export and import will affect the foreign exchange reserve and exchange rate and in the same way it indirectly affects the share prices.

The increased rate of exports and imports of goods and services indicates the importance of exchange rate. Exchange rate is the value of national currency in respect to foreign ones. In this, we have two kinds of exchange rates, one is nominal exchange rate and another is real exchange rates. In our study we used nominal exchange rate, which established on currency financial markets/ stock markets. Countries follow two types of exchange rate systems, one is fixed/pegged exchange rate system and second one is floating exchange rate system. Most of the developing nations which are open to international trade are using floating exchange rates system. In our study each country in BRICS group of nations is following different exchange rate regimes. Brazil and South Africa follows floating exchange rate systems, Russia follows managed exchange rate, India follows managed floating with no predetermined path for the

exchange rate to float and finally China follows managed floating exchange Rate based on market demand and supply with reference to a baskets of currency.

The exchange rate movement is directly influencing the stock markets and investments in the nations. Frequent fluctuations in the foreign exchange market causes volatility in the forex market/ share price market, so countries go for exchange rate interventions to stabilize the domestic currency. The exchange rate intervention involves both exchange rate and foreign exchange reserves. These exchange rate interventions are made based on many factors like current exchange rate, ongoing global economic conditions, and prediction of future exchange rate movements. These interventions are made by central banks based on the foreign exchange reserves maintained by the country. Reserves are gained through higher exports of goods and services and are maintained to withstand the exigencies in the economy.

In this backdrop it is relevant to study the behaviour of these independent variables with dependent variables of share price. This study framed four objectives; each objective deals with each dependent variable and all other independent variables

3. A.1.1 Exchange Rate, Forex Reserve and Trade Openness on Share Price Movements.

The introduction of this chapter gives a brief note on the importance of the independent variables exchange rate, forex reserves and trade openness. This part of the section deals with the behavior of these variables on dependent variable share price movement.

Share prices are considered as most crucial in the development of nation's economy. Especially in developing countries which are open to the international market, the share price market is considered as key factor for international investors. In the emerging economies these share price markets are highly volatile; they undergo significant changes with foreign exchange restriction. The share prices decides the present value of firms assets, these prices are depends on many factors. They depend on the degree of trade openness, exchange rates and reserves. Many empirical studies explained the relation between these variables but its first of its kind to study in an emerging group of nations BRICS.

Extensive literature was documented over the past four decades on the relation between exchange rate and share price movements. There are mixed results on the relationship, some studies shows unilateral relations. In general the depreciation of exchange rate leads to increase in share prices, the reduced exchange rates attracts the foreign investors to invest in different firms and it also reduces the interest rates to the investors. The study of **Adjasi and Biekpe (2005)** establishes a relation, that exchange rate depreciations leads to increase in share market prices but in the short run it is not the same. **Nieh and Lee (2001)** found no significant long run relationship between stock prices and exchange rates in G7 countries. In the study of **Pan et al. (2007)** established a unidirectional causality in the short run from exchange rate to share prices in Malaysian stock market but there is no co-integration in the long run. The studies of **Mishra (2004), Abdelaziz et.al (2008), Granger et al. (2000), and Apte (2001)** found a significant positive relationship between stock prices and exchange rates. A significant negative relationship between the two variables also observed in the study of **Solink (1987)** On the other hand, some studies, such as **Choi, Fang and Fu (2008)** showed the possibility of a very weak or no relationship between stock prices volatility and exchange rates movement.

In BRICS nations, the relationship between these two variables was documented in the studies done by **Bhattacharya and Mukharjee (2003), Sharam and Mahendra (2010), Ray (2012) Singh (2010)** on Indian market. **Tabak (2006) on Brazil market, Zhao (2010) on Chinese market, Adjasi et al.(2011)** on South African market and **Robert Gay (2008)** shows the relation between these two important variable specifically in BRIC nations . In this study we can find the relation between these variables collectively in all BRICS nations.

In addition to exchange rate, foreign exchange reserves are also playing a major role that affects the share prices. After the Asian crisis, accumulation of foreign exchange reserve has been observes in developing nations. They recognized the importance of forex reserves against crisis. These reserves reduce the volatility in the liquidity risk and prevent the sudden reversal of capital flows. The forex reserves also influence the decisions of investors and covers countries external liabilities. The study of **Heaton, Summers, and Aten (2006),** evident that increased reserves may leads to decline in consumption and it can also enhance the economic growth. **Shin-ichi**

Fukuda and Yoshifumi Kon (2010) found the influence of forex reserves on other macro economic variables indifferent financial crisis periods and observed countries with reserves were withstand more to the changes in share market.

The final independent variable is trade openness measures the role of export and import in predicting the development of the economy. The changes in the export and import and its effects will be reflected in the foreign exchange reserve and exchange rate and this in the same way affects the share prices also.

The existing studies are studied individual effect of variables in different nations but till date no research has been done collectively to see the relationship of nominal exchange rate, foreign exchange reserve and trade openness on share prices in BRICS countries. Consequently, this study documents the dynamic effects of exchange rate intervention, forex reserves and trade openness on share prices in BRICS Countries. This study focuses on the economic variables of BRICS nations over a period of 15 years.

Objectives of the Study:

The first objective is to study the influence of Exchange Rate Intervention (Exchange rate + Forex reserve) and Trade Openness on Share Price movement.

<u>Hypotheses for Objective One</u>:

1. ***Null Hypotheses (H_0):*** The exchange rate intervention and trade openness do not affect the share price movements.

2. ***Alternative Hypotheses ($H_1 \neq 0$):*** The exchange rate, forex reserve and trade openness affect the share price movements

These hypotheses are framed to know the influencing role of exchange rate intervention and trade openness on share price movements.

<u>Variables:</u>

Dependent **:** Share Price Movement.

Independent **:** Exchange Rate, Forex Exchange Reserve, and Trade Openness.

3. A.2 Data and Samples Description

The data used for this empirical study is based on panel data modeling using fifteen years monthly data from 1st January, 1998 to 30th September 2012 in BRICS group of countries (Brazil, Russia, India, China and South Africa). The required data set for the selected countries were obtained from various sources. The dependent variable in our study used as log of share price (HP filter is used to adjust the seasonality in the monthly data); the data of share prices were collected from International Financial Statistics (IFS). The independent variables are log of nominal exchange rate in Federal Reserve, log of foreign exchange reserves in US dollar from International Financial Statistics (IFS), trade openness data which include both exports and imports was collected from Organization for Economic Co-Operation and Development (OECD) and GDP from World Bank available in yearly series, we have done interpolate of the series to convert it into monthly series because all other variables data periods follows monthly series. All these variables are considered as key growth indicators in an economy. The BRICS group of nations gained the attention of world economists with their consistent economic growth even in the global slowdown. Over the two decades these developing nations maintained consistent growth in their GDP and become a significant impact on global economic growth. These variables are selected based on the important role played by them in the highly volatile world economy. All the three independent variables show a significant impact on the dependent variable. The data on Exchange rates have been fluctuating over the period of time which impacting the share price movement. Likewise the other three variables also showing significant impact on share prices. The keen interest of the study is to know the movement of above mentioned independent variables such as exchange rate, foreign exchange reserves, and trade openness on the dependent variable share price movement.

3. A.3 Methodology

This study has employed panel data which contains both the time-series and cross sectional data. In panel data we can observe the behaviour of entities across the time. These data sets provides an edge over other type of data sets in estimating the efficiency and we can easily find more information regarding the data structure, more variability, less collinear, increase the number of freedom **Baltagi and Kao (2000) Hsiao (1985, 1986) and Baltagi (1995)** argued, the panel data techniques explicitly show the heterogeneity into the account by allowing for subject-specific variables. Panel data can minimize bias of the data because it handles several thousands of units.

This chapter is discussing about the exchange rate, forex reserve and trade openness causes the share price movements in BRICS countries. Since this study is concluded countries it is more relevant to employ the panel data model. In this regard we employed pooled OLS model, fixed effects and random effects models to the data. We applied Hausman test to choose the best among two methods. Later to avoid error trap study used the fixed effect model with dummy which is also known as Least Squares Dummy Variables (LSDV) estimators. It has included dummy variable for each group then it allows us to take different group-specific estimates for each of the constants for every different section. Then we have employed Wald test for stability. Each test is described in detail later in this section.

3. A.4 Results and Discussions

The statistical analysis, interpretation, and discussion are deals with this section. First this section discusses the descriptive statics of the variables, after that fixed effects model and the random effects model results were discussed. To find the best suitable model among fixed and random models in estimating the relationship, the Hausman test was conducted. Then, fixed effects with dummy variables for each group are described for understanding the group specific behavior and for time specific behavior.

3. A.4 .1 Result of Descriptive Statistics

The descriptive statistics of share price, exchange rate, forex reserve and trade openness for the sample of fifteen years from 1998 to 2012 are shown in the Table

3.A.1. The mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque Bera test are given for the full sample period.

Table: 3.A.4.1

Descriptive Statistics of Share Price, Exchange Rate, Forex Reserve & Trade Openness

Statistics	LSP	LEX	LFOREX	TO
Mean	1.975261	1.030031	4.850369	0.032946
Median	2.008609	0.917981	4.966607	0.028234
Maximum	2.386306	1.723013	5.662169	0.076196
Minimum	0.671510	0.025280	3.651381	0.011397
Std. Dev.	0.301517	0.477170	0.549438	0.016704
Skewness	-0.913374	-0.143054	-0.488685	0.585614
Kurtosis	4.262471	1.871684	2.355917	2.307745
Jarque-Bera	181.8248	49.96397	50.52233	68.25525
Probability	0.000000	0.000000	0.000000	0.000000
Observations	885	885	885	885

This table provides summary statistics of share price, exchange rate, forex reserve &trade openness for the fifteen years panel data sample period from 1998 to 2012.

The mean values of share price, exchange rate, forex reserve and trade openness are 1.975261, 1.030031, 4.850369 and 0.032946 respectively. The standard deviation values of these variables are 0.301517, 0.477170, 0.549438 and 0.016704 respectively. For the same periods a high standard deviation shows in forex reserves with 0.5662169 and low in trade openness with 0.011397. The skewness of is zero and the data is symmetrical. A positive and negative value of skewness defines the data as asymmetrical. The skewness value of listed variable shows -0.913374, -0.143054, -0.488685 and 0.585614 for the same periods. So in our results full sample period trade openness data shows a positive skewed distribution and share price, exchange rate and forex reserve shows a negative skewed, that means our sample data series are asymmetrical. The Kurtosis shows 4.262471, 1.871684, 2.355917 and 2.307745 respectively. In a standard normal distribution the Kurtosis is three. A value lesser than three, indicate flatness and more than three indicates peakedness of the data series. The kurtosis value of exchange rate, forex reserve and trade openness shows flatness and share price shows peakedness in distribution. The Jarque Bera test of normality for all

the four variables in the sample periods rejected the hypothesis with high significant (one percent level).

3. A.4.2. The Result of Pooled OLS Model

Pooled OLS Method (Common constant method):

The Panel data model includes three different methods: (a) Common constant, (b) Fixed effects, (c) Random effects. The study estimates all these three methods so as to incorporate the best fit of the estimation. The Common constant method (also called as pooled OLS method) of estimation presents result under the principal assumption that there are no differences among the data matrices of the cross-sectional dimension (N). In other words the model estimates a Common constant for all Cross-sections (Common constant for countries). Practically, the Common constant method implies that there are no differences between the estimated cross-sections and it is useful under the hypothesis that the data set is a *priori* homogeneous. However, this case is quite restrictive and case of more interest involves the inclusion of Fixed and Random effects in the method of estimation (Asterious, 2006).

Table: 3.A.4.2

The Result of Pooled Ordinary Least Square (OLS)

Variables	Coefficient	t-Statistic
Constant	0.3423	5.729***
Log of Exchange Rate	-0.0814	-6.121***
Log of Forex Reserve	0.3137	23.00***
Trade Openness	5.9209	13.25***
Adjusted R-squared	0.6189	
F –statistic	479.67***	

This table provides the estimated result of pooled OLS model for the sample period from 1998 to 2012.
Note: *** indicates significant at one percent level.

The results indicate that, for every one unit changes in exchange rate leads to negative influence 0.081. ($t=-6.12$, $p<0.05$) when all other variables are constant. The coefficient value of other independent variable forex reserve also shows a positive

relation to the dependent variable of share price. It explains for every one unit increase in reserve leads to 0.313 (t=23.00, p<0.05) increase in share price when all other variables are constant. The trade openness coefficient value shows a highly positive relation with share price. It indicates for every one unit increase in trade openness leads to 5.92units (t=13.25, p<0.05) increase in share price. F test statistically highly significant (F=479.67, p<0.01) meaning that the model is good fitted, R-squared and Adjusted R-squared shows 62 percent of variables predicted the behavior of dependent variable.

3. A.4 .2. The Result of Fixed Effects Model

Fixed Effect Model:

To analyze the impact of variables that shows a discrepancy over time, we used fixed effect. It helps in establishing relationship between independent variable and dependent variable within an entity. It assumes individual entities or time have different intercepts in the regression equation. The fixed effects model regression equation for three explanatory variables is

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + u_{it} \quad \textbf{(3.A.1)}$$

In the subscript index "*it", 'i'*- refers to the cross sectional unit (*i=1,….,N*) and '*t'*-refers to the time period (*t=1,…,T*). Y represents the dependent variable, X represents the independent variable, β represents intercepts, and 'u' is the error term. Now we will insert the variables of the study in the formula.

$$st_{it} = \beta_{0i} + \beta_1 ex_{it} + \beta_2 res_{it} + \beta_3 to_{it} + \varepsilon_{it} \quad \textbf{(3.A.2)}$$

Where st_{it} is the dependent variable share price and ($NTx1$ matrix), ex, res, to are exchange rate, foreign exchange reserves, trade openness respectively and ($NTxK$ stacked matrix of the K independent variables). β_{1i} is the $Kx1$ vector of the unknown parameters and ε_{it} is the error term we have assumed $\varepsilon_{it}(0,1)$, $i = 1,\ldots,N$ and $t = 1,\ldots,T$ is explains the cross-section and time series dimensions of the panel. The Individual effect explains β_{0i} is fixed effect intercept may vary across time and each entity does not vary over time i.e. time invariant.

Table: 3.A.4.3

The Result of Fixed Effect Model

Variables	Coefficient	t-Statistic
Constant	-1.6464	-24.081***
Log of Exchange Rate	0.4865	10.859***
Log of Forex Reserve	0.6351	39.819***
Trade Openness	1.2102	2.5523***
Adjusted R-squared	0.9019	
F –statistic	1162.0***	

This table provides the estimated result of fixed effects model for the sample period from 1998 to 2012.

Note: *** indicates significant at one percent level.

The independent variable exchange rate is showing positive relation and its coefficient value is 0.486. (t=10.85, p<0.05) meaning that for every one unit increase in exchange rate will move the share price by -1.6464. The coefficient value of other independent variable forex reserve also shows a positive relation to the dependent variable share price. It explains for every one unit increase in reserve leads to 0.635 (t=39.81,p<0.05) increase in share price when all other variables are constant. The trade openness coefficient value shows a highly positive relation with share price. It indicates for every one unit increase in trade openness leads to 1.21 units (t=-2.55, p<0.05) increase in share price. F test statistically highly significant (F=1162, p<0.01) meaning that the model is good fitted, R-squared and Adjusted R-squared shows 90 percent of variables predicted the behaviour of dependent variable.

3. A.4 .3. The Result of Random Effects Model/ Error Components Model

Random Effects Model:

The Random effect model is alternative estimation for our data because we have discussed fixed effect model earlier. The constants term in each fixed parameters has fixed, it is like time invariant model. The random effect model will estimate the time invariant variables. The random effect models common/global intercept β_{0i} and the

error term ε_{it} varies across sectional but we are assuming constant over the period of time.

$$st_{it} = \beta_{0i} + \beta_1 ex_{it} + \beta_2 res_{it} + \beta_3 to_{it} + \upsilon_{it} \quad \textbf{(3.A.3)}$$

Becomes,

$$\upsilon_{it} = \partial_1 + \varepsilon_{it}$$

∂_1 = individual specific components.

ε_{it} = reminder components, a traditional error term.

υ_{it} = disturbance term, disturbance term is a composite of the two error components within and between.

Where $\upsilon_{it} = \varepsilon_i + v_{it}$; here st_{it} is $1xK$ vector of explanatory variables, but unlike the fixed effects model, here we were not included dummy variables to capture the heterogeneity (variation) in the cross-sectional dimension. The random effects drawn from the number of individuals (N) exceeds number of parameter (K) it is not considered constant.

Table: 3.A.4.4
The Result of Random Effects Model

Variables	**Coefficient**	**t-Statistic**
Constant	-1.5580	-18.766***
Log of Exchange Rate	0.3950	9.5954***
Log of Forex Reserve	0.6367	40.509***
Trade Openness	1.1515	2.4609***
Weighted Statistics		
Adjusted R-squared	0.8932	
F –statistic	2465.8***	
Unweighted Statistics		
R- squared	- 0.28747	

This table provides the estimated result of random effects model for the sample period from 1998 to 2012.
***Note: *** indicates significant at one percent level*.**

The results of random effect model indicate that, for every one unit changes in exchange rate and forex reserves leads to 0.3950 (t=9.5954, p<0.05) percent and 0.63 (t=40.50, p<0.05) change in share price respectively. The trade openness coefficient value also shows a positive relationship with share price movements. It also indicates every one unit changes in trade openness leads to 1.151 changes (t- 2.46, p<0.05) in share price.

F-statistic is highly significant (F=2465, p<0.01) explains that all the independent variables together influence the dependent variable of share prices (this model is linearly fitted). R-square value (89 percent) is also more than 60 percent indicating that this model is more desirable for forecasting. That means 89 percent of share price behavior is predicted by these independent variables.

3. A.4 .4. Results of Hausman Test

Hausman Test:

Since both fixed effect and random effect models are significant and it is not appropriate theoretically to impose both fixed effect and random effect models at a time. So we used Hausman test to find the appropriate model. It helps to identify the most appropriate model among the fixed effects and random effects model.

Hypothesis:

H_0 Random effects model is appropriate

H_1 Fixed effects model is appropriate

Hausman Test Results:

The results of Hausman test shows significant (Chi-square value 47.94, df=3, p=<0.05) meaning that it fail to accept the null hypothesis (Random effects model is appropriate) and accept the alternative hypothesis (Fixed effects model is appropriate). That means the random effect model end up with inconsistent biased estimates and the fixed effect model giving unbiased and consistent estimates. So fixed effect model is appropriate for this panel data. The results are shown in table 3.A.4 below.

Table: 3.A.4.5

The Result of Hausman Test

Test Summary	Chi-Sq. statistic	Chi-Sq. d.f.
Cross-section random	47.941***	3
This table provides the estimated result of Hausman Test for the sample period from 1998 to 2012. ***Note: *** indicates significant at one percent level***		

Wald Test:

Wald test is used to test whether all dummy variables equal to zero or pooled regression model and fixed effect model with dummy variables is appropriate.

Hypothesis:

H_0 Pooled regression model is appropriate or all dummy variables =0

H_1 Fixed effects model with dummy is appropriate.

Fixed Effect with Dummy Variables:

Estimating the time invariant behaviour of variables we framed this equation

$$lst_{it} = \beta_0 + \beta_1 lex_{it} + \beta_2 lres_{it} + \beta_3 lto_{it} + \beta_4 D_2 + \beta_5 D_3 + \beta_6 D_4 + \beta_7 D_5 + \varepsilon_{it} \quad \textbf{(3.A.4)}$$

For $i= 1..., N$ and $t=1...,T$, where N and T design the cross-section and the time dimensions of the panel. Thus *lst* is a stacked matrix of the dependent variable, *lex, lres, lto* is the stacked matrix of the K independent variables, is the vector of the unknown parameters and is the error term. The thumb rule is, if we have K variables, the dummy will be K-1. We used the dummy in the entities and independent variables.

Table: 3.A.4.6

The Result of Fixed Effects with Dummy Variables (LSDV), Country wise

Variables	Coefficient	t-Statistic
Constant	-1.3175	-19.172***
Log of Exchange rate	0.4865	10.859***
Log of Forex reserve	0.6351	39.819***
Log of Trade openness	1.2102	2.5523***
Dummy 2 (Russia)	-0.7239	-13.534***
Dummy 3 (India)	-0.6880	-11.254***
Dummy 4 (China)	-0.4083	-13.353***
Dummy 5 (South Africa)	0.1759	4.7962***
Adjusted R-squared	0.9019	
F-statistic	1162.0***	

This table provides the estimated result of LSDV effects of cross country for the sample period from 1998 to 2012

Note: *** indicates significant at one percent level.

The results indicate that, for every one unit changes in exchange rate and forex reserves leads to 0.486(t=10.85, p<0.05) and 0.63 (t=39.81, p<0.05) change in share price respectively. The trade openness coefficient value also shows a positive relationship with share price movements. It also indicates every one unit changes in trade openness leads to 1.21 changes (2.55, p<0.05) in share price. For when compared to Brazil, there is a negative change in Russia by -0.7239, India by -0.6880, China by -0.4083 and positive change in South Africa by 0.1759.

The F-value of pooled regression model shows highly statistic significant (F= 1162, p<0.01) meaning that the model is good fitted. By considering R square value the pooled regression model also explicit us that 90 percent of dependent variable was explained by all the three independent variable, which is considered to be a good model. The coefficient of exchange rate, forex reserve and trade openness show a positive influence on share price.

3. A. 4 .7 Results of Wald Test

Wald test results shows highly significant difference (Chi-Squ value= 2544, df=4, p=<0.01) meaning that it fail to accept the null hypothesis and accept the alternative hypothesis stating that fixed effects model with dummy variable is appropriate for this panel data forecasting.

Table 3.A.4.7
The Result of Wald Test

Test Statistic	Value	Df
F-statistic	636.235***	(4, 877)
Chi-square	2544.94***	4

This table provides the estimated result of Wald test for the sample period from 1998 to 2012.
Note: *** indicates significant at one percent significant level

F Statistic

To test joined significant of all the independent variables on dependent variables we want to see the F Statistic and its corresponding 'P'value. Here in all the models, F value shows highly significant (P<0.001), meaning that all independent variables jointly influenced the dependent variable (share price movement). This is a good fitted model.

The second thing is the R square value, theoretically it should be more than 60 percent but 'R' square value for this data is 90 percent, it means that all independent variables namely exchange rate, forex reserve and trade openness collectively explained the dependent variables by 90 percent. In other words the remaining 10 percent explained by other outside variables not considered in the study. Here all the three variables are highly significant meaning that the selected independent variables are influencing the share price movements.

Here we are explaining the variation of BRICS country with dummy variables. The variables are exchange rate, forex reserve and trade openness. The overall value of exchange rate is positive 0.48. Through our analysis we came to know how far the share price varying in BRICS countries, when Brazil is taken as reference country. Out of the result we find South Africa shows better economics growth among the BRICS Nations

during the study period. we are show calculation and graph. The influence of all the independent variables on share price movement is explained in charts below. All the variables are positively impacting the dependent variable. The resercher intended to show the differnces among the BRICS nations with the help of small example.

Example: Let us take exchange rate increases 5 Brazilian Real, what will be the share price in **Brazil.**

Share price of Brazil country (Reference country)

Share price = 1*5 Real

= -1.31 + 0.48 * 5

= 1.09

It indicates that, if the Brazilian Real increases by 5, the share price increases 1.09 Real.

Russia

Share price = 1* 5 Ruble -0.72

= -1.31 + (0.48* 5) -0.72

= (-1.31 + 2.4) – 0.68

=1.09 – 0.72

= 0.37

India

Share price = 1* 5 Rupee -0.68

= -1.31 + (0.48* 5) -0.68

= (-1.31 + 2.4) – 0.68

=1.09 – 0.68

= 0.41

China

Share price = 1* 5 Yen -0.40

= -1.31 + (0.48* 5) -0.40

= (-1.31 + 2.4) – 0.40

=1.09 – 0.40

= 0.69

South Africa

Share price = 1* 5 Rand + 0.17

= -1.31 + (0.48* 5) + 0.17

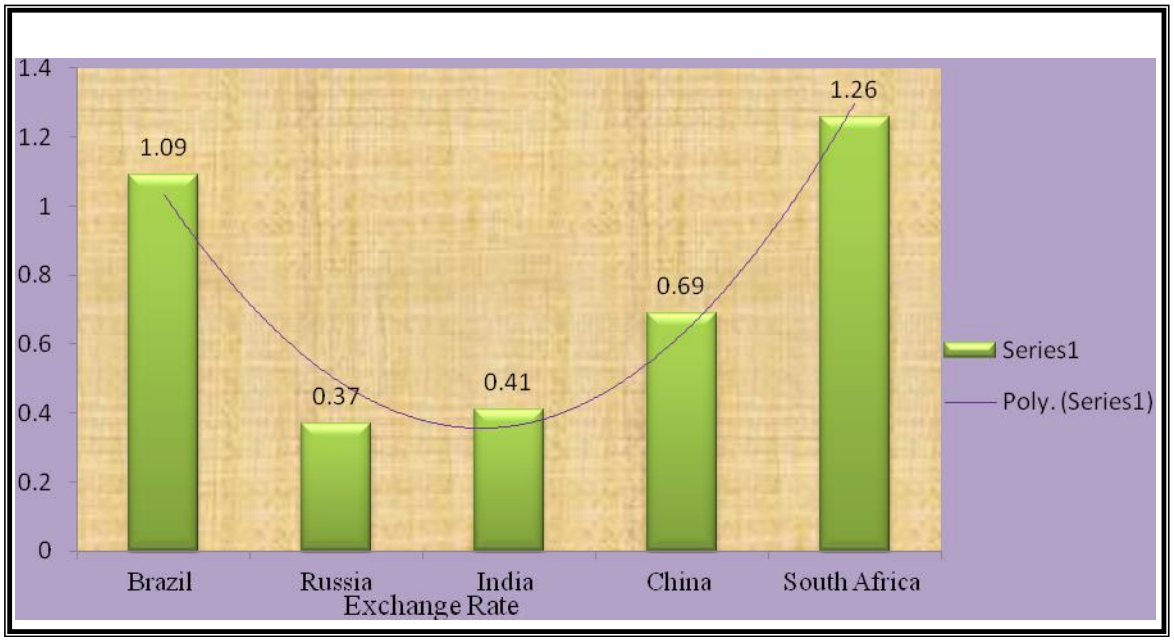
= (-1.31 + 2.4) + 0.17

=1.09 + 0.17

= 1.26

If it done in the same way in all countries, the values are as follows. (Brazil-1.09, Russia, 0.37, India-0.41, China-0.69 and South Africa- 1.26) when Brazil is taken as reference.

Figure: 3.A.4.1
Relationship between Exchange rate and Share price



From the above graph we can infered that changes in the exchange rate positively influencing the share prices of their home country. Here Brazil is taken as reference country so for every 5unit increases in their home country the share prices increases. In Brazil by 1.09, Russia by 0.37, India by 0.41 , China by 0.69 and finally South Africa by 1.26. The exchange rate movement shows less effect on Russian share prices and greater impact on South Africa in BRICS nations.

Let us take forex reserve increases 10 Brazilian Real, what will be the share price in **Brazil.**

Share price of Brazil country (Reference country)

Share price = 1*10 Real

= -1.31 + 0.63 * 10

= 4.99

It indicates that, if the Brazilian forex reserve increases by 5, the share price index increases 4.99 Real.

Russia

Share price = 1* 5 Ruble -0.72

= -1.31 + (0.63* 10) -0.72

= (-1.31 + 6.3) – 0.72

= 4.99 – 0.72

= 4.26

India

Share price = 1* 5 Rupee -0.68

= -1.31 + (0.63* 10) -0.68

= (-1.31 + 6.3) – 0.68

= 4.99 – 0.68

= 4.31

China

Share price = 1* 5 Yen -0.40

= -1.31 + (0.63* 10) -0.40

= (-1.31 + 6.3) – 0.40

= 4.99 – 0.40

= 4.59

South Africa

Share price = 1* 5 Rand + 0.17

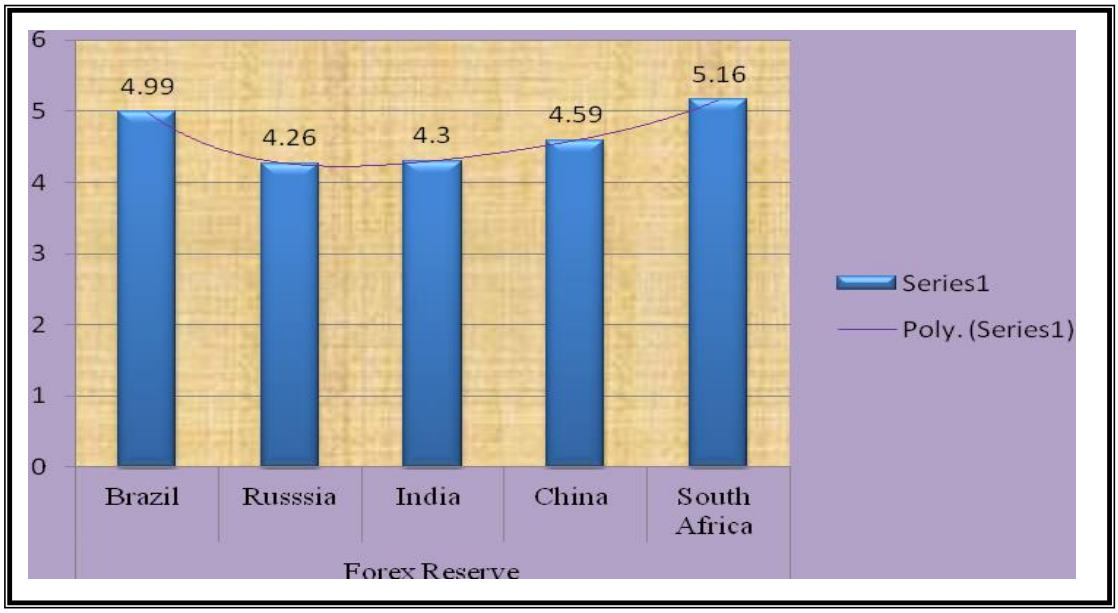
= -1.31 + (0.63* 10) + 0.17

= (-1.31 + 6.3) + 0.17

= 4.99 + 0.17

= 5.16

Figure: 3.A.4.2
Relationship between Forex Reserve and Share price



The Figure **3.A.4.2** shows the relation between forex reserves and share prices. Brazil is taken as reference country, the changes in forex reserves are highly influencing changes in share price in south africa.

Let us take trade openness increases 5 Brazilian Real, what will be the share price in **Brazil.**

Share price of Brazil country (Reference country)

Share price = 1*10 Real

= -1.31 + (1.21 * 5)

= 4.74

It indicates that, if the Brazilian trade openness increases by 5, the share price index increases by 4.74 Real.

Russia

Share price = 1* 5 Ruble -0.72

= -1.31 + (1.21*5) -0.72

= (-1.31 + 6.05) – 0.72

= 4.74 – 0.72

= 4.02

India

Share price = 1* 5 Rupee -0.68

= -1.31 + (1.21*5) -0.68

= (-1.31 + 6.05) – 0.68

= 4.74 – 0.68

= 4.06

China

Share price = 1* 5 Yen -0.40

= -1.31 + (1.21*5) -0.40

= (-1.31 + 6.05) – 0.40

= 4.74 – 0.40

= 4.34

South Africa

Share price = 1* 5 Rand + 0.17

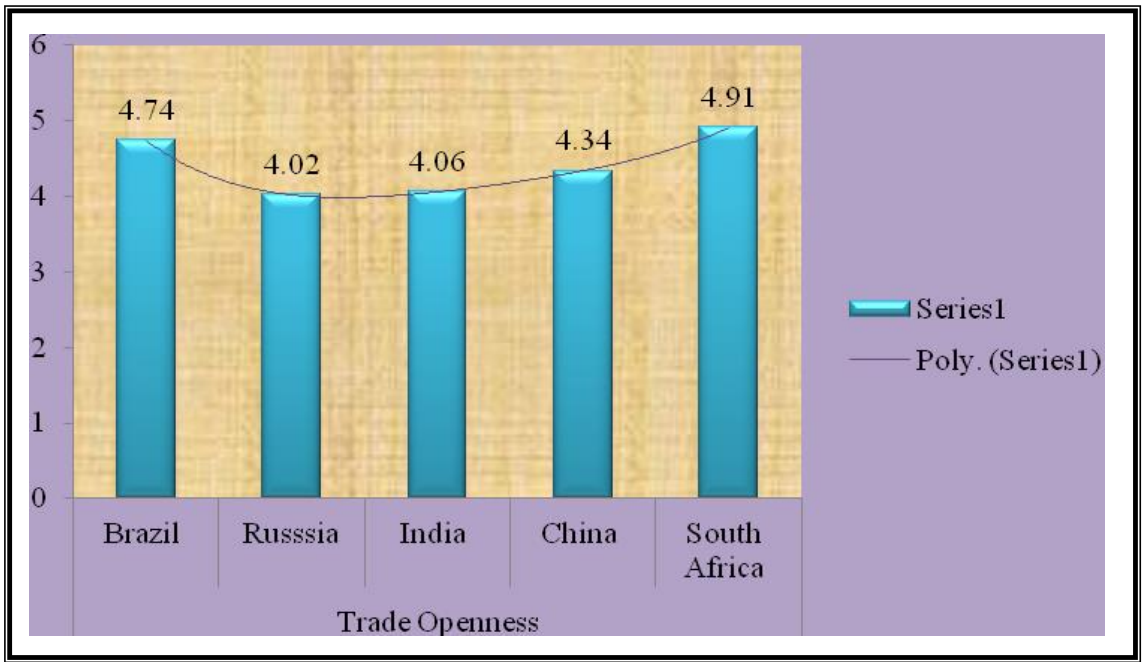
= -1.31 + (1.21*5) +0.17

= (-1.31 + 6.05) + 0.17

= 4.74 + 0.17

= 4.91

Figure: 3.A.4.3
Trade Opennes Vs Stock Price



The third and last graph shows the relation between trade openness and share prices. It showes Brazil and South Africa share prices are highly changing with change in degree of trade opennes. In this Brazil is taken as reference country.

3. A.5 Findings:

The three independent variables exchange rate, forex reserves and trade openness explains 90 percent of share price movement. Which means the share price movement is highly correlating with these three variables and remaining 10 percentages is explained by other economic variables. The coefficient values indicate a positive relationship with share price movement. The coefficient value of trade openness is very high when compared to other two variables. The exchange rate (CV 0.48, $p<0.01$) and forex reserves (CV 0.63, $p<0.01$) show highly significant beta coefficient value on share price movement. They indicate that countries with good monetary policy regarding exchange rate and forex reserves have positive impact on share prices. The trade openness also shows a very high positive relationship with share price movements compared to exchange rate and forex reserve. It indicates every one unit changes in trade openness leads to 1.21 changes (CV 2.55, $p<0.01$) in share price. It shows that when BRICS nations open to the international trade there is a possibility of huge investment which ultimately increases the share prices of the firms.

The result with dummy variables show a significant relation between share price movement and other independent variables, when Brazil is taken as a reference and it is giving a mixed relation among the BRICS nations. They show a positive significant relation in Brazil and South Africa and negative significant relation in Russia, India and China. This result can also be verified by using dummy variables where share prices of Brazil and South Africa are more than the other three countries, Russia, India, and China. Over the period of time the forex reserve has increased in all the five countries with less fluctuation. The reserve might have been increased due to encouragement of FDI, FIIs, and Export etc. Though all the countries have more or less same level of forex reserve, the nature of inflow is different. Therefore the usage of these reserves may be different in individual country. This can be evidenced through exchange rate with share prices and trade openness with share prices. Out of the five countries, South

Africa and Brazil has used the reserve for better growth potential than Russia, India and China and they out performed during the study period.

3. A.7 Conclusion:

The first objective of the study examined the dynamics of exchange rate intervention and trade openness on share prices in BRICS Countries. The study employed fixed effects, random effects and pooled OLS regression model for estimating panel data. During the study period BRICS countries economy shows positive trends in growth. The positive trends in BRICS country influenced by three factors namely foreign exchange rate, foreign exchange reserve and trade openness. Out of the three factors, trade openness (exports and imports) took vital role to improve the economy in BRICS country since its coefficient is higher than other two variables, Forex reserve and exchange rate. The secondly, forex reserves are positively related to share prices, which means all the five countries has increased their economy with greater forex reserves. The forex reserves are helped the BRICS nations to with stand the strong financial crisis and was able to maintain the stable growth. Trade openness is also positively related with share price, meaning that in all the five countries international trade (export and import) has increased.

CHAPTER STRUCTURE

3. B.1 Introduction

In this global open economy, inflation is inevitable in the economically developed and developing nations. Inflation is not just simply rising prices for one or two things but prices generally rising right across the economy. It has great significance on the economy of any country and also considered as key economic indicator in measuring the growth and development of economy. Inflation at certain level helps the economy to grow, if exceeds the limit it brings hyperinflation causing unpredicted effects on the price mechanism of goods and services. It reduces the purchasing power of people and discourages the savings and investments. On the other hand less inflation leads to stagnation of growth with cheap availability of goods and services and it also leads to high rate of unemployment and loss of profits. Governments always try to maintain a mild inflation to keep the economy healthy. Maintaining inflation is considered as biggest challenge to any country.

Inflation also brought down governments and impoverished whole nations. History is telling us that how wars, political instability, corrupted administration has brought inflation. For the first time the world witnessed the drastic effects of inflation in Weimar Germany. The inflation started with the treaty of Versailles in 1922-23 after 1st world war and the monthly inflation rose up to 32,400 percent. It is one of the reasons behinds Adolf Hitler's taking in charge the power. After that the greatest ever reordered inflation was observed in Hungary in 1946 at the end of world war two, the inflation reached more than 13 quadrillion percent , prices were doubled for every 15 hours. The inflation because of political disturbance was observed in Zimbabwe during 2007 to 2009, the inflation reached 79 billion percentages per month. Inflation brought by corrupted economic administration is observed in Brazil, the inflation was at its worst in 1994 with 2,075 percent per month. There are many other reasons for inflation and many cases are documented.

Since the beginning of 1990's, the average inflation rates were brought down from double and triple digits to single digits in almost all emerging economies. The declined inflation and its influence on the growth of the economy over one and half decade are impressive compared to the experience prior to 1990's in which low growth and high unemployment was coincides with high inflation. The increased performance

of low inflation on growth gained the attention of policy makers. According to **Rogoff (1985) and Romer (1993),** the monitory policy effects are less in closed economies and the advantages are more in open economies. Nations with good monitory policy in an open economy are performing well in the global markets.

Our study sample BRICS"- Brazil, Russia, India, China and South Africa, which are considered as developing economies and advancing with a promising future for the global investors. The BRICS is playing a very significant role in the world economic market; the all five nations together become an economic superpower. All these developing nations are affected seriously with high inflations. Over the time they learned to bring down the inflation rates and performing consistently after the economic reforms in the last one and half decades. If we look into inflation rates prior to the reforms in each country of BRICS, Brazil is with 2075 percent inflation rate before reforms in 1994, which is highest in these five countries now it brought down to 9.4 percent as on May 2015, Russia is with 213 percent to 3.6 percent in 2012. India is with around 14 percent inflation rate before reforms in 1991 to 4.6 percent inflation rate in August, 2015. China is the largest economy after USA, the inflation rate before reforms is over 25 percent to 1.45 percent in August 2015, and South Africa inflation rate was over 20 percent to 4.51 percent in August 2015. The impact of inflation in open economies was extensively studied by economist after 1990's. Many proxy variables to the economy were studied by the economist to know the interdependency of the variables and to know which are showing more influence on economic growth.

This part examines one of the proxy variables of economy, which is inflation. The high inflations among developing economies have brought down through globalization in late 1990's. Almost all developing countries opened their economies to integrate them with global economy. This inflation has brought advantages in some countries and challenges in other countries. This is very important to know the influencing factors in open economies to gain the advantages of managed inflation. From the extensive literature we identified three variables which have high influence on inflation. The identified independent variables are exchange rate intervention (exchange rate, forex reserves), trade openness. We have already discussed about the independent variables in first part of this chapter.

Extensive literature work is developed on the Inflation, many economist tried to find the behavior of inflation and its influencing variables. Inflation which effects the economic growth of countries especially in developing nations we observe its duel effects, it plays a significant role in the economic development of nations. Some scholars **like Kormendi and Meguire, (1985), Fischer (1991) and Ericsson et. al (1993)** has stressed the impact of inflation on economic growth. Almost all nations are affected by inflation in the last three decades, after reforms their main objective is to control the inflation. In the process of integrating its economies to outside world, nations opened their economies for international trade. It is believed that the nations with high degree of openness to external trade gains the more output. It is very difficult to monitor the economy in an open economies, because of many external factors shows their significant effect on the economy. In the highly open economies, an uncontrolled and unmonitored economy may lead to hyperinflation.

In the wake of trade opened countries, there are many reasons for inflation; it may be because of internal factors or of external factors. No study is left without mentioning the work of **Romers (1993)** in establishing the relationship between trade openness and inflation; his study proposed that open economies can reduce the inflation with greater monetary policies. Many economists studied this relationship in different parts of the world. **Mukhtar (2010)** tested the Romer hypothesis, that there is a negative relation between inflation and trade openness for Pakistan, which confirms the applicability of Romer's hypothesis for Pakistan. **Samimi, Ghaderi and Sanginabadi (2011)** provided evidence on the impact of trade openness on the inflation in Iran. They applied a bounds test approach to test the level relationship within the autoregressive distributed lag (ARDL) model proposed by **Pesaran et al. (2001).** The empirical results are biased in short and long run. The same method was used by **Imran Sharif Chaudhry et al (2011)** and observed that foreign exchange reserves helps in lowering the inflation rates in Pakistan. **Samimi et al (2012)** the study tested the Romer hypothesis, that inflation is lower in more open economies. The results cast a robust and negative relationship between trade openness and inflation, which opposes the view of Romer. The relationship between these variables was studied almost in all developing nations in the world.

The next observable relationship is exchange rate movements and inflation, exchange rates are very important in the international trade. International payments are made foreign currencies, so maintaining good exchange rate has become crucial for developing economies. Many studies tried to establish the relation between exchange rate movements and inflation. According to **Devereux and Yetma (2002)** observed when there is high exchange rate movements due to currency losing its value in the financial market higher will be the inflation and reduces the profits also. A greater degree of openness due to trade liberalization is likely to lower the rate of inflation and may alter the influence of the real exchange rate on growth, via the impact on the demand for exports and leakage of demand into imports (**Aron and Muellbauer, 2002). Siok kun sek et al (2012)** also established a relation between these variables by using a multivariable GARCH model under BEKK specification and established a positive impact of volatile exchange rates on inflation. **Barro and Gordon (1983)** argue that discretionary policies tend to raise inflation to higher, and more inefficient, levels than monetary regimes that follow well-defined rules.

García and González (2013) the study finds the effect of country risk premium and commodity price shocks on monetary policy in small open economies. It shows that emerging economies face more challenges in designing monetary policy than developed economies. For instance, researchers learned that the risk premium shock could explain most of the volatility in the real exchange rate. For estimation we reviewed Generalized Method of Moments (GMM) by **Arellano and Bond (1991), Holtz-Eakin et al. (1990)** and **Arellano and Bover (1995).**

The final important relationship is countries foreign exchange reserves and inflation. The reserves are helps the nations in volatile currency situations for external payments. The more the reserves is higher the capacity to withstand the volatile situations. The interesting fact is that all these nations accumulated more reserves nearly half of world reserves since their reforms. Many empirical evidences were documented, **Mei-Yin Lin** and **Jue-Shyan Wang (2013)** in their study stressed that increase in forex reserves will increase inflation, when the exchange rates are stronger and it shows mixed result in all five selected nations.

From the above literature it is evident that most of the researchers are very keen on studying the behavior of inflation in the open economies and the results are

not the same in all situations. The empirical evidences from the developing nations showed the impact of inflation on domestic prices and other indexes. This piece of literature helps to understand the behavior of trade openness and exchange rate intervention on inflation in the BRICS economic block

3. B.1.1 Exchange Rate, Forex Reserve and Trade Openness on Inflation:

Objective 2: To evaluate the impact of exchange rate, forex reserve and trade openness on inflation.

Hypotheses for Objective Two:

1. ***Null Hypothesis*** **(** $H = 0$**):** The exchange rate intervention and trade openness do not affect the inflation.

2. ***Alterantive Hypothesis (*** $H \neq 0$ ***):*** The exchange rate intervention and trade openness affect the inflation.

These hypotheses are framed to know the influencing role of exchange rate intervention and trade openness on Inflation.

3. B. 2 Data and Sample Description

To investigate above mentioned relation among the variables, the study uses monthly data for the sample period from January 1998 to September 2012 in BRICS group of countries (Brazil, Russia, India, China and South Africa). The required data set for the selected countries were obtained from various sources. The dependent variable inflation in our study used the Consumer Price Index (CPI) to calculate the inflation percentage. The data of inflation (CPI) were collected from International Financial Statistics (IFS). The independent variables are percentage of nominal exchange rate in Federal Reserve, percentage of foreign exchange reserves in US dollar from International Financial Statistics (IFS), trade openness data which include both exports and imports was collected from Organization for Economic Co-Operation and Development (OECD) and GDP from World Bank (WB). All these variables are considered as key growth indicators in an economy.

3. B.3 Methodology

To investigate above mentioned relation among the variables, the study uses monthly data for the sample period from January 1998 to September 2012. Our study analyses an alternative econometric approach to the normal panel data so the GMM models has exploited the time variation in the models and unobserved country specific effects, it has included lagged dependent variables and control endogeneity of the explanatory variables. The Panel estimator has included instrumental variables based on past realization.

In a dynamic model which includes lags of the dependent variable as explanatory variables standard econometric techniques (OLS, IV, etc.) do not yield efficient estimates of the parameters **(Sevestre, 2002).** The GMM method provides a solution to the problems of simultaneity bias, reverse causality and omitted variable bias **(Kpodar, 2007),** as well as yielding estimates of unobserved country-specific effects and dummy coefficients for which the usual methods ("within" or "difference") would be inappropriate given the dynamic nature of the regression (see **Calderon et al. 2006).**

There are two types of GMM estimators: the first-difference and the system one. In the former case, all variables are first-differenced to eliminate individual and time-specific effects. Variables in levels lagged twice or more are then used as instruments for the explanatory variables, assuming that the errors of the equation in levels are not auto correlated. However, those lagged variables are weak instruments. That is why **Arellano** and **Bover (1995)** and **Blundell** and **Bond (1998)** have proposed a system GMM estimator, which is based on assumptions about the initial conditions such that the moment conditions remain valid even for persistent series. This estimator combines the equations in first differences with equations in which the level variables are instrumented by their first differences. **Blundell** and **Bond (1998)** have shown using Monte Carlo simulations that the system GMM estimator is indeed more efficient than the first-difference one, the latter yielding biased estimates in finite samples if the instruments are weak. We can write general model of GMM

$$in_{i,t} - in_{i,t-1} = (\beta - 1) in_{it-1} + \beta' X_{it} + \eta_i + \varepsilon_{it} \quad \textbf{(3.B.1)}$$

Where inflation is the log of variable , X (exchange rate, foreign exchange reserves and trade openness) represents set of explanatory variables , η is an unobserved country-specific effect, ε is the error term and the i and t represents country and time periods respectively, we write

$$in_{it} = \beta in_{it-1} + \beta' X_{it} + \eta_i + \varepsilon_{it} \quad \textbf{(3.B.2)}$$

Now, to eliminate the country-specific effect, take first difference of equation **(3.B.2)**

$$in_{i,t} - in_{i,t-1} = \beta(in_{it} - in_{it-2}) + \beta'(X_{it} - X_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \quad \textbf{(3.B.3)}$$

The instruments variables is explains by eq.(3.1) endogenous variables of explanatory variable dealt with eq. (3.2) Construction of new error term, $\varepsilon_{it} - \varepsilon_{it-1}$ is correlated with lagged dependent variables $in_{it-1} - in_{it-2}$. We assume that error term is serially uncorrelated and explanatory variables X are weakly exogenous (i.e. the explanatory variables are assumed to be uncorrelated with future realizations of the error term), the GMM dynamic panel estimator uses the following moment condition

$$E[in_{it-s}(\varepsilon_{it} - \varepsilon_{it-1})] = 0 \qquad for \qquad s \geq 2; t = 3,...,T,, \quad \textbf{(3.B.4)}$$

$$E[X_{it-s}(\varepsilon_{it} - \varepsilon_{it-1})] = 0 \qquad for \qquad s \geq 2; t = 3,...,T \quad \textbf{(3.B.5)}$$

The GMM estimator based on the difference estimator, these are appropriate instruments under the following additional assumption: although there may be correlation between the levels of the right-hand side variables and the country-specific select in Eq. (3.2), there is un-correlation between the differences of these variables and the country specific select. This assumption results from the following stationarity property,

$$E[in_{it} + p\eta_i] = E[in_{it} + q\eta_i] \quad and \quad E[X_{it} + p\eta_i] = E[X_{it} + q\eta_i] \quad \textbf{(3.B.6)}$$

$$E\left[\left(in_{it-s} - in_{it-s-1}\right)\left(\eta_{it} + \varepsilon_{it}\right)\right] = 0 \qquad for \qquad s = 1, \qquad \textbf{(3.B.7)}$$

$$E\left[\left(X_{it-s} - X_{it-s-1}\right)\left(\eta_{i} + \varepsilon_{it}\right)\right] = 0 \qquad for \qquad s = 2 \qquad \textbf{(3.B.8)}$$

Thus, we use the moment conditions explained in Eqs. (3.B.4), (3.B.5), (3.B.7), and (3.B.8) and employ a GMM procedure to generate consistent as well efficient parameter estimates **Levine et.al (2000).**

3. B. 4 Results and Discussion

The result of descriptive statistics and GMM are discussed in this part.

3. B.4.1 Result of Descriptive Statistics

The descriptive statistics of inflation, exchange rate, forex reserve and trade openness for the sample of fifteen years from 1998 to 2012 are shown in the Table 3.B.1. From 830 observations, the mean, median, maximum, minimum, standard deviation, skewness and kurtosis were tabled for the full sample period. Since the inflation is calculated in percentages the remaining independent variables are also converted into percentages for easy understanding, that's why we mentioned them as PEX (percentage of exchange rate), PFOREX (percentage of forex reserves) and PTO (percentage of trade openness).

The mean value of inflation is negative with -0.6886 and other independent variables are showing positive values. The exchange rate, forex reserves and trade openness are 0.381529, 1.3492 and 0.38105 respectively. The standard deviation values are high in inflation with 21.12461 and low in remaining independent variables with 2.206992, 2.196963 and 4.509491 respectively. For a normal distributed data the skewness value is zero, which means the data is symmetrical. A positive or negative value of skewness defines the data as asymmetrical. The skewness value of listed variable shows negatively skewed in inflation and trade openness with values of -3.219025 and -15.32818. The remaining independent variables exchange rate and forex reserves are positively skewed with 5.056785 and 0.585690 for the same periods, which means our sample data series is asymmetrical. The kurtosis shows 21.39327, 39.33770, 5.694176 and very high in trade openness with 250.9328 respectively. The Kurtosis

value for a normal distribution is three. A value lesser than three, indicate flatness and more than three indicates peakedness of the data series. All the listed variables are showing value more than three meaning showing peakedness in distribution.

Table: 3.B.4.1

Descriptive Statistics of Inflation, Exchange Rate, Forex Reserve &Trade Openness

Statistics	IN	PEX	PFOREX	PTO
Mean	-0.688687	0.381529	1.349200	0.381059
Median	0.944029	-1.38E-08	1.030501	0.710651
Maximum	67.25443	22.72886	11.17382	1.726756
Minimum	-154.4254	-3.329765	-6.030601	-84.86446
Std. Dev.	21.12461	2.206992	2.196963	4.509491
Skewness	-3.219025	5.056785	0.585690	-15.32818
Kurtosis	21.39327	39.33770	5.694176	250.9328
Probability	0.000000	0.000000	0.000000	0.000000
Sum	-571.6099	316.6689	1119.836	316.2792
Sum Sq. Dev.	369940.4	4037.903	4001.291	16858.13
Observations	830	830	830	830

3. B.4.2 Results of GMM analysis:

The results of GMM analysis to know the relationship of exchange rate, foreign exchange reserve and trade openness on inflation are plotted below in table.1.

Table: 3.B.4.2

Result of Generalized Moment Method approach (GMM)

Variables	Coefficient	Prob.
Constant	-6.472097	0.001
P Exchange rate	4.219227	0.004
P Forex Reserve	0.947326	0.019
P Trade Openness	8.351771	0.038
J-statistic	0.982	
This table provides the estimated result of Generalized Moment Method approach (GMM) for the sample period from 1998 to 2012.		

Table 3.B.4.2 shows that there is a positive relationship between exchange rate, forex reserve and trade openness on the inflation, which is a proxy variable of economy

of BRICS countries. The trade openness shows positive significant, ($p<0.05$) and high coefficient (8.35) relationship with inflation, which means for every one unit increase in trade openness increases inflation by 8.35 units. The exchange rate positively highly significant ($p<0.01$), and high coefficient of 4.21 on inflation, stating that for every one unit dollar rate increases in the international market (depreciation) the inflation increases by 4.21 unit. Though forex reserves are showing positive significance ($p<0.01$), when compare to trade openness and exchange rate, the forex reserves are less coefficient with inflation by 0.94, which means for every one unit increase in forex reserves, there is a 0.94 increase in inflation. Since all the independent variables are positively influencing inflation, it rejects the null hypothesis and accepts the alternate hypothesis significantly.

This is always happening in the growing economies. Increased trade openness ratio indicates increased foreign trade when GDP is constant and it is good for any country and bad if it is reverse. When Forex reserve increases in any country there is a high degree of possibility of investments and increased number of transaction thus accelerate the growth of GDP, as a result increase the inflation at lower/higher level depend upon the domestic monetary policy. As a whole in the BRICS the inflation increases as a result of increased Forex reserve. In BRICS countries, the study gives a positive correlation of exchange rate, forex reserve and trade openness on the inflation. The common feature of these countries is, all are developing nations and controlling inflation is one of their main points in monitory policy, because these countries are highly open to international trade. When there is a good exchange rate the countries will be more open which brings high investments, which accelerate the growth of the country's economy. As a result there is an increase in the inflation is observed in the BRICS nations.

Through these empirical results, we can estimate that there is a positive correlation between these economic variables. Almost all countries in the given long run time period successfully controlled the inflation. But in the period of global economic slowdown they restricted the trade and made changes in the exchange rate in order to sustain. They used the reserves of the country to reduce the inflation. China and South Africa reserves are gradually increasing even in the slowdown period also. The main focus of Brazil and South African economic policy is to control the inflation.

It is evident that countries with greater exchange rate intervention are having greater control over inflation. As these countries are open to the international trade, they have greater chance to get affected by inflation, but in BRICS countries the results are different because these countries are with great potential to export through domestic production. And the internal trade between these countries also helped them to withstand the economic slowdown. In addition to this, the foreign exchange reserves also high in these countries.

3. B.5 Conclusion

This study is an attempt to document the evidence of exchange rate intervention (Exchange rate and Forex reserves) and trade openness on the economy of the BRICS countries. The inflation is considered as one of the proxy variables to see the economy of BRICS Nations. A sample of fifteen years panel and time series data were taken to study the changing patterns of the BRICS economy. The BRICS Nations are highly open to the trade for their economic development and the international trade is completely depends on the exchange rate. These two variables are directly influencing on inflation in this developing economic block. With the increased exchange rate (BRICS currency value depreciates) the cost of production of goods will increase in the domestic market and the general prices levels will also increases. In the same way when the reserve increases, the inflation will also increases. It indicates that the accumulated reserves are generally used to control the inflation. When exchange rates are high the accumulation of reserves through exports are costly so it leads to inflation. Among these independent variables trade openness shows a highly positive relation with inflation because the trade openness facilitated by liberal monetary policy which leads to high inflation. The important point is if there is any sudden rise in inflation or any crisis the BRICS countries can overcome by understanding the changing behaviour of the variables in the past episodes.

CHAPTER STRUCTURE

3. C **EXCHANGE RATE, FOREX RESERVE AND TRADE OPENNESS ON GROSS DOMESTIC PRODUCT (GDP)**

3. C.1 **Introduction**

3. C.1.1 Exchange Rate, Forex Reserve and Trade Openness on GDP

3. C.2 **Data and Sample Description**

3. C.3 **Methodology**

3. C.4 **Results and Discussions**

3. C.4.1 Result of Descriptive Statistics

3. C.4.2 Result of Panel unit root (Breitung, 2000)

3. C.4.3 Result of Pedroni (Engle- Granger based)

3. C.4.4 Results of Fully Modified Ordinary Least Square Regression (FMOLS)

3. C.5 **Conclusion**

3. C.1 Introduction:

The health of any economy is measured by its Gross Domestic Product (GDP), it comprises of several important economic components. Gross Domestic Product has the ability to give an overall picture of the state of the economy. It helps in counties economic planning and policy formulation. The general definition of GDP is the total no of goods and services produced with in the country in a specific period of time. Generally all countries calculate GDP annually; it helps them to understand whether the economy contrasting or expanding. The future studies started predicting the growth of the economies. These predictions not only helped the nations in better planning but also changed the world economic order.

BRICS is one of the predictions made by Jim O'Nil, this acronym stands for five developing nations Brazil, Russia, India, China, and South Africa. The predictions made by him is proved and these five countries accounts $1/5^{th}$ of the world GDP and showing a great significant effect on the world GDP. With this importance the group was taken as sample group in this study. BRICS nations have gained the attention of economic scholars in the last two decades, but the study made by Jim O'Nil helped these nations to come forward and to form into an economic group. Gradually this economic group played key role not only in economic matters and in socio-political matters at international level.

The total GDP of BRICS group of nations accounts $15.8 trillion in 2013; that makes this group third after European Union and United States. China is having a lions share in the total GDP of BRICS, which accounts more than 55 percent. China showed tremendous growth rate in the last decade, the GDP growth rate was seen the double digits. Though the economic depression in 2008 has brought down the GDP growth of these nations, they still maintain healthy economy with slow growth rate. By the end of our study period 2012[85], the GDP growth rates of all nations stands at 1.1 trillion US dollars in Brazil, 0.9 trillion US dollars in Russia, 1.3 trillion US dollars in India, 4.5 trillion US dollars in China and 0.3 trillion US dollars in South Africa. In this study GDP is calculated on real time monthly basis to understand the changing patterns with

[85] **Source : World Bank, 2013.**

other economic variables. The study helps to check this proxy variable of economy with other independent variables like exchange rate, foreign exchange reserves and trade openness. The literature on these combinations helps us in understanding the relations in better way. Many economists were studied these variables individually but a combination of these variables with GDP is first on this group of nations.

The foreign exchange rate independently determines the economic growth of nation. The strong exchange rate often resembles the economic strength and the movements in exchange rates directly affect the imports and exports of goods and services of nations. If we observe the currency valuation and economic growth around the globe from the works of **Dollar (1992)**, **Sachs and Warner (1995)** in the managed exchange rate systems and over valuation effects on economic growth were studied in **Rodrigues and Rodrik (2001)** and **Dani Rodrik (2008)**. The cross national growth literature was observed in **Razin and Collins (1997)**, and **Rajan and Subramanian (2007)**. **Sebastian Edwards and Eduardo Levy Yeyati (2003)** examined the impact of external shocks on economy in different exchange rate regimes. **Carlos Lozada, Blaise Gadanecz and Aaron Mehrotra (2013)** finds flexile exchange rates reduce economic volatility. The exchange rate determines the capital inside the country. In an open economies with flexible exchange rates and regular interventions helps in economic growth.

The second important variable in our study, which shows independent effect on GDP is forex reserves. The BRICS group of nations were severely affected by many economic crisis, among them Asian currency crisis in 1997 is one. All the countries in this group have kept accumulation of reserves as their main agenda in the economic policy. It helps in raising GDP growth rates in the long run. These developing nations are opened their economy to the outside world, the increased integration may leads to volatility in the economy. Accumulation of forex reserves may have both long run and short run effects on the real exchange rate valuation, the undervalued exchange rate triggers the export led growth in open economies. It also enhances the credibility of governments and attracts foreign direct investments, which ultimately enhances the GDP growth of output. In the sample group china accumulated highest reserves than any other nation in the world. The group reserves accounts more than 40 percent of the world reserves.

V.Polterovich, V.Popov (2002) studied the accumulation of forex reserves and long term economic growth and the same was tested in emerging economies by **Borivoje D.Kruskovic and tina maricic (2015)**, **Alberola, E., & Serena, J. M. (2007), Cheng, G. (2013) and Green, R. and Torgerson, T. (2007).** The monitory aspects are discussed by **Pina, G. (2011) and Barbosa-Filho, N. H. (2008)** are few studies to mention.

Trade openness is the essential independent variable in the emerging nations; it is relevant to check the relation between these two variables. Trade openness is the key to integrate the emerging economies into global economic world. Extensive literature work is done on these variables. **S Edwards (1991)** finds that more open economies have experienced tremendous productivity growth**. H.yanikkaya (2003), A Harrison (1996),** and **D Rodrik (1999)** studied the effect of trade openness in the developing economies in cross countries studies. **Sachs and Warner (1995), Rivera-Batiz, L.A., Romer, P.M., (1991)** evidenced the role of trade openness in integrating the economy with global economy. There are many studies to list out to know the relation between these variables in different aspect. Hence it is very relevant to study the relationship between these three independent variables, exchange rate, forex reserves and trade openness on and GDP of BRICS nations.

3. C.1.1 Exchange Rate, Forex Reserve and Trade Openness on GDP:

Objective of the Study:

Objective 3: To evaluate the long term relationship between exchange rate intervention and trade openness with GDP.

Hypotheses for Objective Three:

1. ***Null hypothesis (*** $H = 0$**):** There is a no long term relationship of exchange rate intervention and trade openness on GDP.
2. ***Alterantive hypothesis(*** $H \neq 0$ **):** There is a long term relationship between exchange rate intervention and trade openness on GDP.

These hypotheses are framed to know the influencing role of exchange rate intervention and trade openness with GDP.

3. C. 2 Data and Sample Description

This empirical study used panel data modeling on fifteen years monthly data from 1st January, 1998 to 30th September 2012 in BRICS group of countries (Brazil, Russia, India, China and South Africa). The required data set for the selected countries were obtained from various sources. The dependent variable in our study used as log of Gross domestic production (GDP), GDP refers to the amount of goods and services produced with in the country. Annual GDP is converted into monthly with Interpolates method**,** and is collected from World Bank (WB). The independent variables are log of nominal exchange rate in Federal Reserve, log of foreign exchange reserves in US dollar from International Financial Statistics (IFS), log of trade openness data which include both exports and imports were collected from Organization for Economic Co-Operation and Development (OECD) and GDP from World Bank (WB), the log values are used to adjust with the dependent variable which is being calculated in the monthly rate of percentage. All these variables are considered as key growth indicators in an economy. The BRICS group of nations gained the attention of world economists with their consistent economic growth even in the global slowdown. Over the two decades these developing nations maintained consistent growth in their GDP and become a significant impact on global economic growth. These variables are selected based on the important role played by them in the highly volatile world economy. The keen interest of the study is to know the movement of above mentioned independent variables such as exchange rate, foreign exchange reserves, and trade openness on the dependent variable of Gross Domestic Production (GDP).

3. C.3 Methodology

To study the objective, the hypothesis was tested by the parameter of the GDP by considering the long run relationship with variables, such as exchange rate, forex reserve and trade openness. In order to examine the panel series properties of our data and assess the appropriate methodology, first we conducted panel unit root test

[described in Breitung (2000)] to accept the alternative hypothesis which indicating the data is non stationary.

Breitung (2000) developed pooled panel unit root test, it not necessary for bias correction, which is achieved by the appropriate variable transformation and it is explained that against the homogeneous alternative. Case 1 it is similar to Levin, Lin and Chu (2002) no bias correction required for estimation, case 2. Bias correction factors are avoided by subtracting the initial observations, and case. Serial correlation has been removed with first step regression. Levin, Lin and Chu (2002) and Breitung and Das (2005) to have better sample performance is pre-whitening as

$$\Delta y_{it} = \alpha_i + \sum_{j=1}^{p_i} \gamma_{ij} \Delta y_{it-j} + \mu_{it} \qquad \textbf{(3.C.1)}$$

From which the residuals $\tilde{e}_{it}$ and $\tilde{f}_{it}$ are computed as follows

$$\begin{aligned} \tilde{e}_{it} &= \Delta y_{it} - \sum_{j=1}^{p_i} \hat{\gamma}_{ij} \Delta y_{it-j}, \\ \tilde{f}_{it-1} &= y_{it-1} - \sum_{j=1}^{p_i} \hat{\gamma}_{ij} y_{it-j-1} \end{aligned} \qquad \textbf{(3.C.2)}$$

The residuals then standardized by the regression standard error to obtain $\tilde{e}_{it}$ and $\tilde{f}_{it}$, the two approaches are asymptotically equivalent.

$$\begin{aligned} e_{it}^{*} &= \sqrt{\frac{T-t}{T-t+1}}\left(\Delta\hat{e}_{it} - \frac{1}{T-t}\left(\Delta\hat{e}_{it+1} + \ldots + \Delta\hat{e}_{iT}\right)\right) \\ f_{it}^{*} &= \hat{f}_{it-1} - \hat{f}_{i1} + \frac{t-1}{T}(\hat{f}_{iT} - \hat{f}_{i1}) \end{aligned} \qquad \textbf{(3.C.3)}$$

Here T is sample size after the auxiliary regression and the system requires estimating unit root test is performed in the pooled regression.

$$e_{i1}^{*} = \phi \; f_{it-1}^{*} + \mu_{it}^{*} \qquad \textbf{(3.C.4)}$$

Testing hypothesis $H_0 : \phi^{*} = 0$ and Breitung test showed that the t-statistics has standard normal limiting distribution. The panel unit root test designed against heterogeneous alternative $H_1^2 : -1 \pi \rho_i \pi 1$ for $i = 1,...,N_1$ and ρ_i for $i = N_1,...,N$ asymptotic consistency of the test and individual unit root test under alternative hypothesis have stationary test. i.e. $\lim_{N-\infty} N_1 / N \phi 0$ (group mean estimation and t-test), (Hlouskova and Wagner 2005).

Then we choose Pedroni and FMOLS models to test the long term co-integration. Pedroni (Engle- Granger based) shows whether the overall co-integration among the variables in panel data or not. Through FMOLS model the individual effect of exchange rate, forex reserves and trade openness with GDP are known.

Fully Modified Ordinary Least Square (FMOLS) which explain heterogeneity across individual members of the panel. Working with co-integrated panel approach it allows researcher to choose pool the long run information available while permitting the short run the short run dynamics and fixed effects to be heterogeneous among different members of the panel; group mean of estimator and t-statistics allow to flexible alternative hypothesis as group of mean estimator based on between dimension of the panel while pooled estimators is based on the 'within dimension' of the panel (Pedroni 1996). Consider the co integrated system for a panel of $i = 1,2,...,N$

$$\begin{aligned} y_{it} &= \alpha_i + \beta x_{it} + \mu_{it} \\ x_{it} &= x_{it-1} + \nu_{it} \end{aligned} \qquad \textbf{(3.C.5)}$$

Where y_{it} *and* x_{it} are non-stationary and vector term $\varepsilon_{it} = (\mu_{it}, \nu_{it})' \sim I(0)$ have asymptotic covariance matrix $\Psi_i = (L_i L_i'$ (Li is a lower triangular decomposition of Ψ_i). The variables y_{it} and x_{it} are co-integrated for each member of the panel, with co-integrating vector β. In addition, the asymptotic covariance matrix $\Psi_i = \Psi_i^{o} + \mathrm{I}_i + \mathrm{I}_i'$, where Ψ_i^{0} denote the contemporaneous covariance and I_i is a weighted sum of auto-covariance's. Chiu, Lee and Sun (2010).

3. C. 4 Results and Discussion

The result of descriptive statistics, Pedroni (Engle- Granger based[86]) and Fully Modified Ordinary Least Square (FMOLS) are discussed in this part.

3. C.4.1 Results of Descriptive Statistics

The descriptive statistics of GDP, exchange rate, forex reserve and trade openness for the sample of fifteen years from 1998 to 2012 are shown in the Table 3.C.4.1. The mean, median, maximum, minimum, standard deviation, skewness, kurtosis in 885 number of observation for the full sample period. The log mean values of GDP, exchange rate, forex reserve and trade openness are -0.090745, 1.027412, 4.848224 and -1.543742 respectively. The standard deviation values of these variables are 0.334267, 0.480070, 0.550984 and 0.236408 respectively. For the same periods a high standard deviation shows in forex reserves with 0.550984 and less in trade openness with 0.236408. The skewness of normal distribution is zero and the data is symmetrical. A positive and negative value of skewness defines the data as asymmetrical. The skewness value of listed variable shows 0.046822, -0.139216, -0.492099 and -0.119987 for the same periods. So in our results full sample period GDP data shows a positive skewed distribution and exchange rate, forex reserve and trade openness shows a negative skewed, that means our sample data series is asymmetrical. The Kurtosis shows 2.777600, 1.868109, 2.396140 and 2.058501 respectively. In a standard normal distribution the Kurtosis is three. A value lesser than three, indicate flatness and more than three indicates peakedness of the data series. The kurtosis value of exchange rate, forex reserve and trade openness shows flatness and share price shows peakedness in distribution.

[86] The Engle-Granger (1987) cointegration test is based on an examination of the residuals of a spurious regression performed using I(1) variables. If the variables are co integrated then the residuals should be I(0). On the other hand if the variables are not co integrated then the residuals will be I(1). Pedroni (1999, 2004) extend the Engle-Granger framework to tests involving panel data.

Table: 3.C.4.1

Descriptive Statistics of GDP, Exchange Rate, Forex Reserve & Trade Openness

Statistics	LGDP	LEX	LFOREX	LTO
Mean	-0.090745	1.027412	4.848224	-1.543742
Median	-0.064028	0.918017	4.951069	-1.558332
Maximum	0.677665	1.746383	5.748704	-1.105384
Minimum	-0.717097	0.052811	3.599940	-2.015721
Std. Dev.	0.334267	0.480070	0.550984	0.236408
Skewness	0.046822	-0.139216	-0.492099	-0.119987
Kurtosis	2.777600	1.868109	2.396140	2.058501
Sum	-80.30893	909.2597	4290.678	-1366.212
Sum Sq. Dev.	98.77318	203.7328	268.3676	49.40578
Observations	885	885	885	885

This table provides the summary statistics of GDP, exchange rate, forex reserve and trade openness for the sample period from 1998 to 2012.

3. C.4.2 Result of Panel Unit Root

Before examining the long-run relationship between them, this study first reports the results of Breitung (2000) panel unit root test (Individual Intercept and trend). As shown in **Table: 3.C.4.2**, the null hypothesis of a unit root cannot be rejected for most of the variables in levels at 1 percent significance, suggesting that these variables are non-stationary. To confirm these variables' integration of order, the null of a unit root is examined for the first difference variables. According to first difference, most of the results reject the null hypothesis of a unit root, indicating that all variables are stationary.

Table: 3.C.4.2

Result of Panel Unit Root

Variable	Individual Intercept and trend	Variables	Individual Intercept and trend
Breitung(2000)			
LRGDP	1.61 (0.95)	Δ^{st} LRGDP	-1.83 (0.03)
LEX	0.99(0.84)	Δ^{st} LEX	-3.37 (0.00)
LFORX	2.98 (0.98)	Δ^{st} FORX	-3.86 (0.00)
LIT	-1.34(0.09)	Δ^{st} LIT	-3.41(0.00)

This table provides the estimated result of panel unit root for the sample period from 1998 to 2012.

3. C.4.3 Result of Pedroni. (Engle- Granger based)

Table: 3.C.4.3
Result of Pedroni.

Within-Dimension	
Panel v-Statistic	2.003014**
Panel rho-Statistic	-4.449944***
Panel PP-Statistic	-3.728712***
Panel ADF-Statistic	-1.101970
Between-Dimension	
Panel rho-Statistic	-2.023897**
Panel PP-Statistic	-2.082871**
Panel ADF-Statistic	-0.043389
This table provides the estimated result of Pedroni[87] for the sample period from 1998 to 2012. ***Note: *** indicates significant at one percent level.***	

Pedroni's co-integration tests are employed to investigate the null hypothesis of a no cointegrating relationship against the alternative hypothesis of the existence of cointegrating relationships. The five statistics indicate that the null hypothesis can be rejected at one percent and five percent significant level (within-dimension &between-dimension). For the group ADF-statistic shows more than 10 percent level which, indicate accept the null hypothesis. All the statistics test shows the null hypothesis of no cointegration can be rejected except the group ADF-statistic.

3. C.4.4 Result of Fully Modified Ordinary Least Square (FMOLS)

The above result we discussed about the Breitung (2000) to verify that the variables are non-stationary and the next step examined whether there is a cointegrating relationship among these variables using Pedroni's panel cointegration technique. Finally, **Table: 3.C.4.4** described the Fully Modified Ordinary Least Square (FMOLS) which explain heterogeneity across individual members of the panel.

[87] Pedroni (1999, 2001) proposes seven test statistics, which can be classified into two categories. Four of them are panel cointegration tests based on within-dimension and three of them are group-mean panel cointegration tests based on between-dimension.

Table: 3.C.4.4
Result of Fully Modified Ordinary Least Square (FMOLS)

Variable	Coefficient	t-Statistic
LSEX	0.088230	3.499***
LSFOREX	0.082942	19.09***
LTO	0.450952	51.29***

This table provides the estimated result of FMOLS for the sample period from 1998 to 2012.
Note: *** indicates significant at one percent level.

The empirical analysis shows that all the three variables such as exchange rate, forex reserve and trade openness combines together have a long term relationship with GDP in BRICS nations. This is a good sign for the BRICS country with respect to the predictions of the economist Jim O' Neill to achieve 47 percent of world GDP by the year 2050. This strengthens the economy of BRICS to play a dominant role in the world economy

The exchange rate is positively (CV 0.088, $p<0.01$) associated with GDP, meaning that for every one unit of exchange rate increases, the GDP increases by 0.08 unit. The study found that there is a long term relationship between exchange rate and GDP, which indicate there is a possibility of inflow of FII and FDI that will generate more GDP in the economy. The high exchange rate enables the capital inflow, which helps in domestic production and exporting of goods and services. Thus the GDP of the country will get strengthen.

The forex reserve is also positively (CV 0.082, $p<0.01$) associated with GDP. It explains when reserve increases the investment also increase in the form of production, infrastructure development, transport facility, etc. When the countries have more reserves they can invest in domestic and in more foreign markets. A country having huge investment, its growth will increase. Thus the reserves of a country are directly influencing the GDP. The reserves reduce the burden of the government by reducing the external current account debts. The BRICS nations together constitute highest reserves when compared to the world reserves. Accumulation of reserves helps the BRICS nations to improve the GDP in the economy.

Among the variables (exchange rate, forex reserves, and trade openness) trade openness is highly positive (CV 0.45, $p<0.01$) coefficient with GDP in BRICS countries. Because it brings more investment in these countries through FDI and FII,

which helps in reducing the cost of production and increase in the profits through export. These transactions help in improve the nations GDP. All the BRICS nations are open to the international trade with reasonable restrictions. These favorable conditions encouraged the investors to invest in this economic block, thus it helped in improving the GDP through high production of goods and services in the domestic market. Overall the BRICS countries GDP has improved during the study period with the help of international trade (exports and imports).

3. C.5 Conclusion

In the study period, the GDP growth rate was increased tremendously after reforms in all nations. The empirical result shows long term co-integration between independent variables and the dependent variable. These three independent variables exchange rate, forex reserve and trade openness significantly influenced the GDP of BRICS Nations. Panel unit root test was used to check the stationary of the variables and results observed to be stationary in first difference. Later we used Pedroni co integration test, it shows integration of variables. To know the individual effect of these variables on GDP, the study employed FMOLS and results explicit individual effects on GDP and shows trade openness is highly influencing the GDP than other two variables. Increased degree of trade openness helped the nations to attract more foreign investments and the exposure to the international trade, which gives competitiveness to the domestic export products and helps to increase the GDP. The managed exchange rates also helped them to increases its exports and to maintain foreign exchange reserves. It also implies that the exchange rate and forex reserves in these countries are mostly using for checking the volatility in the economy, so the influence on GDP is low in BRICS nations.

The Overall result shows the exchange rate, forex reserves and trade openness are positively associated with GDP. Out of these three independent variables trade openness has high degree of association with proxy variables of economy of BRICS nations. The nations with high trade openness brings more investment to the country and economy will increase and monetary policy of the country will be liberal which allows fluctuations in the exchange rates of the nations, the exposure to the international trade give competitiveness to the domestic export products, helps to increase the GDP.

CHAPTER STRUCTURE

3. D **EXCHANGE RATE, FOREX RESERVE AND TRADE OPENNESS ON SACRIFICE RATIO**

3. D.1 **Introduction**

3. D.1.1 Changing Trends of Economic Variables in BRICS Nations during the sample period (1998-2012)

3. D.1.2 Exchange Rate, Forex Reserve and Trade Openness on Sacrifice Ratio

3. D.2 **Data and Sample Description**

3. D.3 **Methodology**

3. D.4 **Results and Discussions**

3. D.4.1 Estimates of sacrifice ratios for Brazil

3. D.4.2 Estimates of sacrifice ratios for Russia

3. D.4.3 Estimates of sacrifice ratios for India

3. D.4.4 Estimates of sacrifice ratios for China

3. D.4.5 Estimates of sacrifice ratios for South Africa

3. D.4.6 Estimates of Ordinary Least Square for Sacrifice ratio.

3. D.5 **Conclusion**

3. D. Introduction

The shift of economic supremacy from the hands of developed nations to the developing nations is observed in the last decade. The developing nations marked significant growth rates in their economies. Among the developing nations BRICS group of nations are standing in the front and leading the world economy. With a notable growth rates these nations gained the attention of economists around the globe. The prediction of **Jim O'Neill, (2001)**[88] brought these nations to come under one umbrella, from then this group not only limited to economic activities and also playing a very critical role in geo political aspects also.

After the economic reforms in each nation in BRICS, The international trade has increased tremendously.The five nations opened their economy as never before, along with greater advantages it also posed the threat of frequent external shocks to the economy. The inflations caused by series of financial crisis around the globe become a setback to the developing nations, as it hinders the growth of the economy central banks of these nations are targeting the inflation through different mechanisms. After the successful implementation of inflation targeting by New Zealand many countries formally adopted the inflation targeting mechanism in the past two decades. The inflation brings general increase in the price levels of goods and services, but bringing down the inflation is no free-lunch and is usually associated with non-trivial short run output losses **(Ball, 1994)**[89]**.** After the works of Ball many economists highlighted the concept of sacrifice ratio, which is generally calculated as the ratio of output loss with trend inflation. The following write-ups discuss some of the studies which observed the inflation targeting mechanisms and disinflation episodes over a period in different parts of the globe. This part also helps us in understanding the concept of sacrifice ration and its changes with other macroeconomic variables like trade openness, exchange rate and forex reserves in a lucid way.

Sacrifice ratio is the instrument used in the monetary policy by the central bank of the nations. The sacrifice ratio is calculated by the output loss during the disinflation episodes. The importance of disinflation episodes and sacrifice ratio is got highlighted

[88] O'Neill,J., (2001). "Building Better Global Economic BRICs".

[89] Ball, L. (1994). what determines the sacrifice ratio?. *In Monetary policy*, (155-193). The University of Chicago Press.

with studies of **Romer and Romer (1989).** In his study he found that recession occurred during the disinflation with tight monetary policy in United States in the early 1970's and 1980's. The main question in this regard is "Dose the disinflation cause output loss?" many economists explained theoretically and empirically but the results are mixed. In many cases the disinflation period influencing the behaviour in other cases the monitory policy of the central banks. Eminent economists like **Ball (1994), Romer (1989) and Mankiw (1988)** observed that the output loss is generally more when the disinflation process is highly inflated nations.

In this chapter we calculated the sacrifice ratio for each country and the other external macro economic variables which are influencing the economy. The review of literature provides that the output loss is not only restricted by monetary policy but also by some other economic variables. **Rongrong Sun (2012)** studied the relation between monetary policy and sacrifice ratio and excluding the endogenous factors separately in monetary policy. **Romer and Romer (2004)** in his series of studies also identified the importance of isolation of exogenous factors from endogenous factors in the monetary policy and he also stressed the impact of monetary policies on economic fluctuations should be reflected by exogenous policy movements. This chapter followed **Ball (1994)** in calculating the disinflation episodes, the sacrifice ratio for each disinflation episode is calculated in each country and here one more thing also observed that is changes in the sacrifice ratio based on the duration of the disinflation. According to Romer and Ball the output loss is more if the disinflation period is long. **Gordon and Stephen (1982)** studied that multiple episodes also causes high output loss.

Husek and Formanek (2005) estimated the sacrifice ratio in Czech Republic economy and found that the sacrifice coefficient has a relatively low absolute value. **Daniels et.al (2005)** documented the positive effect of openness on the sacrifice ratio and also relation between central bank independence and openness. Their study found that greater openness reduces the central bank independence on sacrifice ratio**. Serju (2009)** also studied the output cost of disinflation in Caribbean states and found low sacrifice ratios to reduce inflation to single digits. **Denial and VanHoose (2010)** also found the conditional effect of exchange rates on sacrifice ratio. The effect of exchange rate directly influencing disinflation in short run was observed in Nigeria by **Adebiyi and Adebay (2011).**

From the above reviews we can observed that the sacrifice ratio was influenced by the degree of openness and the length of the disinflation periods and the degree of central bank independence. It was observed from the works of **Joseph P. Daniels et al., (2005)** that greater the central bank independence gives greater sacrifice ratio and greater openness reduces the central bank independence so sacrifice ratio will be low. **Ball (1994), Temple (1998)** reported the calculating methods of sacrifice ratio. Many studies was found in individual countries from Europe and Africa was, so it is very relevant to study the sacrifice ratio in a group of developing countries like BRICS, and it also found that very less studies were observed on the effects of exchange rate, forex reserves and trade openness on sacrifice ratio.

3. D.1.1 Trends of Economic Variables in BRICS Nations during the Sample Period (1998-2012):

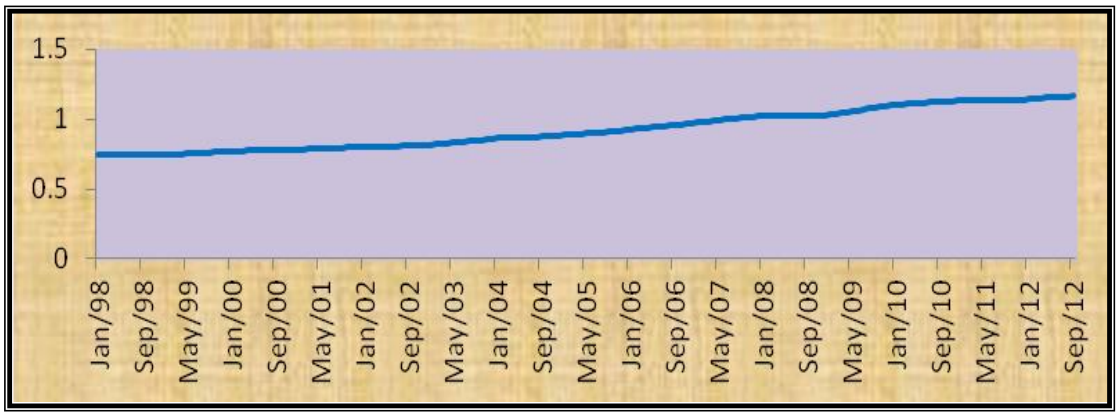
The summary of each country economy is written below to understand the economic strength of each country and to make note the important brake through events in the past. This section also describes the changing patterns of economic variable like GDP, International Trade, Trade Openness, Exchange Rate, Inflation and Forex Reserves country wise in this section.

a) Brazil:

Brazil is the fifth largest country in the world in terms of surface area and is blessed with abundant natural resources. It is the largest economy in the Latin America which has successfully come out of economic downthrown to stand as one of the fastest developing nation. Last two decades even in turbulent economic situations it was successfully maintained its economy. Over the sample period from 1998 to 2012, the GDP growth was steadily rising in this country expect there was a slight down fall in the GDP during the global financial crisis. By the end of 2012 Brazil GDP has crossed 1.2 trillion US dollars. Figure 1.9 shows the trend of GDP growth.

Figure: 3. D.1.2.1

Trends showing GDP (in Trillion US$)



Source : World Bank, 2013.

Though the trade liberalization initiated in 1994, the real trade has increases from 2003 onwards. There was an increase of 382 percent trade of Brazil with other nations in the BRICS group, in dollars it was $10.7 billion to $51.7 billion[90]. This internal trade within the group helped Brazil to boost its trade. From trading of raw materials and agricultural goods to manufacturing goods and identification of oil reserves helped the country to experience the boom in the international trade market. To setback the economy from the global financial crisis it restricted the trade, so we can observe the down fall of the international trade from above $35 million to below $20 billion and after the crisis it came back to normality. Greater the degree of trade openness greater is the international trade. Joining in the BRICS block is also an added advantage because of growing intra trade between these nations at a rapid face.

Figure: 3.D.1.2.2.

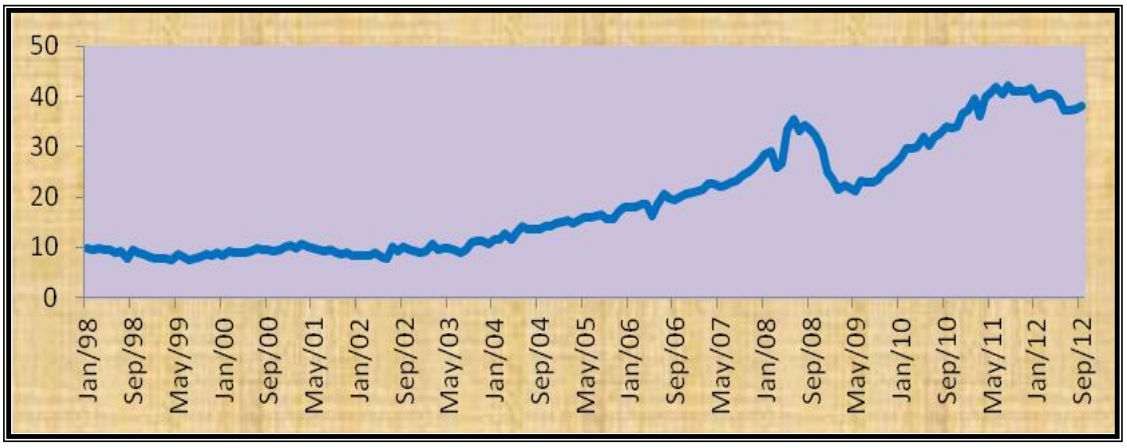
Trends of Trade Openness (in Billion US$)

Source: OEC),2013 (Export and Import) & World Bank,2013 (GDP) GDP converted in to monthly through intrapolate method.

[90] http://www.goldmansachs.com/our-thinking/

Figure: 3.D.1.2.3.

Trends of International Trade (in Million US$)



Source: Organization for European Economic Co-operation (OECD),2013.

Real is the Brazil's national curency used to exchange with US dollar in case of international payments. It was introduced in 1994 in Brazil. Exchange rates are used as an instrument by governmants to encourage investments in the nation or to controle the external infaltions.The value of real is devaluated in 2003 in order to encourage the investments in the country. Over the time period on an average of real was observed to one US dollar.

Figure: 3.D.1.2.4

Trends of Nominal Exchange Rate (Dollar= Brazilian Real)

Source: Federal Reserve,2013.

When the value of real was devaluated in 2003, there was an uncontroled inflow of investments which pushed the economy in to high infaltion state. It was observed more than 15 percent and it was the highest in the data period. The country has succesfully overcome this infaltion with the experience of controlling the high inflation

rate prior to the economic reforms in 1994. The succesfull monitoring of the economy is evident by observing low inflation rate even in the global economic crisis period. During the last decade the average inflation rate was below 5 percent. Graphial representaion of infaltion trend is given below in figure 1.13

Figure: 3.D.1.2.5

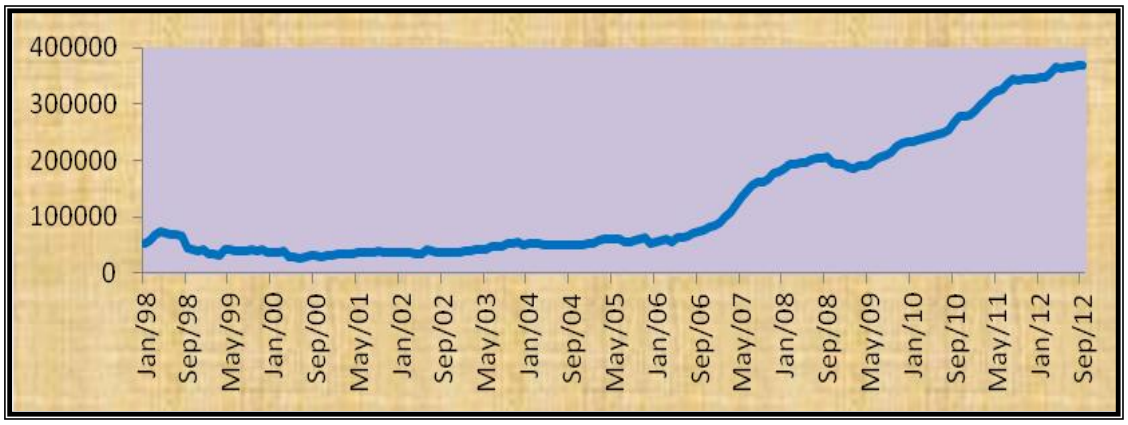
Trends of Inflation (Annually)

Source : World Bank, 2013.

Brazil's main economic policy in the 21st century is to accumlate the foregin reserves. since it opend up the economy to the interantional market, there was a high chance of external shocks so brazil making itself ready to withstand any kind of external shocks by accumulating the reserves. Starting with 50 million US dollars to nearly 400 million US dollars were accumulated in the past one and half decade. It was almost seven times increase in the time period. This is because of the expansion of trade with other BRICS nations from 2003 onwards. Figure.1.14 gives trends of the forex reserves during sample time period.

Figure: 3.D.1.2.6

Trends of Foreign Exchange Reserve (in Million US$)



Source: International Finanacial Statistics (IFS) April, 2013.

b) Russia:

Russia is the world's largest country in terms of surface area. After the collapse of Soviet Union in 1991, the Russian federation aimed to bring stable economic conditions through economic reforms. Since then in these two decades Russia went through many ups and downs in the economic growth. The Russian economy is mainly energy driven economy because of this in this period the economy was hit hard twice with a negative growth rate; one is in 1997-98 drop in oil prices and second was during 2008 global financial crisis. After 1998, the GDP was gradually increased over a decade of time then decreased in the 2008 crisis period and then again got stabilized and growing in a sustainable way to reach one trillion US dollar in GDP.

Figure: 3.D.1.2.7

Trends of Real GDP (in Trillion US$)

Source : World Bank,2013.

After the formation of Russian federation in 1991, the economy has undergone to many macro economic changes, systematically opend the economy to reap the benefit from the market forces. The degree of openess has increased troughout the time except during the global financial crisis period 2008.

Figure: 3.D.1.2.8

Trends of Trade Openness (in Billion US$)

Source: Organisation for European Economic Co-operation (OECD),2013 (Export and Import) & World Bank,2013 (GDP) GDP converted in to monthly through intrapolate method.

Figure: 3.D.1.2.9

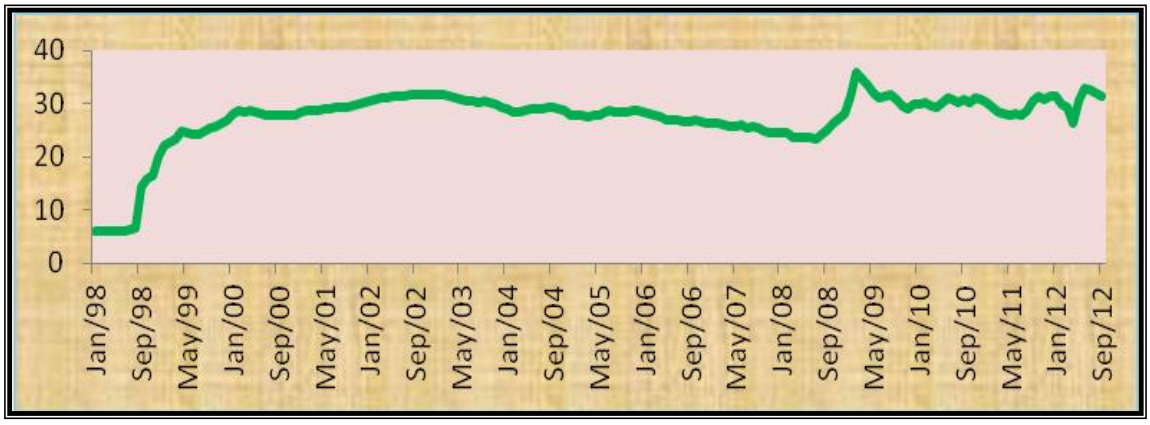
Russia international Trade (in Million US$)

Source: Organization for European Economic Co-operation (OECD),2013.

In 1995 an exchange rate corridor system was introduced, the debt crisis in 1998 triggered the government to go for a manged floating exchange rate system with that effect the value of rouble was dropped. In 2004 the country adopted capital controle regulations which helped in appriciation of Rouble. In 2005, russia operated the dual-currency basket (it was fixed at 55 percent for US dollars and 45 percent for Euro) to controle the volatality of rouble with other currency. The global financial crisis forced the exchange rate system towards moderating the depriciation of rouble. The bank of Russia further planing to bring greater flexibility in rouble exchange rate system.

Figure: 3.D.1.2.10

Trends of Nominal Exchange Rate (Dollar= Russian Ruble)

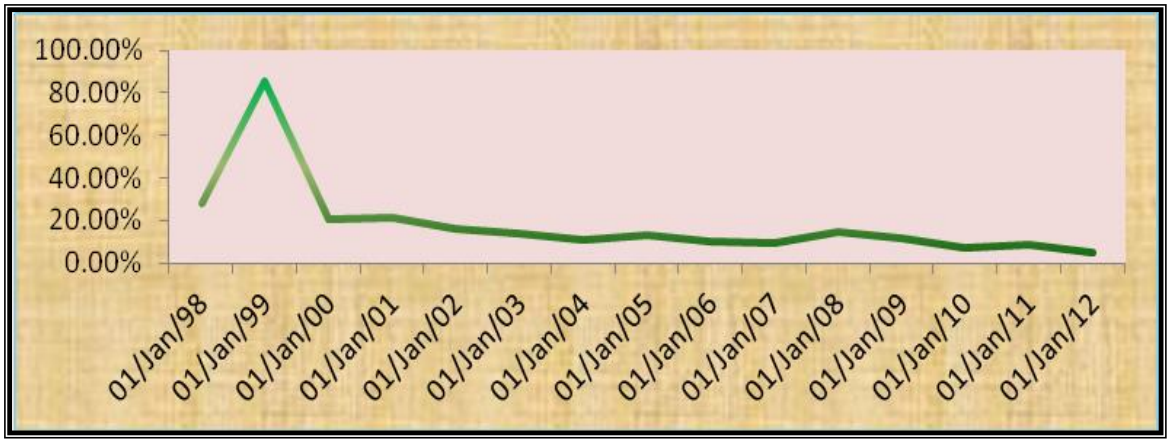


Source: Federal Reserve,2013.

The present inflation rate of Russia is 11.4 percent, the highest level since 2008 global financial crisis. The inflation in Russia is mainly associated with its oil export prices and its Rouble exchange rate. The period between 1992-1994 Russia undergone hyperinflations and later till 1998 it has undergone high inflation. The Asian crisis left Russia into a serious inflation which has crept up nearly 85%, the fall of demand for oil and internal political instability fueled the inflation rate. Russia has successfully able to control inflation only because of rise in oil prices worldwide and the help of World Bank and IMF. From then till 2008 the inflation rate was going down, the crisis brought more than 10% inflation.

Figure: 3. D.1.2.11

Trends of Inflation

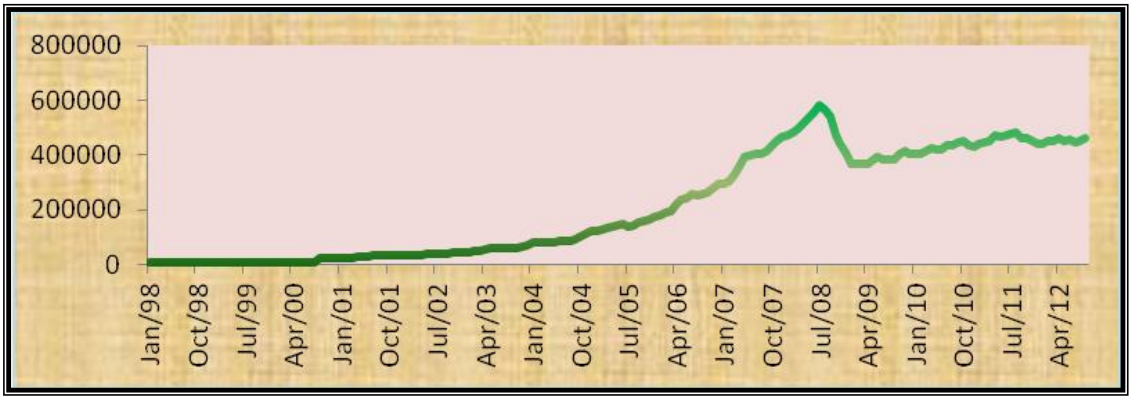


Source : World Bank, 2013.

After the formation of Russian federation in 1991, the country started to rebuild its economy. The country started accumulating the forex reserves from 1991, since then the first decade from 1991 to 2000 showed a very low accumulation of foreign exchange reserves nearly 25 million US dollars. The second decade from 2001 to 2010 there was an enormous growth in the reserves from $25 million to $445 million. In order to set back from global crisis, Russia utilized its reserve that can be observed in the graph below showing a decline in 2008.

Figure: 3. D.1.2.12

Trends of Foreign Exchange Reserve (in Million US$)



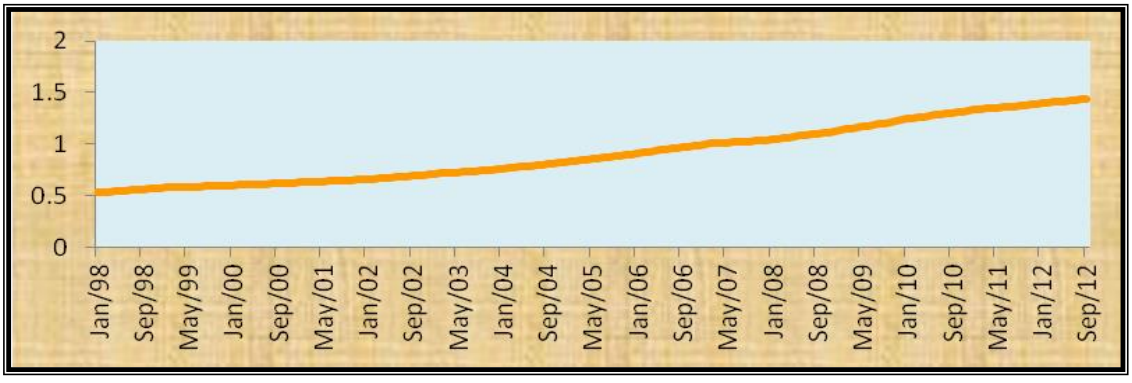
Source: International Finanacial Statistics (IFS) April, 2013.

c) India:

India was able to successfully develop its economy in a healthy position with the help of its five year planns. Though it faced difficulties in the first five year plans, it was able to improve economy through liberalisation. There was a slow down in the growth during the fincancial crisis. It has observed 9% growth rate annually in between 2005 and 2008.

Figure: 3. D.1.2.13

Trends of Real GDP (in Trillion US$)



Source : World Bank,2013.

The international trade was increased when India liberalized its trade in the direction of IMF in 1991, to overcome the reserves deficit caused by the fall of Soviet Union and gulf war. In the beginning the trade was limited to selected products and further liberalized in 2003 which has increased the international trade enormously. The trade restrictions during the financial crisis brought down the international trade and gradual rise was observed in later years.

Figure: 3. D.1.2.14

Trends of International Trade (in Million US$)

Source: Organisation for European Economic Co-operation (OECD), 2013.

Figure: 3. D.1.2.15

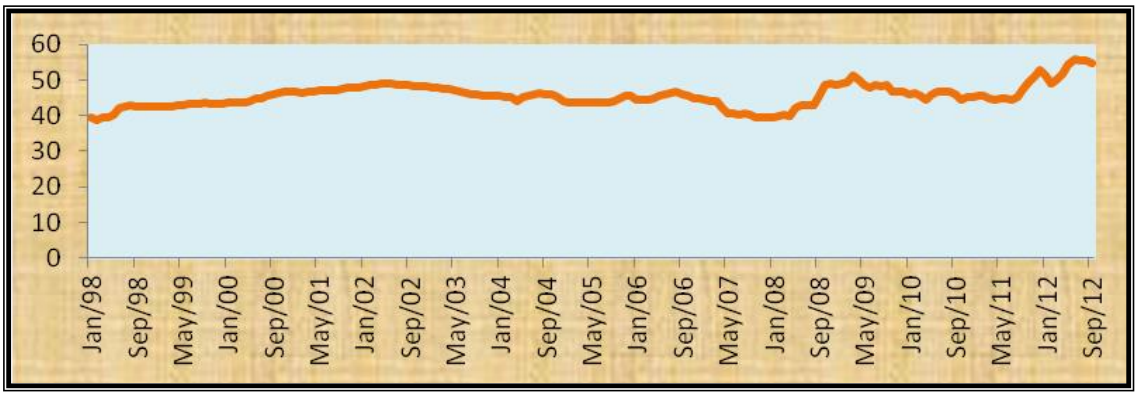
Trends of Trade Openness (in Billion US$)

Source: Organisation for European Economic Co-operation (OECD),2013 (Export and Import) & World Bank,2013 (GDP) GDP converted in to monthly through intrapolate method.

Indian exchange rate system has evolved over the time since 1991 liberalization. The current exchange rate system followed by India is managed floating with no

predetermined path for exchange rate to floating. Since 1993 india moved toward market determined exchange rate. The Indian rupee was generally depreciated with an exception in 2003-05 and 2007-8 the rupee value appreciated

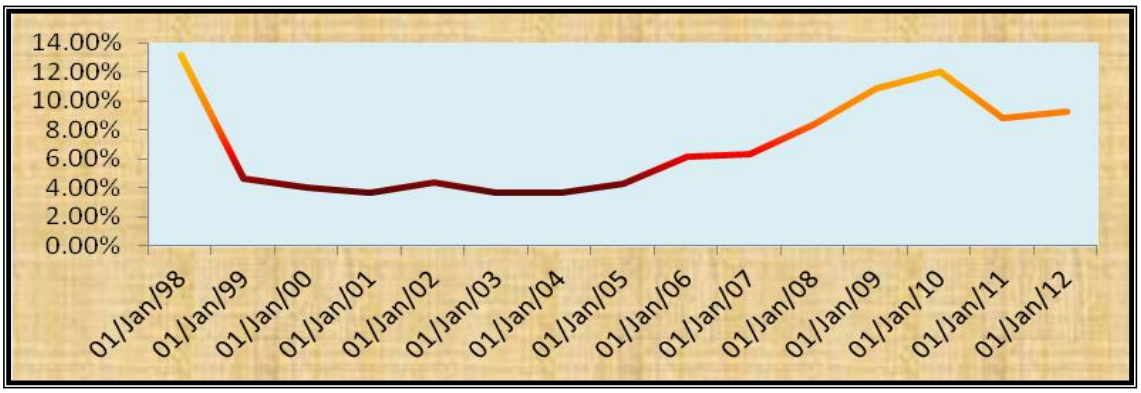
Figure: 3. D.1.2.16
Trends of Nominal Exchange Rate (Dollar- Indian Rupee)



Source: Federal Reserve, 2013.

India has good track record in successfully controlling and monitor the inflation. After the reforms in 1991 the inflation caused by the gulf war and fall of Soviet Union has controlled and again the global financial crisis brought high in the consequent years. The declining trend in average inflation was observed in between 1994 to 2005, it was due to structural changes in macroeconomic framework. The growth rate above 9 percent in 2005-2008 increased the per capital income of the individuals. This rise in per capital income raised aggregate demand which was mismatched with supply caused inflation.

Figure: 3. D.1.2.17
Trends of Inflation by Year



Source : World Bank, 2013.

Indain foreign exchange reserves were altime low in 1990 which forced the country to go for liberalisation, indian forced to accept IMF conditions to overcome the external depbt crisis. Sarting with $2.1 milions in 1990 to $ 38.4 millions by the end of 2000 gives a very low accumulation of reserves. After 2003, accumulation of reserves gained movement and steadyly raising even in crisis period it showed very low fluctuation and reached nearly $290 million.

Figure: 3. D.1.2.18

Trends of Foreign Exchange Reserve (in Million US$)

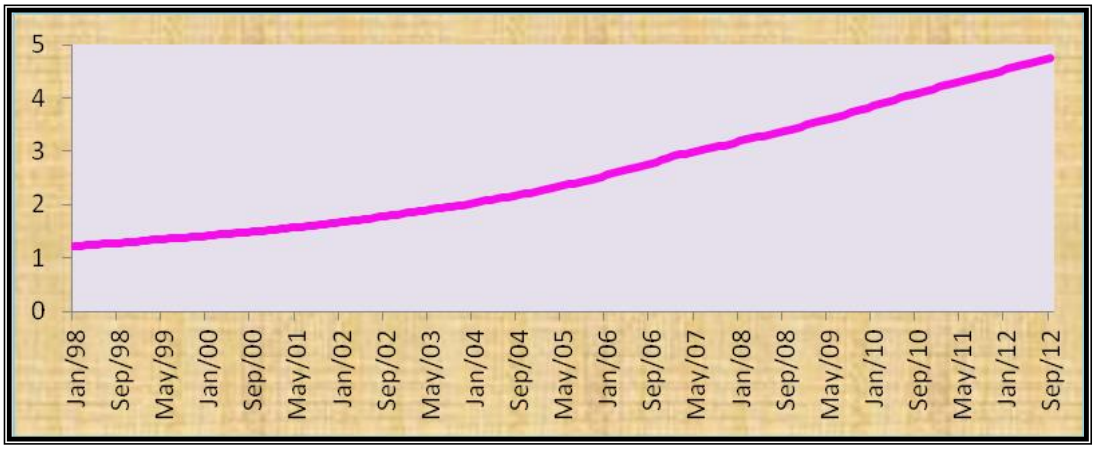
Source: International Finanacial Statistics (IFS) April, 2013.

d) China:

No doubt China is the fastest emerging economy in the world; it is going to overtake the US economy in future. Though the real GDP growth rate and foreign reserves are higher than the developing countries but per capital GDP is far behind of 80 countries and therefore china placed in the list of developing countries. According to World Bank estimation still 200 million people equals to Brazil population lives in poverty in China. So it shifted the policy from numbers to quality and set its GDP target a 15 years low of 7% growth.

Figure: 3. D.1.2.19

Trends of Real GDP (in Trillion US$)

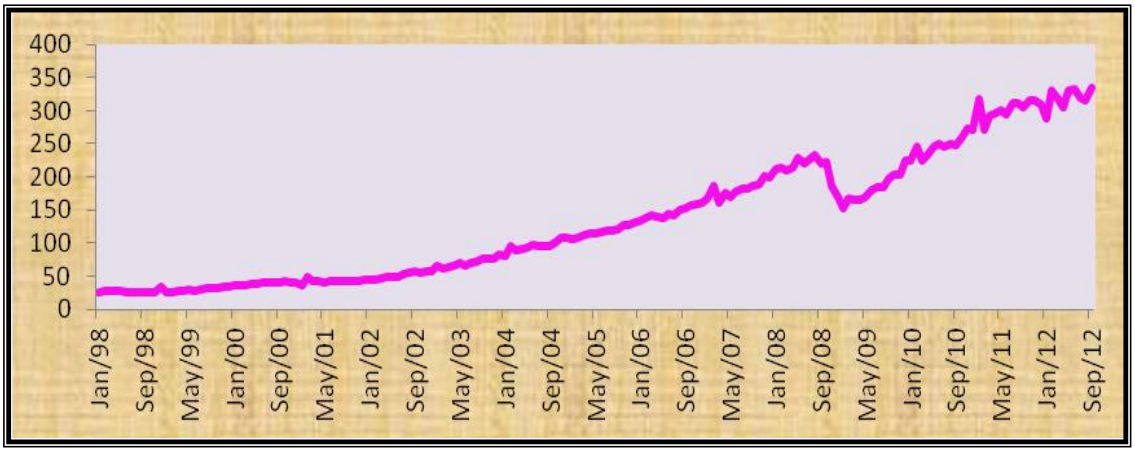


Source : World Bank,2013.

China has become the largest export in the world, and palying a major role in the global production. As a result of 1978 reforms changed the face of China economy. The trade growth was 13.5 percent between 1990-2000 and after entering into the WTO as 143rd member in the year 2001 the foreign trade has increased further rise to 16.2 percent by the end of 2007. It was slowdown in global recession time due to less demand from outside world. Again it has regained movemnt by devaluating the prices or curriencies.

Figure: 3. D.1.2.20

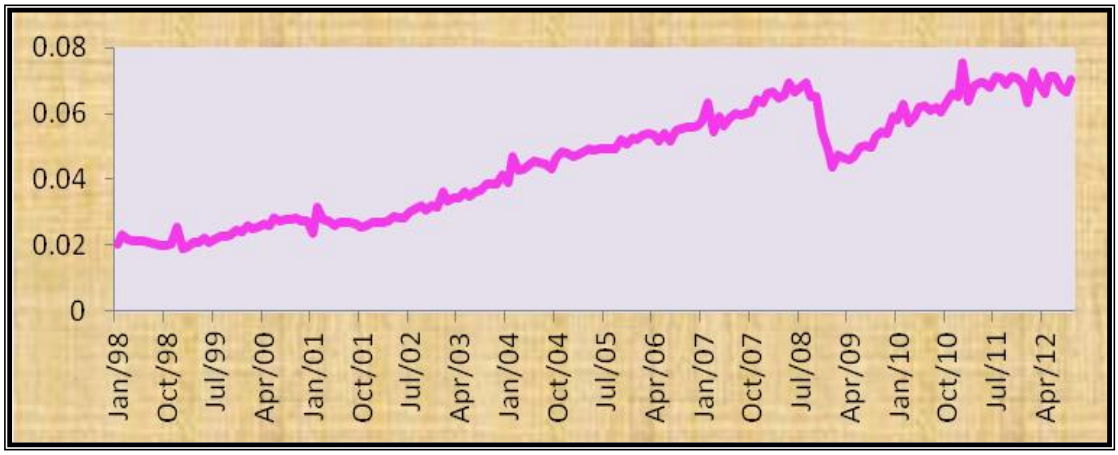
Trends of International Trade (in Million US$)



Source: Organisation for European Economic Co-operation (OECD,2013.

Figure: 3. D.1.2.21

Trends of Trade Openness (in Billion US$)

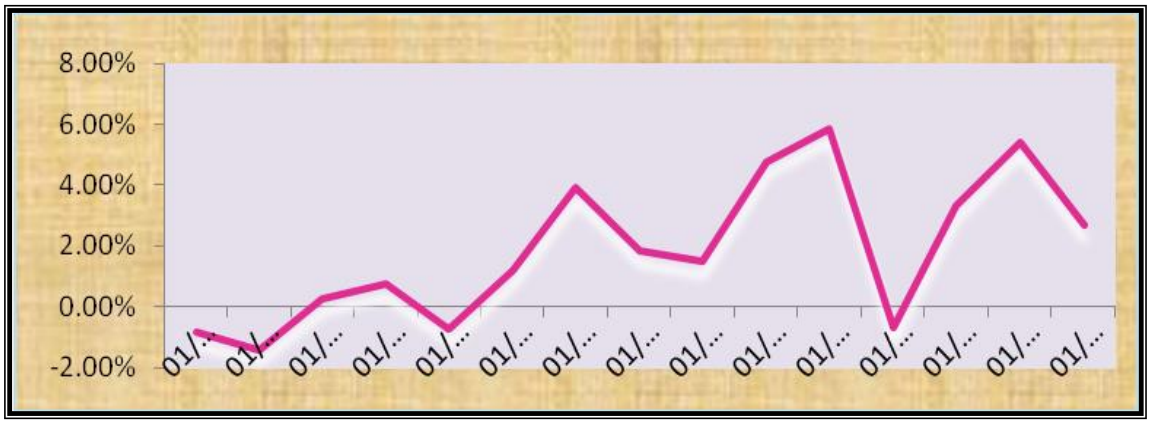


Source: OECD,2013 (Export and Import) & World Bank,2013 (GDP) GDP converted in to monthly through intrapolate method.

A remarkable disinfaltion has experianced by china in the last two decades. The inflation rate has gone upto 30% by the end of 1990 because of price liberalisation and devaluation of renminbi. After that china brought changes in the monetory policy to bring disinflation. Over all the inflation rate in the study period was under control.

Figure: 3. D.1.2.22

Trends of Inflation by Year



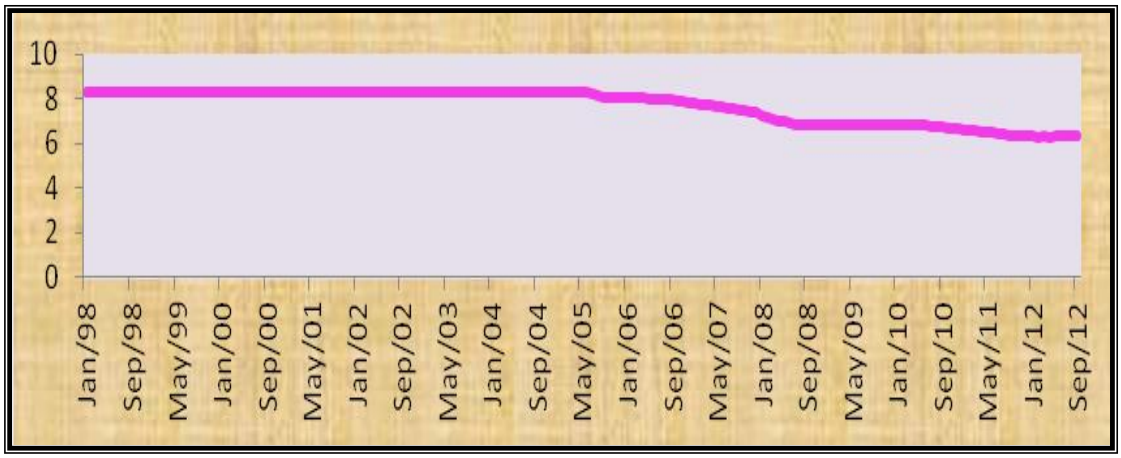
Source : World Bank, 2013.

China keep its exchange rate low in order to encourage its exports and then cheaper to the trading partners. From the Asian crisis in 1998 to mid of 2005, china fixed its currency Renminbi with the value of US dollar. Then it shifted to managed floating system, where the value of Renminbi gradually gained to the US dollar. After the financial crisis china again re-pegged its currency to the US dollar in order to protect

its exports. Again after 2010, China made flexible exchange rate which appreciating the value of Renminbi.

Figure: 3. D.1.2.23

Trends of Nominal Exchange Rate (Dollar= Chinese Yuan)

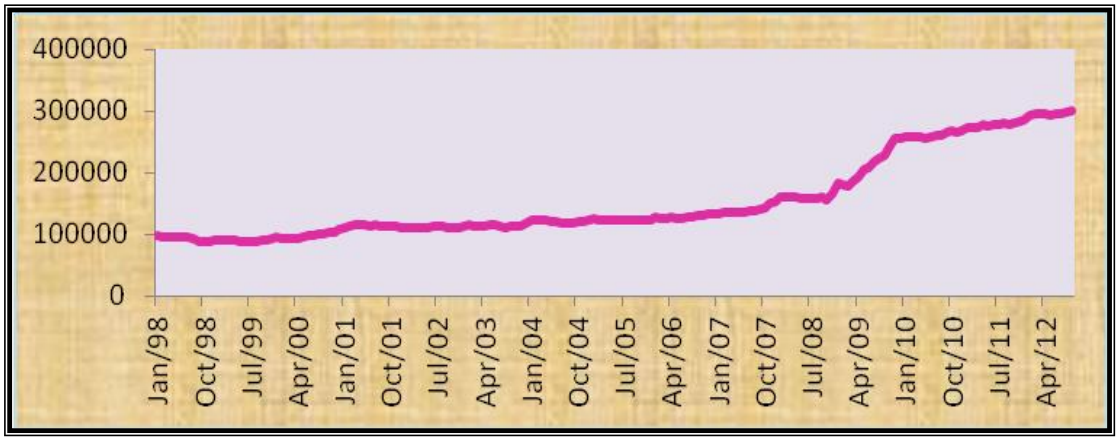


Source: Federal Reserve, 2013.

China is the largest nation with foreign exchange reserves, which has crossed $3 trillion in 2012. The reserves of china in 1998 is nearly 100 million US dollars and reached nearly 3000 million US dollars. A sharp rise in the reserves were observed during the crisis period nearly 500 million US dollors were accumulated in one year itself.

Figure: 3. D.1.2.24

Trends of Foreign Exchange Reserve (in Million US$)



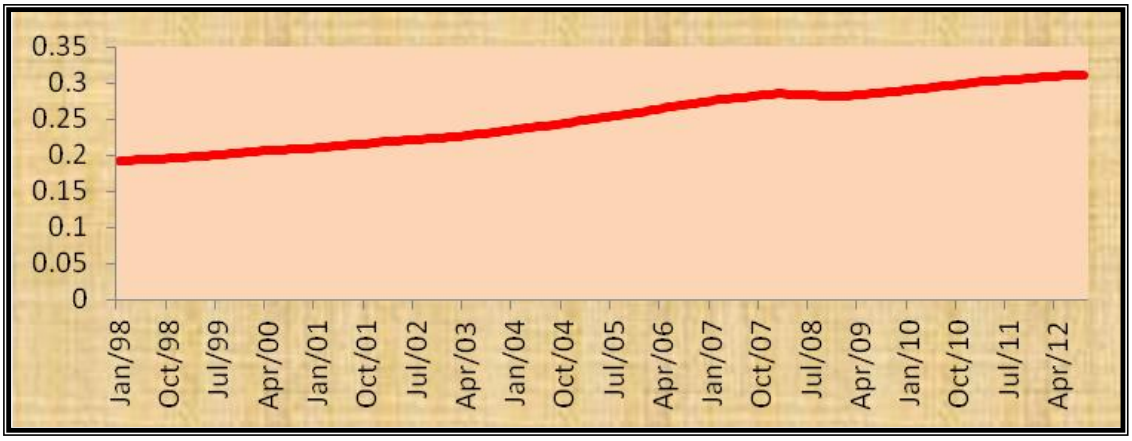
Source: International Finanacial Statistics (IFS) April, 2013.

e) South Africa:

South Africa is one of the largest economies after Nigeria in the African continent. Though South Africa is not in the original prediction of O'nile, it gives a geographical representation and perfectly fit in the catchy acronym. In future South Africa will act as regional center for BRICS bank. The GDP growth of South Africa is one of the consistent positive growths showed by any country. A period of 14 years of positive real GDP growth was observed with an exception of 2008 due to global financial crisis. At an annual growth rate of 5 percent was observed during the time period.

Figure: 3. D.1.2.25

Trends of Real GDP (in Trillion US$)



Source : World Bank, 2013.

In 1994 trade reforms were taken place in South Africa, which increased the trade volume of exports and imports. Till 1999 the growth of trade is slightly lower than the reforms but after that period it has gained the moments and from 2003 with improved terms of trade and picked up with the rise of precious metals. During the period between 2002 to 2007, the prices of exports have grown along with the export volume. The international trade growth is complimenting with the degree of openness and it showed to the international trade in the data period.

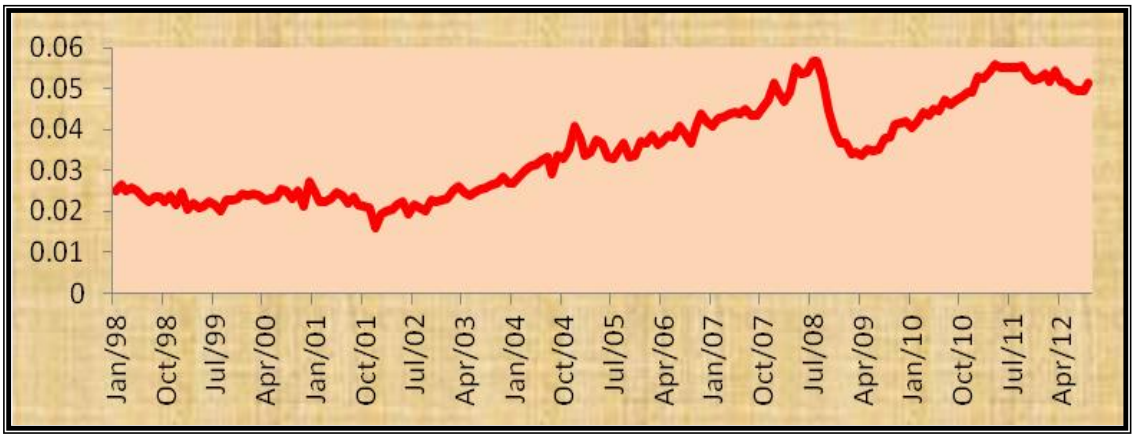
Figure: 3. D.1.2.26

Trends of International Trade (in Million US$)

Source: Organisation for European Economic Co-operation (OECD), 2013.

Figure: 3. D.1.2.27

Trends of Trade Openness (in Billion US$)



Source:OECD,2013 (Export and Import) & World Bank,2013 (GDP) GDP converted in to monthly through intrapolate method.

The growth employment and redistribution (GEAR) program in 1996 and Asian crisis in 1998 and global instability after the Asian crisis caused the depreciation of rand value in between 2000 to 2001. The global financial crisis also affected slightly the depreciation of the rand. The figure 1.36 shows the exchange rate of Rand.

Figure: 3. D.1.2.28

Trends of Nominal Exchange Rate (Dollar= Rand)

Source: Federal Reserve, 2013.

In 2002 inflation targeting strategy was implemented and it brought back to the stability in economy and Asia program was launched in 2006 which included infrastructure development it raised the inflation rate slowly and it was fuelled by global financial crisis and it leads to 12 percent inflation rate was observed during 2008. Later it was controlled by good monitory policies.

Figure: 3. D.1.2.29

Trends of Inflation by Year

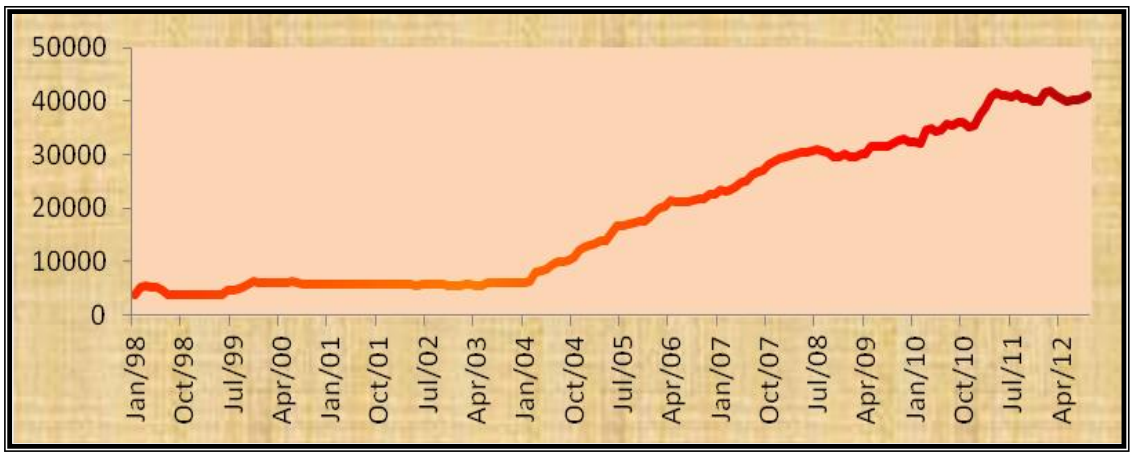
Source : World Bank, 2013.

Among the BRICS nations South Africa is the only country with low foreign exchange reserves, but it observed continuous growth throughout the last two decades. This is mainly inflow of investment into the country and also joining hands with BRIC nations increased its trade relations among the group members. At present the reserves

of the South Africa is nearly 45 million US dollars. Figure 1.38 shows the changing trends of South African forex reserves during the sample period (1998 to 2012).

Figure: 3. D.1.2.30

Trends of Foreign Exchange Reserve (in Million US$)



Source:International Finanacial Statistics (IFS) April, 2013.

Provided with lots of facts and figures in the economic changes in the BRICS nations it is understood that the BRICS nations are playinjg a key role in boosting the global economy, it also observed the importance of some macro economic variables which played a crucial role in the economic structure of all nation from time to time. The significant role played by the exchange rate system, forex reserve and trade openness on the economy of the BRICS nations were also analysed and observed over the time period.

3. D.1.2 Exchange Rate, Forex Reserve and Trade Openness on Sacrifice ratio

Objective of the Study:

The objective is to examine the relationship of exchange rate intervention and trade openness on sacrifice ratio.

Hypotheses for Objective Four:

Null hypothesis ($H = 0$): There is no relationship of exchange rate intervention and trade openness with Sacrifice ratio.

Alterantive hypothesis($H \neq 0$): There is relationship of exchange rate intervention and trade openness with Sacrifice ratio.

These hypotheses are framed to know the influencing role of exchange rate intervention and trade openness with sacrifice ratio.

3. D.2 Data and Samples Description

To examine the relationship between exchange rate interventions, trade openness on sacrifice ratio based on time series data modelling, the study used fifteen years monthly data from January 1st 1998 to September 30st 2012 in BRICS countries (Brazil, Russia, India, China and South Africa). The required data set were selected from central banks of respective countries and also from various other sources. The dependent variable used in our study is sacrifice ratio. The sacrifice ratio is calculated on the basis of Ball (1994) method, where sacrifice ratio is actual output minus potential output divided by trend inflation. The actual output is taken as real GDP (from World Bank) available in yearly series, we have done interpolate of the series to convert it into monthly series because all other variables data periods follows monthly series. Further, the potential output is calculated on the basis of Hodrick–Prescott (HP) filter method. This data is also taken from the World Bank. Then the trend inflation is measured as average inflation, that means peak and through of inflation.

The inflation is calculated with the percentage of Consumer Price Index (CPI). That data is calculated from International Financial Statistics (IFS). Then calculating the sacrifice ratio, as a dependent variable and estimated other independent variables of exchange rate, forex reserve and trade openness. The data for exchange rate, forex reserve and trade openness is taken from Federal Reserve, International Financial Statistics (IFS) and Organization for Economic Co-Operation and Development (OECD) and World Bank respectively. Thus the study is very keen to address what is happening with the exchange rate, foreign exchange reserves and trade openness (export + import / GDP) on sacrifice ratio, which is the proxy for growth of economy.

3. D.3 Methodology

Among all macroeconomic variables inflation is the best indicator of how the economies moving towards achieve stable economic growth. There is a long time discussion that inflation restrains the economic growth of the country. There is an argument that in due course of reducing inflation huge output loss is there in terms of production or high recession in the disinflation period. Hence the policy makers considered the sacrifice ratio as a tool for reducing the output loss with high degree of control on the economy. All countries policy makers have their statement but all of them said have low inflation rate. The unexpected move on controlling inflation creates structural change in the system.

W. Phillips (1958)[91] studied UK's inflation and unemployment. His result showed trade off between inflation and output. We can write the basic Philips curve equation

$$Y^{a} - Y^{Po} = \alpha_0 + \alpha_1(\pi_t - \pi_{t-1}) + \nu_t \qquad \textbf{(3.D.1)}$$

Where Y^{a} and Y^{po} actual and potential output π_t and π_{t-1} actual and trend inflation. The cost of disinflation grows $\alpha_1 \phi 0$. This method has explained that the time bound, it calculated from the certain period of time there was trade of between the inflation and output. While use Phillps curve for estimating disinflation theer was flaw such the disinflation has explained that the time is not varying but recently calculated disinflation showed improvement by **Ball (1994).**

The first three objectives of the study describe the economy of group as a whole and describe how exchange rate intervention and trade openness influence share price movement, inflation and GDP by using panel data analysis in overall BRICS countries. The last objective was analysed by time series to know the individual results of each country economy rather than BRICS as a group. Hence, the fourth objective is to

[91] Phillips, A.W. (1958). The relationship between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957. *Economica 25* N.S., 283-299.

explain how far the combination of exchange rate intervention and trade openness shows influence on sacrifice ratio. In order to analyse this objective, we followed Ball (1994) approach.

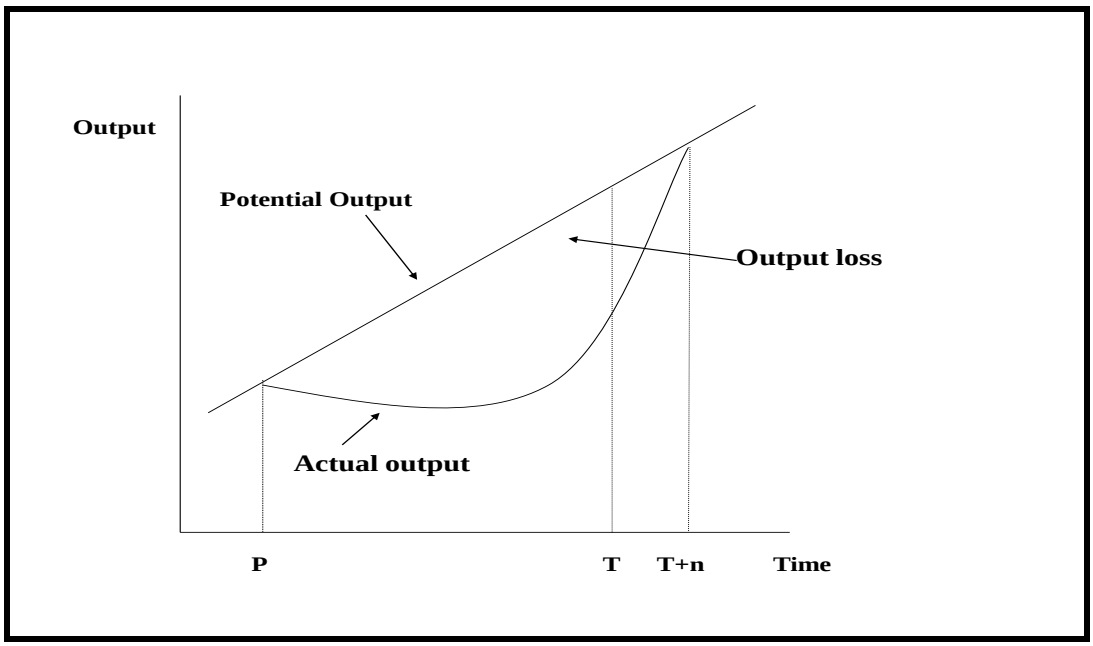
Ball (1994) suggested the procedure to measure the sacrifice ratio is output loss due to drop in inflation rate. Assumed that actual output is equal to the potential output if it is come under the equilibrium *(0)* otherwise disequilibrium. The countries monetary policy had tightened otherwise domestic economics affected by the external shocks.

The potential output has measured by using Hodrick–Prescott filter (H-P) from its actual output. Next, the trend inflation period is (t) the average inflation from $(t-n)$ through $(t+n)$ (*n=1* for the annual data, *n=4* for the quarterly data and *n=12* for the monthly data). Finds peaks and through from trend inflation data from $(t-n \quad to \quad t+n)$, centred nine quarter moving average follows log linear between the two points. The sacrifice ratio is calculated by output loss with trend inflation. We can see the following mathematical formula for computing sacrifice ratio.

$$SR = \frac{y^{a} - y^{po}}{\pi^{P} - \pi^{t}} \qquad \textbf{(3.D.2)}$$

Where y^{a} is the actual output, y^{po} is potential output; π^{p} is the trend inflation peak and π^{t} trend inflation through. Change in output corresponding the change in the trend inflation.

Figure 3.D.4.31
Ball's Method of Measuring Sacrifice Ratio.



3. D.4 Results and Discussions

The estimated results of each country are given bellow and each country has 177 monthly observations in the study period. The disinflation episodes are identified and mentioned the time period. The below table 3.D.4.1 gives the estimates of sacrifice ratio.

Table: Table: 3.D.4.1

Estimates of sacrifice ratios for Brazil

Disinflation Episodes	Start	End	Duration of Month	Inflation		Sacrifice ratio (AVG)
				Min:	Max:	
Episode 1	Aug- 1998	Oct -1999	15	2.08	17.07	-7.4259905
Episode 2	Dec - 2000	May -2001	6	1.55	2.52	0.0001169
Episode 3	Jan– 2002	Dec– 2002	12	2.54	7.98	-0.0005808
Episode 4	Apr– 2004	Jul– 2004	4	2.37	4.34	0.0005807
Episode 5	Nov- 2006	Apr- 2008	18	2.22	4.54	0.0008783
Episode 6	Dec- 2009	May – 2010	6	1.54	2.62	0.0024168
Episode 7	July- 2010	Dec- 2010	6	1.98	4.00	0.0009249
Total number of observations = 67						

In Brazil, out of 177 monthly observations in the time series data starting from 1998 to 2012, 67 disinflation observations were identified and it consists of seven disinflation episodes during the study period. The disinflation period lasts for five years

seven months. Out of the 7 disinflation episodes, episode one (17.07, August 1988 to October 1999) and episode three (7.98, January 2002 to December 2002) falls on high disinflation episodes. The duration wise episodes one, three and five lasts for one year and more, the least duration was observed in episode four (April- July, 2004).

All the episodes are identified when the inflation are above to the level of 1.50. (According to Ball (1994) the acceptable level of inflation is 1.50%) . When the inflation is increases the sacrifice ratio decreases and on the other hand inflation decreases, the sacrifice ratio increases (both the variables are inversely related). Accordingly the inflation increases the sacrifice ratio decreases as a result the output loss decreases. Thus during the period from August 1998 to October 1999 (episode one), January 2002 to December 2002 (episode three) Brazil country suffered heavy output loss when compared to other episodes because during this period the inflation level raises from 2.54 to 17.07 which is beyond the accepted level of 1.5 (Ball,1994). The average sacrifice ratio is also negative in these two episodes. This might happened when Russia has withdraw her currency from emerging markets, and the minimum inflation was observed in December 2009 to May 2010 (Episode 6) and the average sacrifice ratio is also high with 0.0024168 in this episode. This might be due to slashing interest rate by Central Bank to overcome the 2008–2009 economic crises (European economic crisis).

Table: 3.D.4.2

Estimates of sacrifice ratios for Russia

Disinflation Episodes	**Start**	**End**	**Duration of Month**	**Inflation**		**Sacrifice ratio (AVG)**
				Min:	**Max:**	
Episode 1	Feb – 1998	Nov – 1998	10	2.63	54.80	-0.00022135
Episode 2	May– 2000	Sep – 2000	5	1.58	2.32	0.00193705
Episode 3	Aug - 2004	Jan - 2005	6	1.76	2.92	-0.00051251
Episode 4	Dec – 2007	Dec – 2008	13	1.89	5.78	0.00314794
Episode 5	Oct- 2010	May – 2011	8	1.55	4.14	-7.66184005
Total number of observation = 42						

In Russia, out of 177 monthly observations, 42 disinflation observations are identified and separated into five disinflation episodes. The total disinflation period lasts for three years and six months. Out of the five disinflation episodes, episode one

(54.80, February 1998 to November 1998) falls a high disinflation. This may be because of currency crisis in that year, and the minimum inflation episode was observed in March 2010 to October 2010 (1.55). Among all five countries Russia has less number of disinflation episodes (five) covering a shorter period of 42 months. When compared to Brazil (seven episodes) the Russia is having lesser episodes (five). Only episode four lasts more than one year (Dec 2007 to Dec 2008) duration and episode two is very short with five months (May-Sep 2000). The average sacrifice ratios of episode one, three and five are negative with -0.000221, -0.000512 and -7.66184 respectively. Episode four is highly positive among all other episodes in average sacrifice ratio with 0.00314.

Table: 3.D.4.3

Estimates of sacrifice ratios for India

Disinflation Episodes	Start	End	Duration of Month	Inflation		Sacrifice ratio (AVG)
				Min:	Max:	
Episode 1	Feb – 1998	May – 1998	4	2.20	5.19	-0.00187032
Episode 2	Mar – 1999	Feb – 2000	12	4.48	43.65	0.00011287
Episode 3	Sep – 2000	Aug– 2001	12	1.60	10.24	-0.00013037
Episode 4	Jun - 2002	Sep - 2002	4	1.93	2.38	-0.00041656
Episode 5	Feb – 2003	Mar – 2003	2	1.81	2.21	0.00045912
Episode 6	Sep- 2003	Jan – 2004	5	1.92	6.58	-0.00056475
Episode 7	Mar – 2004	Aug – 2004	6	1.81	6.91	-0.00043532
Episode 8	Jan – 2005	Apr – 2005	4	2.48	4.48	0.00012411
Episode 9	Jun– 2005	May – 2006	12	1.92	7.06	0.00045835
Episode10	May- 2007	Apr- 2008	12	2.03	6.73	-0.00065425
Episode 11	Sep- 2008	Aug- 2009	12	1.54	6.19	-0.00077907
Episode12	Jun - 2011	Oct- 2011	5	1.82	3.26	-0.00014851
Total number of observation = 90						

In India 90 disinflation observations are identified during the study period. This consists of twelve disinflation episodes and it accounts for seven years five months. Out of the twelve disinflation episodes, episode two (43.65, March 1999 to February 2000)

falls on high disinflation episodes and the minimum inflation was observed in episode eleven (1.5, September 2008 to August 2009). Among all the five countries India has more number of episodes (twelve). There are five disinflation episodes with a period of 12 months. The positive average sacrifice ratio in episode two (0.00011287) indicates potential growth in that disinflation period and in episode eight also positive growth though disinflation. Episode five is very short for two months (Feb-March, 2003). Inflation was minimum in episode eleven with 1.54 and maximum in episode two with 43.65. The LPG policy introduced in 1998 is the main reason for the disinflations, which brought high investments to India and lead to exponential growth.

Table: 3.D.4.1

Estimates of sacrifice ratios for China

Disinflation Episodes	Start	End	Duration of Month	Inflation		Sacrifice ratio (AVG)
				Min:	Max:	
Episode 1	Dec- 1998	July.-1999	8	2.21	25.05	0.00022888
Episode 2	Feb- 2001	Jan- 2002	12	1.75	18.28	-4.69313005
Episode 3	Aug- 2002	Feb- 2003	7	1.95	6.39	-2.67885005
Episode 4	Mar- 2005	Mar- 2006	13	3.83	20.82	-0.00018875
Episode 5	May- 2006	Nov- 2007	19	4.52	25.12	0.00020470
Episode 6	July- 2009	May- 2011	23	2.07	67.25	4.89414200
Episode 7	Oct- 2011	Nov- 2011	2	2.94	3.01	-0.00124506
Total number of observations = 84						

In China out of 177 monthly observations in the time series data starting from 1998 to 2012, 84 disinflation observations were identified and this was more or less at par with Indian disinflation episodes. It consists of seven disinflation episodes during the study period. The total period of these seven disinflation episodes time period accounts for seven years. Out of seven disinflation episodes, episode six from July 2009 to May 2011 falls on high disinflation (67.25) and the minimum inflation was observed in episode two from February 2001 to January 2001 (1.75). Episodes two, four, five and six are observed more than 12 months of disinflation periods with 12, 13, 19 and 23 months respectively. Episode seven is with least disinflation period for two months

(Oct-Nov, 2011). The average sacrifice ratios are negative in episodes two, three, four and seven. The positive sacrifice ratios are observed in one, five and six episodes.

Table: 3.D.4.5

Estimates of sacrifice ratios for South Africa

Disinflation Episodes	Start	End	Duration of Month	Inflation		Sacrifice ratio (AVG)
				Min:	Max:	
Episode 1	Feb- 1998	July- 1998	6	3.26	5.18	0.00178888
Episode 2	Aug- 1999	July- 2000	12	2.35	14.54	0.00160788
Episode 3	Jun- 2001	Jun- 2002	13	1.70	10.72	0.00011016
Episode 4	Apr- 2003	Jun- 2003	3	3.28	14.35	-0.00027322
Episode 5	July- 2003	Nov- 2004	16	7.35	61.99	-7.90221200
Episode 6	Feb- 2005	Apr- 2005	3	2.64	4.70	-0.00118406
Episode 7	July- 2005	Jan - 2008	30	2.36	6.56	0.0006616
Episode 8	Aug- 2010	Jun- 2011	11	2.78	5.40	0.00031584
Total number of observations = 94						

In South Africa, there are 94 disinflation observations were identified and it consists of eight disinflation episodes during the study period. The total disinflation time period accounts for seven years ten months. Among the BRICS countries, South Africa has longest disinflation episode that was episode seven from July 2005 to Jan 2008. Out of the eight disinflation episodes, episode five (July 2003 to November 2004) falls on high disinflation, this is because the value of Rand depreciated during 2001 to 2003 and the banks started to accumulate the reserves by buying foreign exchange reserves on a spot basis. The maximum inflation was observed in episode five (July 2003- Nov 2004) with 61.99 and the minimum inflation of 1.70 was observed in episode three (June 2001 to June 2002).

The South Africa output growth of the economy was raised steadily from 1994 to an average of 3.0 per cent till 2003 and this growth was maintained at an average of 5.1 per cent in the next four years that is from 2004 to 2007. The new monetary policy

was announced in 2000 which catalyzed inflation at low level. Geo political ties with china helped the nation to gain stronger currency.

Ordinary Least Square method:

To analyse the influence of exchange rate intervention (exchange rate and forex reserves) and trade openness on sacrifice ratio the study used ordinary least square method. For that purpose below equation is framed.

$$sr_t = \beta_0 + \beta_1 ex_t + \beta_2 res_t + \beta_3 to_t + v_t \qquad \textbf{(3.D.3)}$$

Where $\beta_0, \beta_1, \beta_2$ *and* β_4 are parameters, then sr_t is sacrifice ratio, ex_t is exchange rate, res_t foreign exchange reserves and to_t trade openness. This helps in estimating the relationship between the sacrifice ratio and exchange rate, foreign exchange reserves and trade openness. The results table is plotted below and it explains mixed relationship among the variables.

Table: 3.D.4.6

Results of Ordinary Least Square for BRICS Nations

Coefficients	**Brazil**	**Russia**	**India**	**China**	**South Africa**
β_0	0.09 (0.01)	0.17 (0.01)	0.02 (0.17)	0.04(0.00)	0.01 (0.00)
β_1	0.01 (0.02)	-0.01(0.00)	-0.01 (0.04)	-0.02 (0.00)	0.02 (0.01)
β_2	0.02 (0.00)	-0.01 (0.69)	0.08(0.03)	-0.004(0.00)	-0.05 (0.00)
β_3	-0.79 (0.01)	0.27 (0.08)	-0.07 (0.00)	0.004(0.09)	0.22 (0.00)
AR	AR(15) -0.56 (0.00)	AR (13) -0.09 (0.40)	AR(10) -0.22 (0.05)	AR(10) -0.41 (0.02)	-
MA	MA(15) 0.90 (0.00)	-	-	-	-
R^2	0.71	0.66	0.22	0.14	0.36
F – Stat	26.19 (0.00)	4.11 (0.00)	9.25 (0.00)	5.02 (0.00)	17.73 (0.00)

In the above Table 6 Column 2 gives the OLS result of variables in Brazil. The dependent variable sacrifice ratio establishes a positive relationship with two independent variables exchange rate and foreign exchange reserves. It also established

a negative relation with other independent variable trade openness. When countries trade is open to the international markets, more imports and exports will take place. The country has to pay more from its reserves to the imports made when the currency value is depreciated to attract more investments. The magnitude of exchange rate is one percent (1%), forex reserves are two per cent (2%) and trade openness showed that -79 per cent. AR (15) -0.56 and MA (15) 0.90 it is shows that significance at 1 percent level. $\overline{R}^2$ Shows that 71 percent variation was explained by the independent variables and overall statistics F-values showed that significance.

In column 3 Russia's results explains that sacrifice ratio shows a negative relationship with exchange rate, forex reserves and positive relationship with trade openness. The magnitude of exchange rate is -1 per cent, foreign exchange reserves -1 per cent with trade openness 27 percent, which implies that exchange rate appreciation helps in accumulating the foreign exchange reserves, and trade openness shows a positive which means it help the nation to maintain good sacrifice ratio. Whereas AR (13) -0.09 gives significance. $\overline{R}^2$ Showed 66 percent variation among variables and overall F- statistics values showed significance.

In column 4 showed India's results, in this sacrifice ratio establishes negative relationship with exchange rate, trade openness and establishes a positive relation with foreign exchange reserves. The magnitude of exchange rate is -1 per cent, foreign exchange reserves 8 per cent with trade openness -7 per cent, Whereas AR(10) -0.22 (0.05) and $\overline{R}^2$ Showed that 22 percent variation among variables and overall F-statistics values shows significance.

The OLS results of China is given in column 5 of the table, and the results explains that sacrifice ratio shows a negative relationship with exchange rate, forex reserves and positive relationship with trade openness. The magnitude of exchange rate is -2 per cent, foreign exchange reserves is -0.4 per cent and trade openness is 0.4 per cent, which monetary policies and fixed exchange rate helps in accumulating the foreign exchange reserves, and trade openness shows a positive which means it help the nation to maintain good sacrifice ratio. Whereas AR (13) -0.41 but It shows significance. $\overline{R}^2$ Showed 14 per cent variation among variables and overall F- statistics values showed significance.

The last column shows the result of South Africa and it establishes a positive relationship between dependent variable sacrifice ratio and other two independent variables that are exchange rate and trade openness; this dependent variable also establishes a negative relationship with forex reserves. The magnitude of exchange rate is two per cent (2%), foreign exchange reserves is -5 per cent and trade openness is 22 per cent, $\overline{R}^2$ showed that 36 percent variation among variables and overall F- statistics values showed significance.

Country wise Findings:

Brazil:

In Brazil, the increased exchange rate (depreciation of domestic currency) positively associated (CV 0.01, $p<0.05$) with sacrifice ratio. From the data we observed an increase in exchange rate in 2002-2003, this is due to change in government and its new economic policy to control inflation and stabilize exchange rates. The government has increased interest rates, tighten fiscal policy, foreign capital returned in 2003. To reduce the inflation, the Brazil has gone for devaluation of its currency in 2002. This was very helpful to strengthen Brazil's balance of payment to overcome the crisis in 2002. The exchange rates were high when Brazil devaluated its currency in 2002, which increased the output losses and pushed the increased sacrifice ratio (output inflation tradeoff) and in 2008 Brazil used reserves to control the inflation which reduces the output losses and sacrifice ratio.

The forex reserves is also positively associated with sacrifice ratio (CV 0.02, $p<0.01$). In general the reserves are used to reducing the output losses caused by inflation but in Brazil till 2008 recession the reserves are accumulate and inflation is controlled through tightening fiscal, monitory policy, exports are restricted in the disinflation episode period to control the inflation. But to overcome the 2008 economic slowdown Brazil used its reserves to overcome the inflation, in that period the sacrifice ratio has increased. So the increase in reserves leads to increase in sacrifice ratio and vice-versa.

The trade openness in Brazil shows high negative beta coefficient and highly significant (CV -0.79, $p<0.01$) with sacrifice ratio. When there is one unit increase in trade openness, there is -0.79 units decrease in sacrifice ratio. After 1998 Brazil shifted

to the floating exchange rate system, which encouraged the country to be more open to the international trade. Greater trade openness brings high inflation, when the rate of inflation was high the sacrifice ratio also lower.

Over all the Brazil data shows that, the country started more open to the international trade from 1998 as a result inflation was increase. Further, it has changed from pegged exchange rate system to floating exchange rate system and started accumulating reserves. It is observed that whenever the exchange rate and forex reserves are increasing the sacrifice ratio also increasing, and when inflation is high due to trade openness and the sacrifice ratios decreasing.

Russia:

The exchange rate shows negative (CV -0.07) and low beta coefficient ($p<0.01$) with sacrifice ratio. For every one unit increase in exchange rate (appreciation of Russian Ruble), the sacrifice ratio decreases by 0.07 units. In Russia more importing firms benefitted than exporting firms and try to increase the growth potential and as a result inflation increases. (The forex reserve ($p>0.10$) and trade openness ($p>0.05$) are not influencing with sacrifice ratio)**.** The data explicit that the reserves (CV =0.01, $p>0.10$) and trade openness (CV 0.13, $p>0.05$) are not influencing the sacrifice ratio. The reason for negative influence of exchange rate and no influence of forex reserves on sacrifice ratio due to the Russian bank frequently intervene and make corrections in the exchange rate and the inflation is controlled through internal measures like increase in the interest rates by Russian bank.

India:

The exchange rate shows negative (CV -0.01, $p<0.05$) relationship with sacrifice ratio. When every one unit increase in exchange rate, the sacrifice ratio decrease by 0.01 that means when exchange rate increases, the general price levels will rise, and there will be possibility of inflation. Then the theory will apply high inflation with low sacrifice ratio (an inverse relationship).

The forex reserve is positively (CV 0.01, $p<0.05$) associated with sacrifice ratio, countries with high reserves can overcome the sudden fluctuations in economy. Most of the economic disturbances in India are caused due to external factors, so these external shocks are controlled through the reserves. In India internal monetary policy is very effective to control the inflation so the increase in the forex reserves increases the sacrifice ratio.

The trade openness and sacrifice ratio shows a negative (CV -0.07) relationship with high significant ($p<0.01$). In India more number of importing firms was benefitted and improved their growth potentials and tries to increase the international trade as a result inflation increases and sacrifice ratio reduces. (Inverse relationship of inflation and sacrifice ratio).

China:

The exchange rate shows negative sign (CV -0.01) and low beta coefficient ($p<0.01$) with sacrifice ratio. Because China was using fixed exchange rate system and with a strong export market. The country stabilizes the inflations by reducing output cost (that shows low sacrifice ratio). The forex reserves also shows negative (CV -0.04, $p<0.01$) sign with sacrifice ratio. Because the Chinese government did not depend on the forex reserves and they continued to be fixed exchange rate system even in the inflation periods. They used the inflation for its growth; through exports they were able to manage the low output loss which gives low sacrifice ratio. To overcome the 2008 economic slowdown, the Chinese government implemented a large economic stimulus package and an expansive monetary policy. These measures boosted domestic investment and consumption and helped prevent a sharp economic slowdown in China.

Trade openness is not influencing (CV 0.03, $p<0.10$) the sacrificing ratio, since China is self sufficient to overcome any financial turbulences. Chinese economy mostly depends on the export and the country is having sufficient reserves and savings to overcome any external shocks.

South Africa:

The exchange rate shows a high positive sign (CV=0.02, $p<0.01$), with low beta value. This is because the main target of monitory policy of South Africa was to reduce inflation. The increased exchange rate allowed extensive capital inflow in to the country. The increase in exchange rate, depreciate the value of Rand which leads to high output cost.

The forex reserves are negatively (CV -0.05, $p<0.01$) influencing the sacrifice ratio, the time period between 2003 and 2005. There is huge accumulation of foreign reserves in South Africa, but the sacrifice ratio is low in that period, the internal fiscal policy and underperforming of countries exports against global trend forced to increase the output cost of production so the sacrifice ratio is gone to negative.

The trade openness in South Africa showed highly positive beta coefficient and highly significant (CV 0.22, $p<0.01$) with sacrifice ratio. The trade openness brought high capital inflows over the time period in South Africa, which brought the frequent inflations, along with the increasing unemployment and underperformance of exports forced the country to take more disinflationary measure, so the sacrifice ratio is high in the stipulated time period in South Africa.

3. D.5 Conclusion:

This part of study examined the relationship between exchange rate intervention and trade openness on sacrifice ratio in BRICS group of nations in the data period from January 1998 to September 2012. We have calculated sacrifice ratio and OLS model. The results found that when foreign exchange rate get depreciation then foreign exchange reserves would be decay because trade openness showed Positive (negative) sign. Which implies the country could accumulate more foreign exchange reserves, which can help sustaining economic growth and resist inflation. In addition reduce unemployment it could be sustain nominal income and real income. Further these developing economies which are open to international trade are frequently affected by the inflations, so it is necessary to take measures to control the inflation and the sacrifice ratio is used as disinflationary process. The study gives an important insight on the sacrifice ratio of BRICS nations. In the study period all BRICS nations observed high inflation and low sacrifice ratio in 1998-2000. Because all these countries changes their economic system and made liberal policies in order to overcome inflation caused by series of crisis around the globe (example: Asian crisis, Russian currency crisis etc) and during the economic slowdown in 2008-2010 all BRICS nations are taken very long disinflation period which gave high sacrifice ratio.

CHAPTER FOUR

SUMMARY, FINDINGS AND CONCLUSION OF THE STUDY

CHAPTER STRUCTURE

4.1 SUMMARY

4.1.1 Introduction

The emergence of "BRICS"- Brazil, Russia, India, China and South Africa, as a force to reckon in the global economy is of no surprise given the massive economic and demographic size of these countries. The BRICS have already become a brand and an attractive destination for the investors around the globe. The prediction of Jim O'Neill – the emergence and reign of BRICS- in 2001 has come true and has made every nation to look into the present reality.

The BRICS represents about 40 percent of the world population; encompass over 25 percent of the worlds land coverage and comprise huge natural resources. Starting with a share of a little over 10 percent in world Gross Domestic Product (GDP) and less than 4 percent in world trade in 1990, BRICS (with the recent inclusion of South Africa to the forum) now constitutes about 25 percent of world GDP in terms of PPP(Purchasing Power Parity), and 15 percent of world trade. The increase in GDP implies that the economic size of BRICS in terms of its share in world GDP has expanded by 150 percent in the past two decades, and they also estimated that the GDP of these countries may cross 47 percent of the world GDP, and will emerge as strong economic power in the world, and they contribute one fifth of the global economic output. Inter-trade between these countries growing by 30 percent per year, this is the key view, it's the biggest economy in the world if these countries start to implement a closed inter trading system among themselves.

At present the economy of each and every country is trapped in interdependent global economic web. They are mutually dependent on the other in imports, exports, fiscal and monitory stability. This has brought great challenges as well as opportunities to the emerging economies. The challenge for each of them is to cushion themselves from any turmoil in the global economy, and not only sustain but also rise as the new engines of global growth and development. This will make the BRICS the critical sutures in the global economic web- bustling, beaming and beeping their economic prowess.

Such a role makes trade openness imperative and with which comes the higher risk of importing inflation. Timely and calibrated intervention by the central banks is the common recourse for correction in such situations, but that requires sufficient

FOREX reserves. According to **Axel Dreher, Roland Vaubel (2009)**, more open countries are expected to hold more reserves as they are more vulnerable to external shocks. That means if there is high changes in exchange rate, the reserves level are likely to be volatile, which leads the countries to accumulate more reserves. To correct this volatility in exchange rates the central banks intervene by selling the foreign currency accumulated by it or the central banks opt for other monetary policy measures such as regulation of external commercial borrowings to spike or control the capital inflows to the country. **Roland Vaubel (1991, 2005)** also pointed that exchange rate intervention can be used to reduce the volatility in exchange rate. There are many other broad macro economic variables that also play a key role in a country's economic development, but the variables of exchange rate, trade openness, share price movement and inflation undoubtedly are of overwhelming importance especially in a intricately interconnected global economic web where Forex shows the strength, trade shows the openness, inflation the maturity, and share prices the pulse of the economy. This study therefore focuses on the role of exchange rate intervention (Exchange rate and Forex reserves) and trade openness on the economy of BRICS countries, and the share price movement, inflation, GDP and sacrifice ratios are considered as proxy variables to see the growth of economy of BRICS nations.

Specific reason and justification for the study are listed out below:

1. Recently the IMF announced that there is a slight downgrade in the economic growth of BRICS countries when compared with the expected global economic growth. As these five countries together account around 25 percent of world GDP, the study is very relevant in the global economic market.

2. In this present global economic condition, the developing countries are forced to open their economy to the outside world. This brings high interdependence between the countries. And they are highly dependent on exchange rate, forex reserve and the international trade.

3. After the failure of Bretton Wood fixed exchange rate system, the economists trying to find the relationship between exchange rate fluctuations and trade openness and in addition to this the role of Forex reserves also important in the developing countries, in particular the BRICS nations. So it is very relevant to

study the relationship between these variables and their impact on economy of BRICS countries.

4. The abnormal fluctuations in exchange rate are generally controlled by the central bank through exchange rate intervention for stable economic conditions. As the exchange rate intervention requires these two key variables, exchange rate and forex reserve, it is important to study on this system.

5. All these developing countries to some extent depend on the outside world, in order to fulfill the social needs, infrastructure development and the demand for goods and services of people. These countries need huge investments to develop the economic and social conditions of the nation. In this process they undergo changes like high openness, greater fluctuations in exchange rate, inflations, forex reserves, share price movements etc. So to understand one country economic system we need to know the behaviour of variables such as share price, inflation, GDP and sacrifice ratio, which are proxy to the economy.

6. In a developing economy the investments inflows takes place through investment in share of the firms in host countries share market. The more the value of share price, the more will be the GDP. The frequent fluctuation in the stock price which is highly connected to outside world brings a challenge to stabilize the share prices for a better economic progress. It gives a greater relevance in this economic block.

7. The open economy of the countries faces frequent fluctuations in the exchange rate, which shows an impact on share price. So it is necessary to study the relation between these two in order to be maintained a stable economic environment in the country.

8. As BRICS countries are open to the international trade, there is a high chance of getting frequently affected by the inflations. So in order to find the variables like exchange rate, forex reserve and trade openness in controlling inflation is a highly important to understand the economy of BRICS nations.

9. GDP is highly important variable to understand the economic condition of any nation. The BRICS group got such importance because of its stable growth rate

in its GDP. It is mutually interdependent with other macro and micro economic variables. So to study the overall economy of the country is GDP it is necessary to know the behavior of other variables over a long time period.

10. At this juncture it is very important and relevant to know each and every country of the BRICS how they are following disinflationary practices and find out the role of sacrifice ratio in controlling the inflation.

These are the main justification for a research in the area of exchange rate intervention and trade openness on the economy of BRICS countries

4.1.2 Statement of the Problem and Research Questions

In this globalized world, the economy of each country is depends on one another, the failure of one country economic planning is affecting other countries economy. The key macroeconomic variable which plays a great role in shaping the economic development of the nation are need to be concentrated while framing the monetary policy of nations. Most of the economic slowdowns in the world are due to failure in monitoring theses important variables. The recent economic slowdown in 2008 affected almost all countries in the world but the BRICS block surprised the world by overcoming the economic slowdown at that instance but after two, three years the GDP growth rate was started declining. The problems are to identify and see the relationship between the major economic variables and its impact on GDP of the nations.

The research question is how these macroeconomic variables (exchange rate, forex reserve and trade openness related to the economy of BRICS countries (share price, inflation, GDP and sacrifice ratio).

4.1.3 Objectives of the Study

In order to address the above mentioned research issues the present study focuses on the following specific objectives.

1. To study the exchange rate intervention and trade openness on share price movements.

2. To evaluate the impact of exchange rate intervention and trade openness on inflation.

3. To evaluate the long term relationship between exchange rate intervention and trade openness with GDP.

4. To examine the exchange rate intervention and trade openness on sacrifice ratio.

4.1.4 Hypotheses of the Study

From the research questions and followed by objectives, the following research hypotheses were developed and tested as alternative form.

1. **Ha1:**The exchange rate intervention and trade openness affect the share price movements

2. **Ha2:** The exchange rate intervention and trade openness have any impact on inflation.
3. **Ha3:** There is a long term relationship between exchange rate intervention and trade openness with output
4. **Ha4:** There is a relationship of exchange rate intervention and trade openness with sacrifice ratio.

4.1.5 Methodology of the Study

For testing the hypotheses and research question this study uses empirical research with secondary data. A sample of five emerging countries – Brazil, Russia, India, China and South Africa (BRICS) was selected to study the exchange rate intervention (Exchange Rate & Forex Reserve) and trade openness on share price movements, inflation, GDP and sacrifice ratio. The sample period of study was fifteen years from 01st January 1998 to 31th September 2012. The reason for limiting this study till 2012 September, because the recent data is not updated and the data collection was done at the end of year 2013.Time series and panel data for a period of 15 years were collected from various databases such as Central Bank of Brazil, Central Bank of Russia, Reserve Bank of India, People Bank of China, South African Reserve bank,

International Financial Statistics (IFS), Federal Reserve (the Central Bank of United States.), The Organization for Economic, Co-operation and Development (OECD) and World Bank.

For testing the hypotheses this study has used both time series and panel statistical tools. For panel data total number of observation is 885 for one variable but in time series total number of observation is 177 for each variable (it vary on the bases of estimating sacrifice ratio for each country). There are four objectives described in this study. In the first objective a panel data statistical tools was used such as Fixed or Least Squares Dummy Variables (LSDV) Effects Model, Random Effects Model and Pooled Ordinary Least Square (OLS) method. In second objective Panel Generalized Method of Moments (GMM) was used and the third objective Pedroni Co-integration and Fully Modified Ordinary Least Square (FMOLS) Method was used. In last and fourth objective time series data was used to estimates of sacrifice ratio for Brazil, Russia, India, China, and South Africa. The statistical tools are finding the episodes and Ordinary Least Square OLS regression.

4.2 Major Findings of the Study

The following paragraphs are describing the major findings of the study.

4.2.1 Overall relationship:

Exchange Rate, Forex Reserve and Trade Openness:

Brazil:

In Brazil, the exchange rate show insignificant growth, but forex reseryhas been increased significantly ($t=5.28$, $p<0.001$). The trade openness has also showing positive and highly significant ($t=8.19$, $p<0.001$). maintain exchange rate at the same level and increasing to foreign exchange reserve and trade openness in Brazil indicates good sign in the economy.

Russia:

In Russia, the exchange rate growth in the study period gives insignificant, the forex reserves has shown a significant improvement (t=7.684. p<0.001), and the trade openness also seen a highly positive significant growth during the study period (t=8.637, p<0.001). The Russian economy is completely dependent on the natural gases and oils, the frequent changes in the oil market and the value of currency is also changing. However the foreign exchange reserves and trade openness helped the nation to take in to right path.

India:

The Exchange rate value of India shows a insignificant growth in the study period. The foreign exchange reserves (t=11.528, p<0.001) and trade openness (t=9.622, p<0.001) has been improved significantly during the study period. Among the BRICS Nations India's foreign exchange reserve has increased when compared to any other nations during the study period. The LPG policy introduced in 1991 helped the nation to hold the grip on the nation's economy. The frequent monetary adjustments done by the reserve bank, the country able to show growth through foreign exchange reserves and through trade openness.

China:

The exchange rate system of China is different from other BRICS group nations in the study period and it shows a significant negative growth in the study period. Out of five countries in the BRICS group, China's foreign exchange rate alone significantly reduced during the study period (t= -7.263, p<0.001).The forex reserves (t=5.537, p<0.001), and trade openness are giving a significant growth during the study period (t=11.26, p<0.001). In China the exchange rate, forex reserves and trade openness individually and collectively shows a positive impact on the growth of the economy. The strong managed exchange rate system enables the country to accumulate more reserves. Joining of WTO boosted the country export led economic growth in the study period.

South Africa:

In South Africa, the exchange rate was showing insignificant growth in the study period. The forex reserves has improved significantly ($t=9.334$, $p<0.001$), and the trade openness of the South Africa also increased significantly with t-value of 7.990, $p<0.001$. South Africa was the second largest country holds foreign exchange reserves next to India, during the study period.

The objectives wise findings are below:

4.2.2 Effects of Exchange Rate, Forex Reserves and Trade Openness on Share Price.

- The share price movement is explained by 90 percent of independent variables (Exchange rate, Forex reserve and Trade openness).

- The exchange rate, forex reserve and trade openness coefficient value shows a positive relationship with share price movements. The exchange rate (CV 0.48, $p<0.01$) and forex reserves (CV 0.63, $p<0.01$) show highly significant beta coefficient value on share price movement. They indicate that countries with good monetary policy regarding exchange rate and forex reserves have positive impact on share prices.

- The trade openness also shows a high positive relationship with share price movements compare to exchange rate and forex reserve. It indicates every one unit changes in trade openness leads to 1.21 changes (CV 2.55, $p<0.01$) in share price. It shows that when BRICS nations open to the international trade there is a possibility of huge investment which ultimately increases the share prices of the firms.

- The result with dummy variables show that a significant relation between share price movement and other independent variables, when Brazil is taken as a reference and it is giving a mixed relation among the BRICS nations. They show a positive significant relation in Brazil and South Africa and negative significant relation in Russia, India and China.

- This result can also be verified by using dummy variables where stock prices of Brazil and South Africa are more than the other three countries, Russia, India, and China.

- Over the period of time the forex reserve has increased in all the five countries with less fluctuation. Increased reserve due to encouragement of FDI, FIIs, and Export etc. Though all the countries have more or less same level of forex reserve, the nature of inflow is different. Therefore the usage of these reserves may be different in individual country. This can be evidenced through exchange rate with stock prices and trade openness with stock prices. Out of the five countries, South Africa and Brazil has used the reserve for better growth potential than Russia, India and China and they out performed during the study period.

4.2.3 Effects of Exchange Rate, Forex Reserves and Trade Openness on Inflation.

- Through these empirical results we assumed that there is a positive correlation between exchange rate, forex reserve and trade openness on the inflation which is a proxy variable of economy of BRICS countries.

- Trade openness and exchange rate are highly influencing the inflation when compare to the forex reserve. Increased trade openness ratio indicates increased foreign trade when GDP is constant and it is good for any country and bad if it is reverse. In our result trade openness shows positive significant, ($p<0.05$) and high coefficient (8.35) relationship with inflation.

- In the international financial market the individual country currency can depreciate and appreciate depends upon its strength. When the country currency appreciate, that shows a possibility of decreasing the inflation on the other hand it depreciate, there is possibility of increasing the inflation. In our results dollar exchange rate positively highly significant ($p<0.01$) with inflation stating that for every one unit dollar rate increases in the international market (depreciation) the inflation increases by 4.21 unit. This is always happening in the growing economies. But the degree of inflation increases is debatable and can been seen in the fourth objective.

- When Forex reserve increases in any country there is a high degree of possibility of investments and increased number of transaction thus accelerate the growth of GDP, as a result increase the inflation at lower/higher level depend upon the domestic monetary policy. In our results the forex reserve is positively, significantly ($p<0.001$) with inflation meaning that for every one unit of forex reserve increases the inflation increases by 1.41 unit. As a whole in the BRICS the inflation increases as a result of increased Forex reserve. In the home country (India) also during the study period the same situation, we have witnessed.

- In BRICS countries, the study gives a positive correlation between exchange rate, forex reserve and trade openness on the inflation. The common feature of these countries is, all are developing nations and controlling inflation is one of the main points in monitory policy of almost all countries, because these countries are highly open to international trade. When there is a good exchange rate the countries will be more open through this they can maintain reserves. Thus this trade openness brings high investments, which accelerate the growth of the countries economy. As a result there is an increase in the inflation is observed in the BRICS nations.

4.2.4 Effects of Exchange Rate, Forex Reserves and Trade Openness on GDP.

- The empirical analysis shows that all the three variables such as exchange rate, forex reserve and trade openness combines together have a long term relationship with GDP in BRICS nations. This is a good sign for the BRICS country with respect to the predictions of the economist Jim O' Neill to achieve 47 percent of world GDP by the year 2050. This strengthens the economy of BRICS to play a dominant role in the world economy.

- The exchange rate is positively (CV 0.088, $p<0.01$) associated with GDP, meaning that for every one unit of exchange rate increases, the GDP increases by 0.08 unit. The study found that there is a long term relationship between exchange rate and GDP, which indicate there is a possibility of inflow of FII and FDI that will generate more GDP in the economy. The high exchange rate

enables the capital inflow, which helps in domestic production and exporting of goods and services. Thus the GDP of the country will get strengthen.

- The forex reserve is also positively (CV 0.082, $p<0.01$) associated with GDP. It explains when reserve increases the investment also increase in the form of production, infrastructure development, transport facility, etc. When the countries have more reserves they can invest in domestic and in more foreign markets. A country having huge investment, its growth will increase. Thus the reserves of a country are directly influencing the GDP. The reserves reduce the burden of the government by reducing the external current account debts. The BRICS nations together constitute highest reserves when compared to the world reserves. Accumulation of reserves helps the BRICS nations to improve the GDP in the economy.

- Among the variables (exchange rate, forex reserves, and trade openness) trade openness is highly positive (CV 0.45, $p<0.01$) coefficient with GDP in BRICS countries. Because it brings more investment in these countries through FDI and FII, which helps in reducing the cost of production and increase in the profits through export. These transactions help in improve the nations GDP. All the BRICS nations are open to the international trade with reasonable restrictions. These favorable conditions encouraged the investors to invest in this economic block, thus it helped in improving the GDP through high production of goods and services in the domestic market.

- Overall the BRICS countries GDP has improved during the study period with the help of international trade (exports and imports).

4.2.5 Effects of Exchange Rate, Forex Reserves and Trade Openness on Sacrifice Ratio.

Brazil:

- In Brazil out of 177 monthly observations in the time series data starting from 1998 to 2012, 67 disinflation observations were identified and it consists of seven disinflation episodes during the study period. It accounts for five years seven months. Out of the 7 disinflation episodes, episode one (17.07, August

1988 to October 1999) and episode three (7.98, January 2002 to December 2002) falls on high disinflation episodes.

- All the episodes are identified when the inflation are above to the level of 1.50. (The acceptable level of inflation according to Ball (1994) is 1.50). When the inflation is increases the sacrifice ratio decreases and on the other hand inflation decreases, the sacrifice ratio increases (both the variables are inversely related). Accordingly the inflation increases the sacrifice ratio decreases as a result the output loss decreases. Thus during the period from August 1998 to October 1999, January 2002 to December 2002 Brazil country suffered heavy output loss when compared to other episodes because during this period the inflation level raises from 2.54 to 17.07 when it accepted level is 1.5 (Ball,1994). This was happened when Russia has withdraw her currency from emerging markets, and the minimum inflation was observed in December 2009 to May 2010 (Episode 6), this is due to slashing interest rate by Central Bank to overcome the 2008–2009 economic crisis (European economic crisis).

- In Brazil, the increased exchange rate (depreciation of domestic currency) positively associated (CV 0.01, $p<0.05$) with sacrifice ratio. From the data we observed an increase in exchange rate in 2002-2003, this is due to change in government and its new economic policy to control inflation and stabilize exchange rates. The government has increased interest rates, tighten fiscal policy, foreign capital returned in 2003. To reduce the inflation, the Brazil has gone for devaluation of her currency at 2002. This was very helpful to strengthen Brazil's balance of payment to its crisis at 2002. The exchange rates are high when Brazil devaluated its currency in 2002, which increased the output losses and pushed the increased sacrifice ratio (output inflation tradeoff) and in 2008 Brazil used reserves to control the inflation which reduces the output losses and sacrifice ratio.

- The forex reserves is also positively associated with sacrifice ratio (CV 0.02, $p<0.01$). In general the reserves are used to reducing the output losses caused by inflation but in Brazil till 2008 recession the reserves are accumulate and inflation is controlled through tightening fiscal, monitory policy, exports are restricted in the disinflation episode period to control the inflation. But to

overcome the 2008 economic slowdown Brazil used its reserves to overcome the inflation, in that period the sacrifice ratio has increased. So the increase in reserves leads to increase in sacrifice ratio and vice-versa.

- The trade openness in Brazil shows high negative beta coefficient and highly significant (CV -0.79, $p<0.01$) with sacrifice ratio. When there is one unit increase in trade openness, there is -0.79 units decrease in sacrifice ratio. After 1998 Brazil shifted to the floating exchange rate system, which encouraged the country to be more open to the international trade. Greater trade openness brings high inflation, when the rate of inflation was high the sacrifice ratio also lower.

- Over all the Brazil data shows that, the country started more open to the international trade from 1998 as a result inflation was increase. Further, it has changed from pegged exchange rate system to floating exchange rate system and started accumulating reserves. It is observed that whenever the exchange rate and forex reserves are increasing the sacrifice ratio also increasing, and when inflation is high due to trade openness and the sacrifice ratios decreasing.

Russia:

- In Russia out of 177 monthly observations, 42 disinflation observations are identified. Out of the five disinflation episodes, episode one (54.80, February 1998 to November 1998) falls a high disinflation. This is because of currency crisis in that year, and the minimum inflation episode was observed in March 2010 to October 2010(1.55). Among all five countries Russia has less number of disinflation episodes (five) covering a shorter period of 42 months. When compared to Brazil (seven episodes) the Russia is having lesser episodes (five).

- The exchange rate shows negative (CV -0.07) and low beta coefficient ($p<0.01$) with sacrifice ratio. For every one unit increase in exchange rate (appreciation of Russian Ruble), the sacrifice ratio decreases by 0.07 units. In Russia more importing firms benefitted than exporting firms and try to increase the growth potential and as a result inflation increases. (The forex reserve ($p>0.10$) and trade openness ($p>0.05$) are not influencing with sacrifice ratio)**.**

- The data explicit that the reserves (CV =0.01, p>0.10) and trade openness (CV 0.13, p>0.05) are not influencing the sacrifice ratio. The reason for negative influence of exchange rate and no influence of forex reserves on sacrifice ratio due to the Russian bank frequently intervene and make corrections in the exchange rate and the inflation is controlled through internal measures like increase in the interest rates by Russian bank.

India:

- In India 90 disinflation observations are identified during the study period. This consists of twelve disinflation episodes and it accounts for seven years five months. Out of the twelve disinflation episodes, episode two (43.65, March 1999 to February 2000) falls on high disinflation episodes and the minimum inflation was observed in episode eleven (1.5, September 2008 to August 2009). Among all the five countries India has more number of episodes (twelve).

- The exchange rate shows negative (CV -0.01, p<0.05) relationship with sacrifice ratio. When every one unit increase in exchange rate, the sacrifice ratio decrease by 0.01 that means when exchange rate increases, the general price levels will rise, and there will be possibility of inflation. Then the theory will apply high inflation with low sacrifice ratio (an inverse relationship).

- The forex reserve is positively (CV 0.01, p<0.05) associated with sacrifice ratio, countries with high reserves can overcome the sudden fluctuations in economy. Most of the economic disturbances in India are caused due to external factors, so these external shocks are controlled through the reserves. In India internal monetary policy is very effective to control the inflation so the increase in the forex reserves increases the sacrifice ratio.

- The trade openness and sacrifice ratio shows a negative (CV -0.07) relationship with high significant (p<0.01). In India more number of importing firms was benefitted and improved their growth potentials and tries to increase the international trade as a result inflation increases and sacrifice ratio reduces. (Inverse relationship of inflation and sacrifice ratio).

China:

- In China out of 177 monthly observations in the time series data starting from 1998 to 2012, 84 disinflation observations were identified and this was more or less at par with Indian disinflation episodes. It consists of seven disinflation episodes during the study period. This seven disinflation episode time period accounts for seven years. Out of seven disinflation episodes, episode six that is from July 2009 to May 2011 falls on high disinflation episode (67.25) and the minimum inflation was observed in February 2001 to January 2001 (1.75) and during the period how the selected variables affected the sacrifice ratio is given below.

- The exchange rate shows negative sign (CV -0.01) and low beta coefficient ($p<0.01$) with sacrifice ratio. Because China was using fixed exchange rate system and with a strong export market. The country stabilizes the inflations by reducing output cost (that shows low sacrifice ratio).

- The forex reserves also shows negative (CV -0.04, $p<0.01$) sign with sacrifice ratio. Because the Chinese government did not depend on the forex reserves and they continued to be fixed exchange rate system even in the inflation periods. They used the inflation for its growth; through exports they were able to manage the low output loss which gives low sacrifice ratio. To overcome the 2008 economic slowdown, the Chinese government implemented a large economic stimulus package and an expansive monetary policy. These measures boosted domestic investment and consumption and helped prevent a sharp economic slowdown in China.

- Trade openness is not influencing (CV 0.03, $p<0.10$) the sacrificing ratio, since China is self sufficient to overcome any financial turbulences. Chinese economy mostly depends on the export and the country is having sufficient reserves and savings to overcome any external shocks.

South Africa:

- In South Africa, there are 94 disinflation observations were identified and it consists of eight disinflation episodes during the study period. The total disinflation time period accounts for seven years ten months. Among the BRICS

countries, South Africa has longest disinflation episode. Out of the eight disinflation episodes, episode five (July 2003 to November 2004) falls on high disinflation, this is because the value of Rand depreciated during 2001 to 2003 and the banks started to accumulate the reserves by buying foreign exchange reserves on a spot basis, and the minimum inflation (1.70) was observed during June 2001 to June 2002.

- The exchange rate shows a high positive sign (CV=0.02, $p<0.01$), with low beta value. This is because the main target of monitory policy of South Africa was to reduce inflation. The increased exchange rate allowed extensive capital inflow in to the country. The increase in exchange rate, depreciate the value of Rand which leads to high output cost.

- The forex reserves are negatively (CV -0.05, $p<0.01$) influencing the sacrifice ratio, the time period between 2003 and 2005. There is huge accumulation of foreign reserves in South Africa, but the sacrifice ratio is low in that period, the internal fiscal policy and underperforming of countries exports against global trend forced to increase the output cost of production so the sacrifice ratio is gone to negative.

- The trade openness in South Africa showed highly positive beta coefficient and highly significant (CV 0.22, $p<0.01$) with sacrifice ratio. The trade openness brought high capital inflows over the time period in South Africa, which brought the frequent inflations, along with the increasing unemployment and underperformance of exports forced the country to take more disinflationary measure, so the sacrifice ratio is high in the stipulated time period in South Africa.

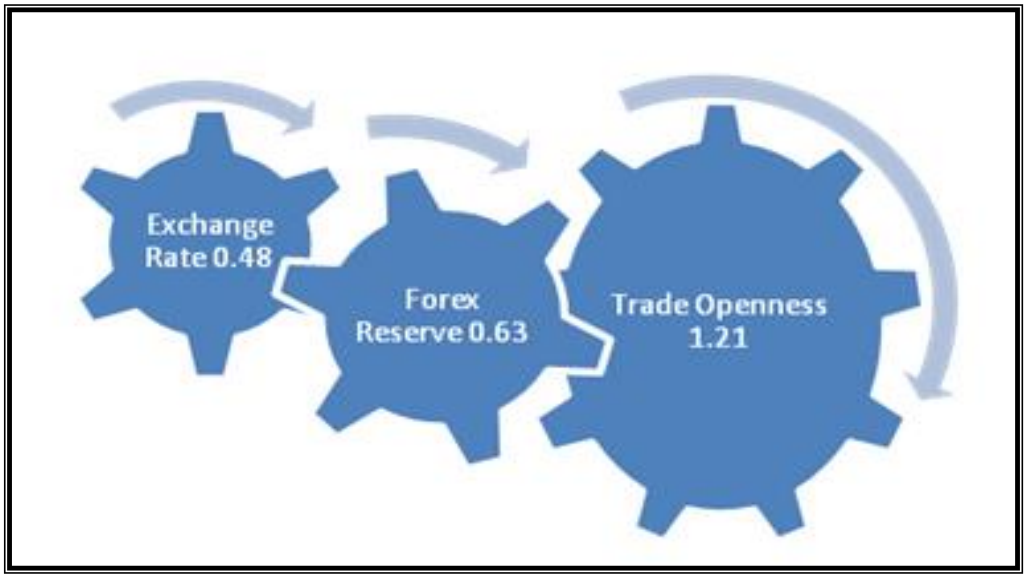
4.3 Contributions of the Study

4.3.1 Share Prices with Exchange Rate, Forex Reserves and Trade Openness.

In this study the empirical results explicit that the exchange rate, forex reserves and trade openness are positively influencing the share price movement. The overall increased exchange rate (depreciation of BRICS currency value) positively associated with share price movement but with low beta co-efficient value (0.48).This indicates exporting firms are more benefited than importing firms and this has given way to increase in accumulating the forex reserves. The forex reserve also shows a positive influence on share price movement (0.63) slightly higher than the exchange rate. This result indicates that the forex reserves in all the five countries possess more or less equal amount of reserves. It seems the utilization of these reserves was may be differ by individual country. This can be evidenced through influence of exchange rate and trade openness on share price movements.

Out of the five countries, South Africa and Brazil has used the reserve for better growth potential than Russia, India and China. This we have witnessed in graphs (exchange rate to share price and trade openness to share price). As a result the positive influence of exchange rate and forex reserve on share price movements. The trade openness (International trade) also shows a positive relation and high beta co-efficient (1.21) on share price movement. This is possible because of increased capital inflows in BRICS countries in the form of FDI and FII increases the international trade. The trade openness of BRICS nations enabled them to get more investments through FII which influence directly on share price movements. The above discussion can be summed up as the increased exchange rate leads to increased forex reserves and thus increases the international trade. Therefore the share price is showing positively relation in the long run. The relationships of these variables are shown in the following figure.

Relationship among Exchange Rate, Forex Reserve and Trade Openness in BRICS.



4.3.2 Inflation with Exchange Rate, Forex Reserves and Trade Openness.

The exchange rate, forex reserves and trade openness are positively associated with inflation. With the increased exchange rate (BRICS currency value depreciates) the cost of production of goods will increase in the domestic market and the general prices levels will also increases. In the same way when the reserve increases, the inflation will also increases. It indicates that the accumulated reserves are generally used to control the inflation. When exchange rates are high the accumulation of reserves through exports are costly so it leads to inflation. Among these independent variables trade openness shows a highly positive relation with inflation because the trade openness facilitated by liberal monetary policy which leads to high inflation. Next important point is if there is any sudden rise in inflation or any crisis the BRICS countries can overcome by understanding the changing behaviour of the variables in the past episodes.

4.3.3 Gross Domestic Product with Exchange Rate, Forex Reserves and Trade Openness.

In general, BRICS exchange rate, forex reserves and trade openness shows a long term relationship with GDP. A general concept is when exchange rate increases the value of currency will depreciate as a result huge investments comes into country to

produce at low cost so the output will increase, this concept can be applicable in our study, the study also accepted the general phenomenon when the exchange rate increase as a result there is an inflow of FII, FDI that will increase the GDP of the BRICS nations. During the study period the reserves was positively influencing on GDP, that indicates when the countries have more reserves they can invest in domestic and in foreign markets. The same results were identified with the proxy variable of share price movement in the BRICS countries. However the reserve on GDP shows less influence than the reserves on share price movement, this is because the reserves can be identified in two different forms, one in the form of FII and the other is FDI. The FII can't have impact on GDP but FDI is directly influencing on GDP. This is the reason when reserve show high relation with share price as same compare to GDP. The increased exchange rate and forex reserve helping the international trade to boost the GDP. The results are more or less same when we see the influencing variables to share price movement which is another proxy variable. Therefore the researcher is happy about results obtained.

4.3.4 Sacrifice Ratio with Exchange Rate, Forex Reserves and Trade Openness.

The developing countries are highly connected with the international trade and there is a possibility of frequent inflations in their development process. The study gives an empirical support to the BRICS nations regarding the sacrifice ratio. Through this one can understand the disinflationary trends in the series of episodes. By studying the sacrifice ratio for each and every individual episode helps in understanding disinflation process and the other factors (use of reserves, Govt. intervention, and monetary policies during the episode time) which are influencing the disinflation and in framing the better monetary policy to control the inflation.

In Brazil exchange rate and reserves are showing positive relationship with sacrifice ratio where as trade openness was showing negative relationship with sacrificing ratio. This is because the monetary policy of Brazil is to reduce the inflation through accumulation of reserves. The accumulated reserves were used to reduce the balance of payments of the country but internal measures are lacking in controlling the inflation so sacrifice ratios is low in this country.

In Russia exchange rate showing negative relationship with sacrificing ratio and rest of the variables forex reserve and trade openness are not influencing with sacrifice ratio. The disinflation periods are long with low sacrifice ratio because the country focuses on the currency accumulation and it is highly dependent on export of oils and natural gas.

In India exchange rate and trade openness shows negative relationship with sacrifice ratio and exchange rate shows positive relationship on sacrifice ratio. Because of the strong monetary policy, the country used its reserves to reduce the output losses in the disinflation period.

In china exchange rate and forex reserve shows negative relationship on sacrifice ratio. But trade openness shows positive relationship on sacrifice ratio. The disinflation measures are very reflexive in china. The export market in china is very strong and the reserves are used for other purposes.

In South Africa exchange rate and trade openness shows positive relationship on sacrifice ratio but forex reserve shows negative relationship on sacrifice ratio. South Africa is have more debts when they open to international trade, the reserves accumulated are used to reduce the balance of payments and investments are used to improve the export productions, the sacrifice ratio is low when reserves are high.

4.4 Limitations of the Study

The data is not normally distributed more trouble shooters are needed in analyzing the panel data. Each country is having their own limitations (pros and corns), therefore sophisticated statistical tools are applied in the panel data. The analysis and interpretation of panel data is different from time series data. The researcher have taken more painful in understanding the importance, identifying the requirements of the objectives and to check the hypothesis with different tools for different objectives in order to achieve the accuracy of the results.

1. As an international study, there may be differences in the calculation of indices of share prices among different countries in the study. In order to avoid this, data has been collected from IFS which maintain an index on its own ensuring a common base.

2. The recent data is not updated to current period because the data collection was done at the end of year 2013.

3. Since, some countries monthly data is not available, the annual GDP has been converted into monthly with the help of interpolates method with origin software.

4. As it is a panel study, it cannot be applied any common model in the analysis. Thus, selected models have been used in the analysis.

5. Since the study is based upon the secondary data, all the limitations inherent to the secondary data will also be applicable to this study.

4.5 Scope for Further Study

- There is a large scope for future research in the study area. The same study can be done in other economic group of nations such as SAARC; G7 etc. these blocks are also contain developing countries like BRICS.

- To know the role of share price movement in the economic growth of the country, the researcher can use different indices instead of using common indices for each country.

- The effect of these independent variables (exchange rate, forex reserve and trade openness) can be studied individually in each country in detail connecting its policies. It gives effective results to understand the changing patterns of variables in each country at different time periods in respect to their policies.

- In developing countries the disinflation periods are either very short or very long; it is purely depend on the monetary policies of the government. With these independent variables (exchange rate, forex reserves and trade openness), the sacrifice ratio is not showing similar effect when same condition happened in all countries (BRICS). So in further study can identify other variables which are more influencing on sacrifice ratio.

- There is a large scope to study the behavior of the selected variables in short periods especially during the economic slowdown of the nations.

4.6 Conclusion

This study is an attempt to document the evidence of exchange rate intervention (Exchange rate and Forex reserves) and trade openness on the economy of the BRICS countries. The share price movement, inflation, GDP and sacrifice ratio are considered as a proxy variables to see the economy of BRICS Nations. A sample of fifteen years panel and time series data were taken to study the changing patterns of the BRICS economy.

The selected independent variables explicit a positive relation with share price movement. Among these three variables trade openness is highly influencing the share price movement in BRICS Nations. To check the relationship of individual country, the study employed with dummy variables and Brazil was taken as reference, the result shows that Brazil and South Africa having positive relation with stock prices and remaining three countries shows negative relationship. In the study period Brazil and South Africa are focused on accumulating the forex reserves in-order to reduce the inflation and they are open to international trade, these leads huge capital inflows into these countries so the share price also increased.

The BRICS Nations are highly open to the trade for their economic development and the international trade is completely depends on the exchange rate. These two variables are directly influencing on inflation in these developing economic block. In the study period, these independent variables (exchange rate, forex reserve and trade openness) individually correlate with the GDP of BRICS Nations. To know the individual effect of these variables on GDP, the study employed FMOLS. That gives trade openness is highly influencing the GDP than other two variables. It implies that the exchange rate and forex reserves in these countries are mostly using for reducing inflation, so the influence on GDP is low in BRICS nations.

The Overall result shows the exchange rate, forex reserves and trade openness are positively associated with share price, inflation and GDP. Out of these three independent variables trade openness has high degree of association with proxy variables of economy of BRICS nations. The nations with high trade openness brings

more investment to the country and the share prices increases and monetary policy of the country will be liberal which allows fluctuations in the exchange rates of the nations, the exposure to the international trade give competitiveness to the domestic export products, helps to increase the GDP.

These developing economies which are open to international trade are frequently affected by the inflations, so it is necessary to take measures to control the inflation and the sacrifice ratio is used as disinflationary process. The study gives an important insight on the sacrifice ratio of BRICS nations. In the study period all BRICS nations observed high inflation and low sacrifice ratio in 1998-2000. Because all these countries changes their economic system and made liberal policies in order to overcome inflation caused by series of crisis around the globe (example: Asian crisis, Russian currency crisis etc) and during the economic slowdown in 2008-2010 all BRICS nations are taken very long disinflation period which gave high sacrifice ratio.

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