“Retraction: Exchange rate intervention and trade openness on the global economy with reference to Brazil, Russia, India, China and South Africa (BRICS) countries”

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EXCHANGE RATE INTERVENTION AND TRADE OPENNESS ON THE GLOBAL ECONOMY WITH REFERENCE TO BRAZIL, RUSSIA, INDIA, CHINA AND SOUTH AFRICA (BRICS) COUNTRIES

Abstract

Currently, the economy of the world is trapped in interdep ent global nomic web. The countries of the world are mutually dep on oth er's imports, exports, fiscal and monitory policies in terms o ability. is go great challenges and opportunities to the emerging e omies ese countries have greater trade openness to the internati al trading d are ore af ed by inflation. The BRICS represent about 40 percen th orld tion; enc pass over 25 percent of the worlds land coverage and c ise hug ural res ces. BRICS share of a little over 10 percent in world Gro D stic Pro) and less than 4 percent in world trade in 1990, BRICS (with the t inclusion of South Africa to the forum) now constitutes about 25 r f world P in terms of PPP (Purchasing Power Parity), and 15 percent of orld trade. The incr n GDP implies that the economic size of BRICS in terms o s share in w l GDP has expanded by 150 percent in the past two decades, and th also estimate hat the GDP of these countries may cross 47 percent of the world G and will en ge as strong economic power in the world, and they co e fift the al economic output. The BRICS economies operate un varie netary policy frameworks and procedures. Brazil and South Africa hav nflatio g regimes, while other countries follow multiple indicator framewo The re va ther indicators, such as trends in inflows and outflows of ign direc vestme (FDI), trade openness, current account balance, forex re- es and eco nically tive labor forces that could make BRICS a formidable force ckon with This study applies significantly exchange rate, Forex reserve a de openness on the global economy of BRICS countries.

Keywo s trade, global economy, exchange rate

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INTRODUCTION

"BRIC" (Brazil, Russia, India, and China) has 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". It 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 issues of global importance. At their third summit in China in 2011, the leaders invited South Africa to join, thus becoming the BRICS.

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 are 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 takes some monetary policy to increase the capital inflows to domestic country. Roland Vaubel (1991, 2005) also pointed that exchange rate intervention can be used to reduce the volatility in exchange rate. Many other broad macroeconomic 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.

1. UNDERLYING CONCEPTS

1.1. 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, the term exchange rate intervention is the term used for two variables namely exchange rate and foreign reserve and see how these two variables are influencing the economy of BRICS countries.

1.1.1. 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 system. The exchange rate determination the decision of investors. In general, countries with high exchange rate face high demand for export and less demand for imports, consequently the 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 currency with US$ since US$ is used as a reference currency in the world economy.

Foreign exchange reserve: Foreign exchange reserves refer 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 is employed as foreign currency assets in terms of US dollar.

1.1.2. 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 measure on openness of international trade of goods and services.

Trade openness plays a significant role in the economy of the country, especially in the developing economics. 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.

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1.1.3. Share price

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 be 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.

1.2. 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 (... flation has higher variance). In normal st...ge infla... tion is comfort, when it is at 4-5 percen... At t... same time economic accuracy is e...cting th... investment and slow down in the ...omy. So ...la... tion is important and ...ed indic...r to explain the structure of economy.

1.2.1. Gross domesti...duct (G...)

Gross domesti...produ...has ...he ability to give an overall ...ictu... the st... of the economy. Through ...is we ca...redict ...nether the economy is contr...ng or expa...ng and we can also understand t... depressions and inflations through GDP. The gen...l definition of GDP is the total no of goods and se...ices produced within the country in a specific period of time.

1.2.2. Sacrifice ratio

The monitory policy of the emerging economies is giving importance to control the inflation. Such measure comes 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 is defined as output loss, but long term loss is beyond the trough. The sacrifice ratio derives a relation between output loss and trend inflation.

1.2.3. Methods to estimate the sacrifice ratio

Ball (1994) developed a model to calculate the sacrifice ratio in different disinfla...n episodes in the time period. The most prominen...ethod used as alternative to the linear Philips ...(1958) approach to calculate the sacrifi... ratio ...Ball's episode specific models (1994). According ...him, the sacrifice ratio is compute...s the ratio ...the sum of deviations b... tre...outpu...and actual output, to th...hange ...trend ...flation over the disinflation e...sode... allo...s variation in the sacrifi...ati...by d...ation e...odes even within the same ...untry o...time...hus, it allows comparison of e...iency and effectiveness of the central ...etary a...hority in disinflating the economy. To observe t...fluctuations in the inflation, ...ll (1994) h... given the acceptable level of normal inflation ... 1.50.

...r calculating sacrificing ratio the following for... is used:

$$Sacrifice\ Ratio = \\ = \frac{Actual\ Output\ -\ Potential\ Output}{Average\ Trend\ Inflation},$$

- *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 it 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.

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- *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.

2. REVIEW OF LITERATURE

The detailed reviews among these variables in BRICS countries during last couple of decades helped to find out the research gap for this study.

Chkili and Nyuyen (2014) investigated the dya namic linkage between the exchange rate and stock market return in BRICS countries. They employed univariate analysis, Markov switching VAR model (MS-AR model) and likelihood ratio (LR) test was applied to check the relation between these variables and the data period was from 1997 to 2013. Through MS-AR mod[illegible] observed two regime shift behaviors for[illegible] stock markets, one is a low volatility regime a[illegible] ano[illegible]er is the high volatility regime an[illegible]bsequ[illegible]ly they found stock market have [illegible] influenc[illegible]n exchange rate during [illegible]th [illegible]alm[illegible]d turbulent periods. Finally the effe[illegible]of excha[illegible]e rate on stock returns have insignifi[illegible]t impa[illegible] while stock price on exch[illegible] rate re[illegible]led highly significant impact [illegible] BRIC[illegible]ountrie[illegible]Ali, Anwar, and Ziaei (201[illegible] revea[illegible]d th[illegible] a causal relationship was f[illegible]nd [illegible]w[illegible]en exch[illegible]ge rates and stock prices in[illegible]RIC co[illegible]ies. T[illegible] data were collected from D[illegible] Stream for [illegible]e period of May 5, 2003 to Septem[illegible]6, 2010 on weekly basis. They used Bivariate Gra[illegible]r causality tests, Tado-Yamaneto causality (modified WALD) test and KPSS tests (Kwiatkowski). The study shows there was a stable relationship between Brazil and Russia in the post crisis and crisis period. In India there was a causality running during pre crisis period, and in all three sub-periods they found there is no relationship between exchange rate and stock prices in China. Silva and Peruffo (2012) 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 increasing the importance of trade between Brazil to other BRICS countries. Rjoub (2012) investigated the dynamic long and short run relationship betw[illegible]n Turkish stock price, exchange rate and the US[illegible]ck prices. He used Co-Integration, Granger Ca[illegible]ty, Impulse Response Tests and Vector A[illegible] Regre[illegible]on from August 2001 to August 2009.[illegible]e study co[illegible]luded co-integration revealed a lo[illegible]run relat[illegible]ship along with Granger[illegible]lity s[illegible]ing[illegible]change rate and Turkish[illegible]ock pr[illegible] are having bidirectional relationsh[illegible], an[illegible]mp[illegible]e response indicated [illegible]ki[illegible] sto[illegible]ce, exc[illegible]nge rate and US stock pr[illegible]respon[illegible] withi[illegible] a short time. Ray (2012) analy[illegible] the effect and causal relationship be[illegible] macr[illegible]nomic variables and Indian [illegible]ck price. The v[illegible]ables used in the study are [illegible]E (Sensex)[illegible] are price for Indian stock market a[illegible] macroec[illegible]nomic variables are BoT, CNMR Inte[illegible], CPI as proxy for inflation, FDI, [illegible]OREXREV, GDP, IIP (base year: 2004–2005), [illegible] money supply (M3) representing money w[illegible]h public, demand deposit of bank, demand [illegible]eposit with RBI, COIL, REER, and WPI (base year: 2004–2005). The period of data was from 1990–1991 to 2010–2011 on annual bases. The researcher collected data for the year 2010–2011 from Indian Economy Survey Handbooks of Statistics, except consumer price index for inflation from OECD and crude oil from international energy statistics.

The study used multivariate Granger causality and multiple regressions methods to find the casual relationship between the variables. The result showed that oil price and gold price have negative significant effect on stock price and balance of trade, FOREX, Interest rate, GDP, IIP and money supply positively effect on stock price. Hsing (2011) 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

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rate, inflation rate or the world interest rate). He collected quarterly data from IFS (International Financial Statistic) on the basis of February 1980 to March 2010. The study suggested that South African stock market index has long-run positive relationship with real output and world stock market index and a negative relationship with domestic real interest rate, but no relation to government deficit, M3 (Broad money), the nominal effective exchange rate or world interest rate. Daniels and VanHoose (2009) empirically evaluated the implications of an open economy, in which both trade openness and capital mobility can influence the sacrifice ratio, which is also controlling other important factors like central bank independence and wage duration. They employed data of Temple (2002) and Daniels et al. (2005) taken from Ball (1994) regarding sacrifice ratio (SAC) of 58 disinflation 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 raise the sacrifice ratio. Rahman, Sidek, and Tafri (2009) investigated the dy... linkages between Malaysian stock mark... index and selected macroeconomic variables. They ... plied vector autoregressive (VAR) ...ointegra...on and VECM for these linkages. They concl...d all the selected variabl... hav... co...rration with stock market index. In a...tion res...s and index of industrial production (...) showe... positive relation, and mone...ely, int...t rates and exchange rate sho... negat... relati... Malaysian stock market i...ex. F...ther...ore, reserves and interest ra... sh...e bidirec...nal causality with stock m...ket ind... and ...idirectional linkages for o...r variables. Loungani, Razin & Yuen (2002) inv...igated the determinants of countries sacrifice ...tio, 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 measured from disinflation episodes depends on the degree of restrictions on the current and capital accounts. Loungani, Razin, and Yuen (2001) estimated the determinants of the output-inflation trade off in an open economy. The study data period was 1950–1986, and the data were taken from the IMF annual report. Further, the sample of 35 countries used in Ball, Mankiv, and Romer (BMR) bases which was grouped into four average values of capital index. They found that the loss in output from reducing inflation is lower in countries that impose some restrictions on capital mobility.

3. STATEMENT OF THE PROBLE...

In this globalized world, t... economy ... each country depends on one anot... the failur... one country's economic ...ing ...ffecti...g other countries' econom... Recen... the IMF announced that there is a sli...t do...gra...in the economic growth ...f B...ICS ...tries, w...n compared with the expe... global ...onom... growth. As these five countrie... gether account for around 25 perce... orld G...P, t...e study is very relevant in t... global economi... market. In this present global economic ...ndition, the developing countries a... forced to ...pen their economy to the outside worl... rings high interdependence between ...e countries, and they are highly dependent on e...nge rate, forex reserve and the international t...de. 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 are 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. As the exchange rate intervention requires these two key variables, exchange rate and Forex reserve, it is important to study on this system. 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. The key macroeconomic variable which plays a great role in shaping the economic development of the nation needs to be concentrated while framing the monetary policy of nations. The problems are to identify and see the relationship between the major economic variables and its impact on GDP of the nations.

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OBJECTIVES OF THE STUDY

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

2. To know the impact of exchange rate intervention and trade openness on inflation. To find the long term relationship between exchange rate intervention and trade openness.

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

HYPOTHESES

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

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

H 3: There is a long term relationship between exe change rate intervention and trade openness with output.

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

4. METHODOLOGY OF THE STUDY

The methodology of the study is empirical and fully depends up on the seconda data. Data were collected from various database ch as Central bank of Brazil, Central bank of ia, Reserve Bank of India, People Ban of Ch South African Reserve bank, Int national F ncial Statistics (IFS), Federal Reser (the Centr ank of United States). Th niza for E nomic, Co-operation an Deve ment (OECD) and World Bank.

The follo table s ws th ain variables used in the study.

e following are t ain statistical tools used to amine the ove said objective and also testing t ypothes

Table 1. Variables and its description

Sl. No	Variables	Description
		Inde ndent v riables
1	Exchange rate	Nominal exc e rate of do tic c ncy (Brazilian Real, Russian Ruble, Indian Rupee, China Y n and Sou rican Rand) ollar
2	Forex reserve	Fo rrency ts in term of US dollar accumulated by the countries
3	Trade openness	Tra ness is th io of international trade (exports + imports) divided by GDP
		ependent variables
4	Share price	price in of ternational Financial Statistics (IFS) updated
5	Inflation	Perc age of Co mer Price Index (CPI)
6	GDP	T amo of goods and services produced within the country. Annual GDP converted by monthly ith Inte lates method
7	Sa ce rati	The ratio lculated by Ball method (1993) as actual – potential output / average inflation

Table 2. tistical tools used

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

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5. OBJECTIVE WISE HYPOTHESES, METHODOLOGY, STATISTICAL TOOLS AND FINDINGS

Procedure for 1st objective

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

Hypothesis (H 1): 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 uses monthly data for the sample period from January 1998 to September 2012. Thus the study tries 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:

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

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 $NT \times 1$ stacked matrix of the dependent variable, ex, res, to are the $NT \times K$ stacked matrix of the K independent variables, β is the $K \times 1$ vector of the unknown parameters and ε_{it} is the error term. Thus $ex_{it}, re..., to_{it}$ are the it^{th} observation on the K explanato... variables. The individual effect, β_{it}, is constant o... time t and specific to the individual cross-sectional unit i. ε_{it} is assumed to have zero mea... and const... vari-ance and to be independen... distribut... over time and individuals.

Findings

- The s... price ...veme... is explained by 90 percent ... independent variables (exchange ... forex r... rve and trade openness).
- The exch...ge rate, forex reserve and trade openness ...efficient value shows a positive re-...p 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 comparing to exchange rate and forex reserve. It indicates every one unit changing 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 shows 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.

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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 have used the reserve for better growth potential than Russia, India and China and they outperformed during the study period.

Procedure for 2nd objective

- *Objective:* To know the impact of exch ge rat intervention and trade openness on i latio

- *Hypothesis (H 2):* The excha rate inte n- tion and trade oper ss ffect inflation.

Variables

- *Endogenous:* lation
- *Exogenous:* chan rate
- Foreig xc e reserve
- Trad penne
- *Eco etric mode* anel data, Generalized Mome Method approach (GMM)

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

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

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 cor lation between exchange rate, forex reserve a rade openness on the inflation, which is a p variable of economy of BRICS count s.

- Trade openness and exch e rate ar ghly influencing the i n, w com red to the forex rese e. Incre d trade openness ratio indicates i rease orei trade, when GDP is t ar good f any country and bad i s revers n our ult trade openness shows po ve signi antly, ($p < 0.05$) and high cient ( ) r lationship with inflation.

- In the in rnational financial market the individual untry currency can depreciate and e, which depends upon its strength. When the country currency appreciates, that hows a possibility of decreasing the inflation, when it depreciates, there is possibility of increasing the inflation. In our results dollar exchange rate is 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 if debatable and can be 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 accelerating the growth of GDP, as a result increasing the inflation at lower/higher level depends upon the domestic monetary policy. In our results the forex reserve is positive, significant ($p < 0.001$) with inflation meaning that for every one unit of forex reserve increase the inflation increases by 1.41 unit. As a whole in the BRICS the inflation increases as a result of increased Forex reserve.

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In the home country (India) also during the study period, we have witnessed the same situation.

- 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 point 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 an increase in the inflation is observed in the BRICS nations.

Procedure for 3rd objective

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

Hypothesis (H 3): 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 analysis:* 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 indicates 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 is 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

- The empirical analysis shows that all the three variables, such as exchange rate, forex reserve and trade openness combined 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 indicates 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 strengthened.

- The forex reserve is also positively (CV 0.082, $p < 0.01$) associated with GDP. It explains when reserve increases the investment also it leads to 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 will lead to the increase of its growth. 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 com-

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pared 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, $p < 0.01$) coeffip cient with GDP in BRICS countries. Because it brings more investments 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 to 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 GDP of BRICS countries has improved during the study period with the help of international trade (exports and imports).

Procedure for 4th objective

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

Hypothesis (H 4): There is a r onship o x- change rate interventio nd trade enness with Sacrifice ratio.

Variables

- *Endogenous* acrifi rati
- *Exoge s:* ge rate
- Forei exch reser
- Trad penness
- *Econom ic 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 fulfill this objective, we follow Ball (1994) approach. We start from who proposed first sacrifice ratio by Ball (1994). He suggested the procedure to measure the sacrifice ratio is output loss due to drop in inflation rate. Assumed that actual output equals to the potential output if it comes under the equilibrium *(0)* otherwise disequilibrium. The countries' monetary policy had tightened, otherwise domestic economics is affected by the external shocks. The potential output has measured used by the Hodric Prescott filter (H-P) from its actual output. Next, t rend inflation period is (t) the average inflati om $(t-n)$ through $(t+n)$ ($n=1$ for the nnual , $n=4$ for the quarterly data, and n 12 for the nthly data). Finds peaks and throu from tre nfla- tion data from $(t-$ $(t+$ cente d nine quarter moving a age fo s log linear between the two points. T sacr e r o is calculated by output s ith inflatio We can see the followin thema l for ula for computing sacrifice rati

$$SR = \frac{y^a - y^{po}}{\pi^P - \pi^t}, \qquad (3)$$

w e y^a is e actual output, y^{po} is potential outp P the trend inflation peak and π^t is nd inflation through. Change in output corres ds to the change in the trend inflation.

rdinary least square shows how exchange rate, foreign exchange reserves and trade openness influence sacrifice ratio.

$$sr_t = \beta_0 + \beta_1 ex_t + \beta_2 res_t + \beta_3 to_t + \nu_t, \qquad (4)$$

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 estimate the relationship between the sacrifice ratio and rest of the explanatory variables. The results were explained below, the results came 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 they consisted of seven disinflation episodes during the study period. It accounts

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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 is above to the level of 1.50 (the acceptable level of inflation according to Ball (1994) is 1.50). When the inflation 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 the accepted level is 1.5 (Ball, 1994). This happened when Russia has withdrawn 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) is positively associated (CV 0.01, $p < 0.$ with sacrifice ratio. From the data observed an increase in exchange rate in 2002–2003, due to change in government and its new economic policy is to control inflation and stabilize exchange rates. The government has increased interest rates, tight fiscal policy, foreign capital returned in 200. To reduce the inflation, Brazil has gone for devaluation of its currency in 2002. This was very helpful to strengthen Brazil's balance of payment to its crisis in 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 are 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 accumulated 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 the sacrifice ratio and vice-versa.

- The trade openness Brazil shows high negative beta coefficient and is highly significant (CV –0.79, p 0.01) with sacrifice ratio. When there is one unit increase in trade openness, there –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 is also lower.

- Overall the Brazil data show that the country started to be more open to the international trade from 1998, as a result inflation 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 is also increasing, and when inflation is high due to trade openness, the sacrifice ratios decrease.

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

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months. When compared to Brazil (seven episodes) Russia has less 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 tried to increase the growth potential, which increased inflation (the forex reserve ($p > 0.10$) and trade openness ($p > 0.05$) do not influence the sacrifice ratio).

- The explicit data show that the reserves (CV = 0.01, $p > 0.10$) and trade openness (CV 0.13, $p > 0.05$) do not influence the sacrifice ratio. The reason for negative influence of exchange rate and no influence of forex reserves on sacrifice ratio is 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 were identified during the study period. This consists of twelve disinflation episodes and accounts for seven years and 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 increases in exchange rate, the sacrifice ratio decreases 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 which is highly significant ($p < 0.01$). In India more number of importing firms benefitted and improved their growth potentials and tried to increase the international trade as 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 episodes 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 from 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 show 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 gov-

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ernment 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 does not influence (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 identified disinflation observations and it consists of eight disinflation episodes during the study period. The total disinflation time period accounts for seven years and 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 buy[illegible] eign exchange reserves on a spot basis [illegible]nd the minimum inflation (1.70) was observ[illegible] duri[illegible] June 2001 to June 2002.

- The exchange rate [illegible] ws[illegible] hig[illegible]ositive 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 depreciates the value of Rand which leads to high output cost.

- The forex reserves are negatively (CV −0.05, $p < 0.01$) influencing the [illegible]rifice ratio. The time period is between 200[illegible] 2005. There is huge accumulation of fore[illegible] reserves in South Africa, but the sac[illegible]ice rat[illegible]s low in that period, the internal [illegible]scal policy [illegible]d underperforming of count[illegible] exports [illegible]gainst global trend forc[illegible]increa[illegible]the ou[illegible]ut cost of production[illegible] the s[illegible]ifice ratio is gone to negative.

- The [illegible] open[illegible] in S[illegible]th Africa showed highly p[illegible]ive beta [illegible]oefficient and was highly [illegible]icant [illegible]V 0.22, $p < 0.01$) with sacrifice ratio. The trade [illegible]penness brought high capital inflows o[illegible] the time period in South Africa, which br[illegible]ght the frequent inflations, along [illegible] increasing unemployment and underperformance of exports forced the country [illegible] take more disinflationary measure, so the sacrifice ratio is high in the stipulated time period in South Africa.

CONCLUSION

This study is an [illegible]ttem[illegible] to d[illegible]ument the evidence of exchange rate intervention (exchange rate and forex reser[illegible]s) a[illegible] t[illegible]de ope[illegible]ess on the economy of the BRICS countries. The share price movement, inflation, [illegible]DP an[illegible]crifice[illegible]tio are considered as a proxy variables to see the economy of BRICS nations. A[illegible]mple of fifteen years panel and time series data were taken to study the changing patterns of the BRI[illegible]economy. The selected independent variables explicit a positive relation with share price movement. A[illegible]ng 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, which leads huge capital inflows into these countries, so the share price also increases. The BRICS nations are highly open to the trade for their economic development and the international trade completely depends on the exchange rate. These two variables are directly influencing inflation in this 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.

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That leads to trade openness highly influencing the GDP than other two variables. It implies that the exchange rate and forex reserves in these countries are mostly used 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 bring more investments 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 gives 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 contr the inflation and the sacrifice ratio is used as disinflationary process. The study gives an important insig n the sacrifice ratio of BRICS nations. In the study period all BRICS nations observed high inflation a w sacrifice ratio in 1998-2000. Because all these countries change their economic system and de libe policies in order to overcome inflation caused by series of crisis around the globe (example: sian crisis, ssian currency crisis etc.) and during the economic slowdown in 2008–2010 all BRICS na ns are tak very long disinflation period which gave high sacrifice ratio.

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