Monetary Policy and Growth in BRICS

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Abstract— This study examines the relationship between monetary policy and GDP in BRICS countries, namely, Brazil, Russia, India, China, and South Africa. Using data from 1981 to 2020, we employ a Johansen Co-Integration Test. The study also considers the role of money supply fluctuations in the transmission of shocks to GDP through an Impulse Response Function. The results of this study have important implications for central banks in BRICS countries. Policymakers should consider the effects of monetary policy on GDP and the role of exchange rate fluctuations in the transmission of monetary policy. Our finding suggest that expansionary monetary policy can stimulate economic growth in the short run, while contractionary policy can help control inflation. However, policymakers should also be cautious of the potential negative impact of exchange rate fluctuations on the transmission of monetary policy. Overall, this paper contributes to the literature on the effectiveness of monetary policy in emerging economies and provides insights into the unique challenges faced by BRICS countries in managing their monetary policies.

Index Terms- Money Supply, Inflation, GDP, Exchange Rate, Monetary Policy

I. INTRODUCTION

Experts first referred to the four major developing nations of Brazil, Russia, India, and China by the acronym 'BRIC', which was later altered to 'BRICS' to include South Africa. O'Neill (2001), a Goldman Sachs economist, invented it by first creating a heterography of the word 'brick' using the initials of the quartet. The organisation in question has a combined nominal GDP of more than US$ 16 trillion and a total foreign reserve worth US$ 4 trillion, so it is more than simply a wordplay.

BRICS have failed to come together, despite the fact that they are now a much bigger player in the global economy. Even on crucial matters like choosing Dominique Strauss-replacement Kahn's at the IMF, the BRICS countries were unable to present a convincing argument against the traditional viewpoint that the IMF should be led by a Western European. Nor have they been able to speak with one voice about the most important global economic and financial challenges – coordination of monetary and fiscal policies, macroprudential regulation, development aid etc (Cohen, 2013).

The resources, as well as the ideals and objectives, of the BRICS countries are quite different. The only thing they all have in common is that they are all BRICS members. While China and Russia lack democracy, Brazil and India do. China and India are net importers of hydrocarbons, while Brazil and Russia sell them. The only permanent members of the UN Security Council are China and Russia; the others are not. The BRICS countries differ significantly from one another in terms of financial system structure, income levels, education, inequality, and health issues (Mostafa & Mahmood, 2015). As a result, it is highly challenging to coordinate action and speak with one voice. It's hardly a disappointment that the BRICS haven't actually accomplished anything concrete yet.

This problem of in action will soon be overcome BRICS now have a clear leader that can address the issue of internal differences in goals and resources. BRICS is quickly becoming a China-led club. China's nominal GDP is currently more than the sum of the GDPs of the other club members, as opposed to 15 years ago (Dua & Upadhyaya, 2019). The same is true with net international financial position, outward foreign direct investment, and development aid. The long-discussed idea for a 'BRICS Bank' has now been realised thanks to China's leadership. The New Development Bank (NDB), the first significant regional development bank to be launched without the participation of OECD nations, was established by the BRICS.

The creation of NDB, which has its headquarters in Shanghai, indicates that international financial institutions should have been more adaptable in changing their administration to take into account the growing influence of BRICS (Bell, 2011). At least

initially, it seems unlikely that NDB will beat current development banks in terms of expertise and project quality. However, it will be the first real multilateral initiative that the non-OECD nations completely control. However, it is also telling that NDB is the sole visible BRICS project. NDB is thriving precisely because it fits into China's larger 'One Belt, One Road' or New Silk Road vision. In this regard, NDB serves as evidence that China currently controls the BRICS club, much like it does the Shanghai Cooperation Organization. While speaking on an equal footing at summits, the leaders of BRICS will always adopt China's strategy whenever they are up to something serious.

In terms of GDP, labour force, and consumer potential, the developing world continues to see significant growth rates. Industrialized nations are currently experiencing growth that is quite low. By 2050, the 'BRICS' group of countries, according to Goldman Sachs, will surpass the developed world as the richest states (Radulesca et al., 2014). Understanding the economic behaviour and effects of the rising economies is so vital. The 'BRICS' group has been the subject of numerous studies, but there have been relatively few in the area of monetary economics.

1.1 Money Supply and GDP in general

The entire amount of money and other liquid assets existing in an economy is referred to as the money supply. Cash and other deposit instruments that can be utilised just as easily as cash are both included in a nation's money supply.

Another figure that is frequently released by a nation's government is its GDP. The value of all the finished goods and services produced inside a nation's boundaries over a given period of time is calculated as the GDP. Typically, GDP is used as a comprehensive measure of a nation's overall economic health.

The GDP determined at current market prices is referred to as nominal GDP. Although this is not always the case, nominal GDP typically increases along with the money supply. Real GDP, also known as 'constant-price' or 'inflation-corrected' GDP, is a measure of a nation's GDP that accounts for inflation. Real GDP and the money supply don't necessarily go hand in hand. The productivity of economic agents and enterprises has a stronger tendency to affect real GDP.

1.1.1 Monetary Policy

A nation's money supply may be increasing for a variety of reasons. More money could be printed by national central banks. Banks may decide to reduce their liquidity ratio and thereby increase the amount of money they are ready to lend to individuals and companies. If a central bank purchases its currency from foreign exchanges to increase its foreign reserves, there may also be an influx of foreign cash. Through its operations, primarily the purchase of government securities, the government may also raise the amount of money in circulation. Investors who held the bonds now have more money to spend when the government purchases their bonds.

1.1.2 How the Money Supply Impacts Gross Domestic Product

Many macroeconomic theories predict that a rise in the money supply will result in lower economic interest rates. Increased borrowing opportunities result from an expansion of the money supply. According to the law of supply and demand, this increase in supply tends to drive down the cost of borrowing money. Consumption, lending, and borrowing rates all tend to rise when borrowing is more convenient. In the near run, higher rates of consumption, lending, and borrowing are associated with higher levels of expenditure, total economic output, and, presumably, GDP. Although this conclusion is anticipated and expected, it is not necessarily the outcome.

It is more challenging to foresee how a rise in the money supply will behave over the long term. The price of assets—such as homes and stocks—has a significant tendency to artificially rise after an increase in the money supply or anything else that causes a lot of liquidity to flow into the economy. This capital misallocation can result in wasteful and speculative investments, which can quickly increase asset prices and then cause a contraction or an economic recession, which is a sharp fall in economic activity.

On the other hand, if prices are not misallocated and asset prices do not artificially rise, it is feasible that an increase in the money supply will ultimately simply result in higher prices for consumers than they would have otherwise had to pay.

1.2 Relationship Between GDP and the Money Supply

A higher level of GDP is preferable to a lower level, even though it is not a perfect indicator of an economy's production and health. The GDP of a nation tells us how big its economy is, and one of the strongest predictors of long-term economic growth is the GDP growth rate. The trend in living standards through time is closely correlated with the GDP per capita measurement.

In general, the value of money in circulation rises when the GDP growth rate indicates increased economic productivity. This is so that each unit of cash can be later used to purchase more expensive goods and services.

Even if the amount of money in circulation does not decrease, economic development frequently has a naturally deflationary effect. The technology industry provides some proof of this tendency, as innovations and technological progress are outpacing inflation now and driving down prices for devices like televisions, cell phones, and computers.

1.3 Brazil

Brazil is the largest economy in Latin America and the ninth-largest economy in the world, with a gross domestic output of $1.87 trillion. Brazil has one of the fastest-growing economies in the world up until 2012. But since then, a number of problems have weighted on Brazil's economy, causing its growth rate to slow. Brazil actually went into recession in 2014 before starting a slow comeback.

Brazil's GDP increased by just over 1% by 2018. Along with facing moderate economic growth, the country is also up against corruption, which has undermined investor trust and poisoned the environment for investments. Brazil has also faced with high inflation and interest rates, while low commodity prices and weak demand have been issues.

Brazil has accomplished a lot despite the growth lulls. The levels of poverty and economic inequality in the nation steadily increased and decreased between 2003 and 2012. The World Bank reports that between 2003 and 2014, the income level of the poorest 40% of the population climbed on average by 7.1%, as opposed to a 4.4% increase in overall population income.

The dominance of the country's service sector, which accounts for over 63% of its GDP, is reflected in the structure of the Brazilian economy. Industry, which makes up the secondary sector and less than one-fifth of the GDP, since the 1990s, Brazil's agricultural sector has contributed about 5% of the nation's GDP. Since the difficult period and recession of 2014, Brazil has begun to recover. The nation in Latin America is likewise implementing necessary reforms in order to maintain its current growth trajectory. For successful growth rates in the coming years, increasing productivity, competitiveness, and investment are all essential.

1.3.1 Monetary Instruments

Brazil's growth pattern has been asymmetrical, with dips, sporadic slowdowns, and periods of very strong growth. Because of this, despite experiencing periods of rapid growth, Brazil's average growth rate for the 35 years starting in 1980 has been less than 3%. The economy of Brazil has been affected over time by numerous policies that have been implemented and their overall effects. The continued increase in bank investments in securities assets, particularly public bonds, which stepped forward to structurally occupy a prominent position in the banks' total assets and revenues, reinforced the contraction trend in credit operations that began between the years of 1995 and 1996 in response to the Central Bank's restrictive monetary policy (Moreira et al., 2021).

Following a trend that began at the start of the 1990s, banks were equally successful in preserving their levels of profitability by taking advantage of service revenues even during times when credit operations were on the decline. Since loans have been concentrated in the short term and financial leverage has reduced during periods of greater uncertainty, this process has verified the acting character of Brazilian banks and highlighted the risk aversion of these institutions. Therefore, open market operations

revenues have become increasingly important to banks' income, especially during the credit cycle's declining phase.

The expansion of credit didn't occur until after the first few months of 2003, mostly as a result of the macroeconomic environment's recovery and the new government's assurance that the economic policy, such as the Brazilian Customs System or the NCM policy framework, wouldn't alter (Adrogué, 2010). The explanation is that, although though the inflation-targeting regime was put in place back in 1999, it wasn't until the financial sector's credibility finally arrived with the decrease in macroeconomic instability. Thus, the onset of the new cycle ascending path has reacted to the recovery of a group of variables that have replied to the external accounts' notable improvement.

The decline in average expectations for the currency rate, inflation, and interest rates was influenced by a recent boom in capital flows to developing nations, a lack of risk aversion among foreign investors, and an upward trend in commodities prices. In order to increase their market share and profit margins, banks had to rethink their operational strategies, giving credit expansion priority. This was made necessary by the expansion of the trade balance, the liquidity cycle toward the periphery countries, and the ensuing expectations that the monetary authority would lower short-term interest rates.

Because of the high level of external fragility in developing countries like Brazil, the behaviour of the currency rate plays a significant role in convincing banks to alter the degree of their preference for liquidity. On the one hand, it has a direct impact on the price of outside finance. On the other hand, it made it possible for inflation and interest rates to fall. Due to financial innovations introduced by banks to expand the use of external liabilities, the first direct effect of the Brazilian credit boom of 2003 only became significant until 2007. In contrast, the second effect was crucial for accelerating the credit offer from the outset.

However, as 2008 progressed, banks had progressively more challenges in renewing their external credit lines, which supported operations involving the transfer of resources and foreign exchange swaps. In the end, Lehman Brothers' bankruptcy resulted in the cessation of external financial flow supporting domestic credit. Additionally, the need to cover the significant losses in the subprime mortgage markets required foreign banks to transfer money to the parent company, which required the liquidation of financial holdings. As a result, these institutions withdrew their participation in the Brazilian private financial system. As a result of the banks' cautious response and abrupt tightening of interbank lending in response to the expectations reversal, some banks—particularly the smaller ones—found it challenging to address their liquidity issues.

1.4 Russia

Before the commencement of the succeeding golden decade, the majority of the 1990s saw Russia's economic growth rate remain negative. Russia's GDP increased by at least 4.7% year from 1999 to 2008. Russia now has one of the economies that is expanding the quickest. However, the surge in commodity prices, particularly the price of oil, was the main driver of this development. The global financial crisis of 2008–2009 exposed Russia's reliance on oil, which gave the Russian economy a shock. As oil prices stabilised, the economy gradually recovered (Voskoboynikov & Solanko, 2014).

The Russian economy then expanded somewhat in 2011 and 2012, but in 2013 a slowdown brought on by emerging structural problems started to occur. The following several years saw the nation's economy continue to deteriorate as a result of a number of issues, including falling oil prices, geopolitical unrest, and sanctions imposed by the West as a result of its invasion of Ukraine. In 2015, its GDP shrank by 2%. However, it was able to increase every year from 2016 to 2018, after which it began to decline and fell to 2.7% in 2020. Russia's GDP grew at a pace of 4.7% in 2021, the greatest increase since 2008.

Russia is heavily dependent on energy and fuel production. The so-called fuel and energy complex in the nation entails the extraction, production, processing, distribution, and consumption of all forms of energy. These businesses provide support to numerous economic sectors, and the biggest exports of Russia are their goods.

To create a more balanced economy that is less subject to changes in commodity prices, Russia will probably need to diversify even further. Putting more of an emphasis on its industrial and service sectors could lead to more enduring long-term prosperity (Kudrin & Gurvich, 2015). Although the GDP composition demonstrates the growing significance of services, the majority of its economy is still based on oil exports.

1.4.1 Monetary Instruments

For Russia, the 1990s were a pivotal decade because it was then that its monetary policies underwent significant upheaval. A lot of things changed; banks were established; the Soviet Union had crumbled, and with it, the public's confidence. The Soviet Gosbank's Russian Republic branch office was transformed into the Central Bank of the Russian Federation (CBR) in June 1990, and the two institutions coexisted until the Soviet Union's dissolution in December 1991.

The only currency in the former Soviet Republics up until the mid-1990s was the ruble, and the ties between the central banks of those nations and CBR were identical to those that existed between the Soviet Gosbank's Moscow headquarters and its head branch offices in the former Soviet Republics. While they were unable to print Ruble banknotes, the central banks of the former Soviet republics were able to independently lend Ruble to their local governments and businesses. CBR didn't have any efficient controls on these central banks' loan supplies until the middle of the 1990s, nor was it motivated to do so (Nakamura, 2016). However, in this circumstance, inflation was impossible to manage. In July 1993, CBR demonetarized old-face banknotes and produced new-face banknotes to combat inflation. The Russian home economy was confused by this fairly hurriedly implemented move, but it nonetheless prompted the central banks of the former Soviet republics to establish correspondent relationships with CBR. The contracts were a useful tool for CBR in regulating the amount of loans provided in rubles by the central banks of the former Soviet Republics. The ex-Soviet Republics eventually started using their own currencies instead of the ruble because there were few advantages to continuing to do so.

After 1992, CBR continued to offer soft loans to assist businesses experiencing financial difficulties. The International Monetary Fund loaned money to CBR and the Ministry of Finance in May 1993, and it was formally announced that they would adopt a tougher monetary policy at that time. However, the state of domestic politics remained unsettled. It was not simple to conduct a rigid monetary policy because it was surely unpopular among the Russian industries and people. In actuality, CBR continued to administratively distribute CBR loans with low or even negative real interest rates. Beginning in February 1994, CBR began distributing a portion of its loans through auctions, which mandated that the lowest interest rate submitted be greater than the interbank rate. Although not frequently used, auctions marked the beginning of the transition from central bank loans being distributed administratively to the capital market managing money. The administrative allocating of CBR loans was totally terminated in the second half of 1994, and the real interest rate of the CBR loans turned positive.

After these developments, a monetary and financial system resembling that of a market economy started to operate in the Russian Federation in or around 1995. The 1990-enacted CBR Act was replaced in April 1995 by the new CBR Act, which established the institutional and legal framework for financial oversight and the application of monetary policies typical of market economies (Baliño, 1997). Real loan rates turned positive in mid-1995, and inflation finally started to decline. But the banking industry included well over 2,000 very small banks with shaky commercial foundations. The financial supervision authorities also lacked experience. Many financial firms filed for bankruptcy as a result of the financial crisis in 1998 brought on by the default of government bonds (Vdovichenko & Voronina, 2006). After 1999, high oil prices helped Russia's economy recover. In this environment, efforts were made to reform the financial industry and the financial and monetary system in order to create a successful capital market.

1.5 India

Since 2000, India's economy has experienced some of the world's fastest growth. In terms of nominal GDP, it has the fifth-largest economy in the world.

India's GDP expanded overall at a pace of 5% in 2019. Strong demand for the nation's goods and services, along with a high level of industrial activity, were the main drivers of this rise. The country, which once gave cotton and tea to Britain, now has a varied economy, with the service sector driving much of the activity and growth. India is currently seen as 'player' in the realm of global economics. India's economy in 2020–2021 was significantly harmed by the COVID-19 pandemic response. India's GDP fell by about 24% in the second quarter of 2020 compared to the same period in 2019, as COVID-19-related restrictions on all non-essential companies severely reduced economic activity.

The government put a lot of effort into growing the heavy industry sector, but eventually this focus was seen as unsustainable. India started to relax its economic constraints in 1991, and the country's private sector expanded as a result of increased liberalisation. India is now regarded as having a mixed economy because the private and state sectors coexist there and because it makes use of foreign trade.

As of 2020, agriculture, which was once India's primary industry and source of income, made up about 18.32% of the GDP. Analysts have noted that this downturn should not be interpreted as a reduction in production, nevertheless. Instead, it is a reflection of the substantial growth in India's industrial and service outputs. In India, the service sector has grown from making up a small portion of the GDP to nearly 55% between 2019 and 2020 over the past 60 years. India is an excellent site for business because of its large population of educated, skilled, and English-speaking individuals. The manufacturing of power and tourism are further components of India's service sector. Although the nation still heavily relies on fossil fuels like coal, oil, and gas, it is expanding its ability to create nuclear, wind, solar, and hydroelectric power.

India has emerged as a major economic force in the twenty-first century. More than 90 million people in India were lifted out of extreme poverty between 2011 and 2015, in large part because of the country's strong economic growth, which raised people's living conditions nationwide. India is one of the fastest-growing economies among the major emerging markets. Investors from all around the world have started to focus on it.

1.5.1 Monetary Policy and Money Supply

Early Indian monetary policy was designed to finance budgeted expenditures and budget deficits. Monetary policy would initially aid in drought relief during an agricultural shock before becoming tighter just as the lag demand consequences of an agricultural downturn were beginning to affect industry (Goyal, 2011). Ordinarily, administered oil and food prices were increased when monetary tightness reduced inflation rates. Procyclical macro policies resulted as a result, but widespread administered pricing reduced volatility.

Between 1965 and 1967, a severe drought and shocks to the terms of trade caused a budgetary tightening that resulted in a decrease in public investment and deficits. A credit-targeting approach to monetary policy was unforgiving but not harsh. Due to the automatic financing of the budget deficit, fiscal and monetary policies were closely correlated. After the oil price and agricultural supply shock between 1973 and 1975, harsh monetary and fiscal policies were implemented. There was an unnecessary loss of output in both situations. It would have been more productive to concentrate on maintaining supply. Following the oil shock of 1979–1980, the reduction in public investment and severe monetary tightness were avoided. Although the recovery was quick, deficits and supply-side deficiencies were growing.

Instead of increased money creation, political business cycles in India primarily took the shape of reductions in long-term development spending and actions that affected allocative efficiency. The future was given up to appease populism in the here and now. Because of these decisions, Indian inflation remained low by developing nation standards, but it was persistent, higher than global inflation rates, and it reduced the country's potential growth rates.

The prevailing development paradigm has altered to favour openness since the 1970s. The negative impacts of regulations were also becoming clear in India. A little amount of liberalisation began in the middle of the 1980s, but the mid-1991 balance of payments

crisis, when foreign exchange reserves were only good for 11 days of imports, gave rise to a substantial push for external openness. The financial crisis and a number of domestic frauds made it clear that limiting credit and enforcing strict interest restrictions were harmful to economic growth and stability. It enabled the implementation of several unfinished committee reports.

Price stability and growth remain the primary goals of monetary policy, but in accordance with the Chakravarty Committee's (RBI 1985) recommendations, from the middle of the 1980s until 1997-1998, the intermediate target shifted from credit controls to flexible monetary targeting with 'feedback' from inflation and growth (Dua, 2020). M3 expansion served as a nominal anchor, but reserve money was the operating goal. The main operational tool was the cash reserve ratio (CRR), together with the continuous use of some selected credit controls. However, in the 1990s, as the economy became more open due to financial market deregulation and liberalisation, money demand became more unstable and money supply became more endogenous. Wide departures from the intended money supply targets occurred repeatedly. The RBI acknowledged that when the demand function of money became unstable, it was reasonable to anticipate that monetary policy would be imprecise.

Interest rates were unstable in the 1990s, and flexible nominal money supply targeting proved ineffective in the face of these shifts. Following the negative effects of the interest rate peak of the 1990s, the Reserve Bank transitioned to an interest rate-based operating method and based its decisions on a range of monetary conditions indicators, including forward-looking anticipation surveys. In April 1998, it formally adopted a 'multiple-indicator strategy' after making informal modifications to practise in the middle of the 1990s (Dash & Goyal, 2000).

Although there was no formal inflation targeting, policy announcements listed growth facilitation and inflation control as their main goals. Future inflation and growth were influenced by the various indicators. The desired rate of inflation was specified at 5%, with the long-term goal of lowering it even further.

1.6 China

Following Deng Xiaoping's introduction of free-market reforms and departure from a rigidly planned economy in 1978, the Chinese economy underwent rapid transition and had extremely quick growth. For decades, private entrepreneurship fuelled urbanisation and growth, but the rate has slowed recently due to government restrictions on these businesses and the persistent dominance of state-owned enterprises in the economy (Roberts & Russell, 2019).

Infrastructure development, urbanisation, a rise in per capita income, and a significant change in the composition of China's GDP have all resulted from the country's transformation from a poor nation centred on subsistence farming to one with a highly industrialised economy and a sizable services sector (Clark et al., 2017). Notably, China is now classified by the World Bank as 'an upper-middle-income country'.

China continues to be a global leader in manufacturing, but it also has a sizable and rapidly expanding service industry. By 2020, the services industry in China made up 54.5% of the country's GDP, up from 44.2% a decade earlier. Contrarily, throughout the same time period, the once-dominant agriculture sector saw its share of the nation's GDP decline from 9.3% to 7.7%.

China continues to be the world's top agricultural producer, followed by India, despite the fact that agriculture now makes up less than 8% of its GDP. China's agriculture has seen changes as a result of the economic reforms of 1978. Four out of every five Chinese people used to work in agriculture. This changed as private farming was encouraged and small companies in rural regions grew as a result of property rights. 39.4% of China's GDP in 2021 came from the industry sector, which comprises manufacturing, construction, mining, and utilities. Over the past two decades, the service sector in China has more than doubled its contribution to economic output, accounting for 53.3% of GDP in 2021. In 2013, it surpassed the industrial sector.

Prior to 2010, China's real gross domestic product regularly increased by more than 10% each year.

However, the COVID-19 epidemic caused growth to dip to 6% in 2019 and 2.3% in 2020. After that, growth increased to 8% in 2021. Early in 2022, COVID-19 lockdowns in large metropolitan areas under a zero-tolerance policy continued to restrain growth.

1.6.1 Money Supply

Government officials keep a careful eye on the money supply and take the required steps that are appropriate for the entire economy or for specific sectors. Because of China's own economic system, its monetary policies depart from those practised by other nations. China has a trade surplus because its economy is based on manufacturing and exports. More is sold to the world than is bought. Chinese exporters get paid in dollars for their exports, but they must use local money, such as the yuan or the renminbi, to cover local costs and salaries (He, 2017). The rate of yuan can increase against the U.S. dollar because of the enormous supply of dollars and the demand for yuan. If that occurs, Chinese exports become more expensive and lose their advantage in terms of competitive pricing on the global market. This is an issue for the Chinese economy since it could lead to decreased or no sales of manufactured goods, high levels of unemployment, and stagnation of the economy. To prevent this, the PBOC, the central bank of China, steps in and artificially lowers currency rates.

China's money supply has consistently increased in recent years. The GDP of China has expanded in proportion to the money supply. Because China's export-driven economy operates differently from other nations' economies, the relationship between its currency and economy is intriguing (He, 2017). Major changes led by the Chinese government between 2010 and 2020 have enhanced China's market orientation and opened up the Chinese economy.

During this time, a number of resources have been made marketable and made available to consumers, which has drawn significant foreign investment. The resources include labour and human capital as well as manufactured commodities, infrastructure, technology, and natural resources. The demand for Chinese currency has surged, stimulating commercial bank lending and ultimately increasing the money supply. Over the previous ten years, the money supply has dramatically increased. China effectively controlled the expanding money supply during periods of rapid and steady economic growth while maintaining stable exchange rates.

The bank raises the amount of domestic currency available, increasing the likelihood of high inflation. The PBOC sells the necessary quantity of domestic currency bonds, which removes the extra cash from open markets, in order to reduce the amount of surplus money supply. When necessary, the PBOC also purchases domestic currency bonds to inject cash into the markets.

Another measure used by China is currency printing. Yuan can be printed by the PBOC as needed; however, this can result in significant inflation. China, however, has strict state-dominated economic regulations, which give it the ability to control inflation in a different way than other nations. Subsidies and other price-control mechanisms are modified in China in order to curb inflation. China has created its own procedures to maintain a firm hold on its economy as a mix of a socialist and free-market economy. As a well-known financial superpower, China is expanding its economy under carefully monitored conditions.

1.7 South Africa

South Africa has improved the wellbeing of its inhabitants significantly since switching to democracy in the middle of the 1990s, but this progress has halted over the last ten years. Between 2005 and 2010, the proportion of the population living below the upper-middle income country poverty line decreased from 68% to 56% (Dingela & Khobai, 2017). Since then, however, it has trended slightly upward, reaching 57% in 2015 and is expected to reach 60% in 2020.

Progress in eradicating poverty has been hampered by structural issues and slow growth, which has been made worse by the COVID-19 epidemic. Rising unemployment, which hit an all-time high of 35.3% in the fourth quarter of 2021, severely restrains the advancement of household welfare. Youths between the ages of 15 and 24 have the greatest unemployment rate, which is roughly 66.5%.

With a consumption expenditure Gini coefficient of 0.67 in 2018, South Africa's dual economy continues to have one of the highest and most enduring rates of inequality in the world. A history of exclusion and the nature of economic growth, which is not pro-poor and does not produce enough jobs, both contribute to high inequality. Inequalities are passed down from generation to generation with little change over time since wealth inequality is much larger and intergenerational mobility is poor (Arora & Vamvakidis, 2005).

Even though it is recovering from the COVID-19 epidemic more slowly than anticipated, the South African economy is still forecast to rise by 1.9% in 2022. In the first half of 2022, employment growth increased, but the labour market condition remained difficult. While inflation has risen to a 13-year high, poverty has reached levels that have not been seen in more than ten years. In order to ensure stronger growth results and the reduction of poverty, ongoing reforms and investments are needed despite the risky outlook. With only an average 1% growth between 2012 and 2021, the South African economy was already in a precarious situation when it entered the pandemic, which caused an overall 5.6% decline in GDP per capita. Long-standing structural restrictions, such a lack of electricity, are still in place. The licence requirement for integrated energy generation was raised in 2021, among other significant measures to eliminate structural barriers to growth over the medium term. As a significant net exporter of minerals and a net importer of oil, commodity prices continue to be significant for South Africa. For growth to be accelerated and employment to be created, investment, including foreign direct investment, must be strengthened.

1.7.1 Monetary Policy and Money Supply

Price changes are frequently the result of external supply shocks or modifications to other governmental policies, which a central bank has no control over and cannot stop. Some of the nation using inflation targeting have made an effort to recognise these trends that cannot be promptly reversed by monetary policy actions and to exclude them from their inflation targets. For instance, they modify the price index they use for targeting in order to account for indirect taxes, the impact of droughts and other climatic circumstances on food prices, and changes in the price of commodities globally.

The South African Reserve Bank has chosen to stay away from inflation targeting due to these difficulties, the complexity of the transmission mechanism of monetary policy, and the lengthy lags associated with monetary policy interventions. However, the primary goal of South Africa's monetary policy is to bring domestic inflation rates into line with the average rates of inflation in its main trading partners and foreign rivals (Mpofu, 2011). However, no official pledges are made in this policy statement regarding the quantitative inflation rate, the price index involved, or the precise time frame the central bank expects to achieve this goal.

The Reserve Bank publishes detailed money supply guidelines early in each calendar year to give advance notice of the probable stance of monetary policy. The growth in the money supply is a key factor in the inflation process, and the more predictable monetary policy is, the easier it is for private-sector businesses to make business decisions. Additionally, it serves as a benchmark against which the actual effectiveness of monetary policy can be assessed.

M3 is the money supply aggregate that is used in South Africa to define the intermediate goal of monetary policy. This complete total includes all current banknotes, coins, and domestic private sector deposits at financial institutions (Nell, 2000). Because M3 is the money supply aggregate with the most stable link to domestic demand and is unaffected by deposit changes between different maturities, the Reserve Bank chose to use it for this purpose.

1.8 Conclusion

The BRICS are confronted with divergent macroeconomic conditions as a result of the differences in monetary and fiscal policy support. They are currently heading into a positive growth zone since Q2:2021, notably after the epidemic while China's recovery has been rapid and robust. Greater discrepancies characterize results of inflation. China has managed to keep retail inflation low despite strong producer price inflation, while commodity exporters Brazil and Russia are facing inflation rates that are significantly higher than target and tolerance levels.

Inflation in South Africa is within the desired range. The upper tolerance band for inflation in India was broken in May, but effective supply-side policies, such as increased access to imports and buffer inventories, as well as efforts to encourage productivity, have had an impact and brought inflation near to target in September and October 2021.

In terms of their monetary policy frameworks, the BRICS share a great deal in common. Four of them have started targeting inflation. All of the numerical targets, with the exception of Russia, which wants to keep inflation close to 4%, include tolerance ranges that vary from 4%. South Africa follows an inflation target range of 3-6% rather than a specific point objective. China does not use inflation targeting but instead maintains low and stable inflation of less than 3%. More recently, the normalization of policy accommodation between Brazil and Russia has been accomplished, and Brazil is now engaging in orthodox tightening. South Africa, China, and India still adhere to liberal monetary policy positions.

II. METHODOLOGY

2.1 Johansen Co-Integration Test

Johansen co-integration methodology is used to test the co-integration between variables based on the Vector Auto Regression (VAR) model. The VAR model is given as follows (Johansen & Juselius, 1990);

$$Z_t = II_1 Z_{t-1} + \dots + II_j Z_{t-j} + \phi D_t + \varepsilon_t \quad (1)$$

The equation (1) can be reformulated again as Vector Correction model illustrated below (Johansen, 1992):

$$\Delta Z_t = IIZ_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Z_{t-j} + \phi D_t + \varepsilon_t \quad (2)$$

Where;

$$II = \sum_{i=1}^{p} \pi - 1 \text{ and } \Gamma_i = -\sum_{j=i+1}^{p} II_j \quad (3)$$

The results of the co-integration are related with the rank of II. If the rank of II is zero; there is no linear combination related with Z_t. If the rank of II is 1 which means that there is a linear and independent combination among variables. If the rank of II is bigger than 1, it means there are co-integrating vectors between variables.

The co-integration relationship between variables can be tested by two tests which are Trace and Maximum Eigen-value Test. These tests examine the existence of co-integrated vectors. The Trace Test is illustrated below:

$$\text{Trace} = -T \sum_{i=q+1}^{n} \ln (1 - \bar{\lambda} i) \quad (4)$$

Where; $\bar{\lambda}_{r+i}, \dots, \bar{\lambda}_n$ are n-q of smallest squared conical between Z_{t-j} and ΔZ_t series. The alternative test is Maximum Eigen-value test which is shown below;

$$L - \max = -T \ln (1 - \bar{\lambda}_{q+1}) \quad (5)$$

This test statistics compares the q co-integrating vectors; $r \leq q$ and the alternative is $r \leq q+1$.

2.2 Impulse Response Function

Impulse response functions represent the mechanisms through which shocks spread over time. We consider the Wold representation of a covariance stationary VAR(p),

$$Y_t = C(L)\, \varepsilon_t$$
$$= \sum_{i=0}^{\infty} C_j\, \varepsilon_{t-i} \quad (6)$$

The matrix C_j has the interpretation

$$\partial Y_t / \partial \varepsilon'_{t-j} = C_j \quad (7)$$

or

$$\partial Y_{t+j} / \partial \varepsilon'_t = C_j \quad (8)$$

That is, the row *i*, column *k* element of C_j identifies the consequences of a unit increase in the *k*th variable's innovation at date *t* for the value of the *i*th variable at time $t + j$ holding all other innovation at all dates constant.

2.3 Cumulated impulse response functions

Suppose Y_t is a vector of trending variables (i.e., log prices and output) so we consider the first difference to reach stationarity. So, the model is

$$\Delta Y_t = (1 - L) Y_t = C(L)\varepsilon_t \quad (9)$$

We know how to estimate, interpret, and conduct inference on C(L). But if we are interested in the response of the levels of Y_t rather than their first differences (the level of and prices rather than their growth rates). To find these responses we transform the model

$$Y_t = Y_{t-1} + C(L)\varepsilon_t \quad (10)$$

The effect of ε_t on Y_t is C_0. Now substituting forward, we obtain

$$Y_{t+1} = Y_{t-1} + C(L)\varepsilon_t + C(L)\varepsilon_{t+1}$$
$$= Y_{t-1} + C_0\varepsilon_{t+1} + (C_0 + C_1)\varepsilon_t + \dots \quad (11)$$

and for two periods ahead

$$Y_{t+2} = Y_{t-1} + C(L)\varepsilon_t + C(L)\varepsilon_{t+1} + C(L)\varepsilon_{t+2}$$
$$= Y_{t-1} + C_0\varepsilon_{t+2} + (C_0 + C_1)\varepsilon_{t+1} + (C_0 + C_1 + C_2)\varepsilon_{t+1} \dots \quad (12)$$

So, the effect of ε_t on Y_{t+1} is $(C_0 + C_1)$ and on Y_{t+2} is $(C_0 + C_1 + C_2)$. In general, the effects of ε_t on Y_{t+j} are

$$\tilde{C}_j = C_0 + C_1 + ... + C_j$$

defined as cumulated impulse response functions.

III. DATA ANALYSIS

3.1 Johansen Co-Integration Test

We run the Johansen cointegration tests using the trace test stochastic matrices and the long-run structural modelling. The procedure offers robust outcomes, especially when the variables exceed more than two. To accomplish this procedure, we used RStudio. We check the test values and the values at 5% significance level. Accordingly, we determine the number of variables on which cointegration exists by it being (n-1) variables.

i. Brazil

Values of test statistic and critical values of test:

```
       test  10pct  5pct  1pct
r <= 3 |  3.72   7.52  9.24 14.97
r <= 2 | 20.67* 17.85 19.96 27.60
r <= 1 | 36.53* 32.00 34.91 43.07
r = 0  | 58.76* 49.65 53.12 62.16
```

The cointegration outputs for Brazil are shown above, the asterisks show a significance level at 5%, where the trace tests indicate that, at least, two cointegrations exist by rejecting the H_0 which stated that there is no cointegration (r = 0) but cannot reject r = 1 and r = 2. Therefore, there are two significant cointegrating relationships among the variables.

ii. Russia

Values of test statistic and critical values of test:

```
       test  10pct  5pct  1pct
r <= 3 |  3.74   7.52  9.24 12.97
r <= 2 |  9.65  17.85 19.96 24.60
r <= 1 | 36.70* 32.00 34.91 41.07
r = 0  | 69.28* 49.65 53.12 60.16
```

The cointegration outputs for Russia are shown above, the asterisks show a significance level at 5%, where the trace tests indicate that, at least, one cointegration exists by rejecting the H_0 which stated that there is no cointegration (r = 0) but cannot reject r = 1. Therefore, there is one significant cointegrating relationship among the variables.

iii. India

Values of test statistic and critical values of test:

```
       test  10pct  5pct  1pct
r <= 3 |  4.44   7.52  9.24 12.97
r <= 2 | 11.77  17.85 19.96 24.60
r <= 1 | 35.81* 32.00 34.91 41.07
r = 0  | 69.75* 49.65 53.12 60.16
```

The cointegration outputs for India are shown above, the asterisks show a significance level at 5%, where the trace tests indicate that, at least, one cointegration exists by rejecting the H_0 which stated that there is no cointegration (r = 0) but cannot reject r = 1. Therefore, there is one significant cointegrating relationship among the variables.

iv. China

Values of test statistic and critical values of test:

```
       test  10pct  5pct  1pct
r <= 3 |  2.51   7.52  9.24 12.97
r <= 2 | 22.38* 17.85 19.96 24.60
r <= 1 | 37.58* 32.00 34.91 41.07
r = 0  | 57.34* 49.65 53.12 60.16
```

The cointegration outputs for China are shown above, the asterisks show a significance level at 5%, where the trace tests indicate that, at least, two cointegrations exist by rejecting the H_0 which stated that there is no cointegration (r = 0) but cannot reject r = 1 and r = 2. Therefore, there are two significant cointegrating relationships among the variables.

3.1.5. South Africa

Values of test statistic and critical values of test:

```
       test  10pct  5pct  1pct
r <= 3 |  3.33   7.52  9.24 12.97
r <= 2 | 16.59  17.85 19.96 24.60
r <= 1 | 37.47* 32.00 34.91 41.07
r = 0  | 57.65* 49.65 53.12 60.16
```

The cointegration outputs for India are shown above, the asterisks show a significance level at 5%, where the trace tests indicate that, at least, one cointegration exists by rejecting the H_0 which stated that there is no cointegration (r = 0) but cannot reject r = 1. Therefore, there is one significant cointegrating relationship among the variables.

Notice here that the availability of cointegration among the variables implies that to some extent the variables are interdependent on one another and are highly integrated as if they are components of one integrated region. Thus, the coefficients of the cointegrating equation encompass useful information of whether the previous values influence the present values of the variables in the long run. Non-cointegration, in principle, would imply that the influence of these variables together in the long term is zero, while cointegration entails that each variable contains a sort of information (variable) on the projection of the others. Hence, the presence of cointegration is sufficient evidence to suggest that the variables are interdependent. That is to say, there is a certain relationship that exists among the variables.

3.2 Impulse Response Function

3.2.1 Brazil

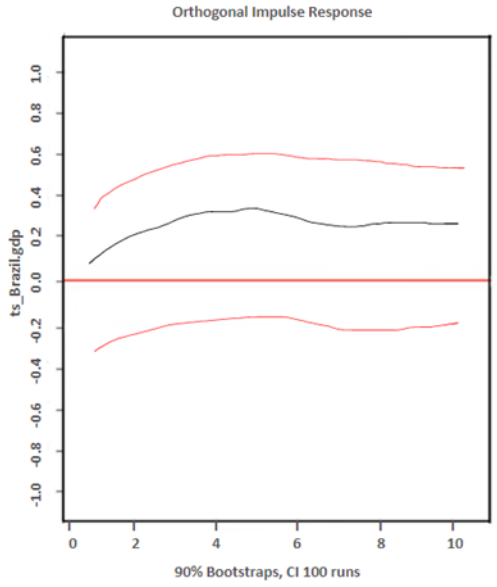

Figure 1 GDP of Brazil when Money Supply is shocked

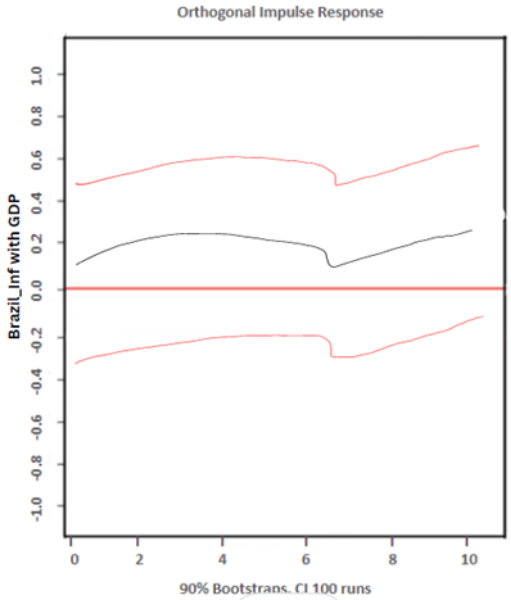

Figure 2 GDP of Brazil when Inflation is shocked

There's a positive impact of Money Supply on GDP in the case of Brazil. Indicating that with a rise in the money supply the GDP of Brazil will increase.

In the case of shocking Inflation to check its impact on GDP a similar positive impact was seen, increasing inflation showed an increase in GDP.

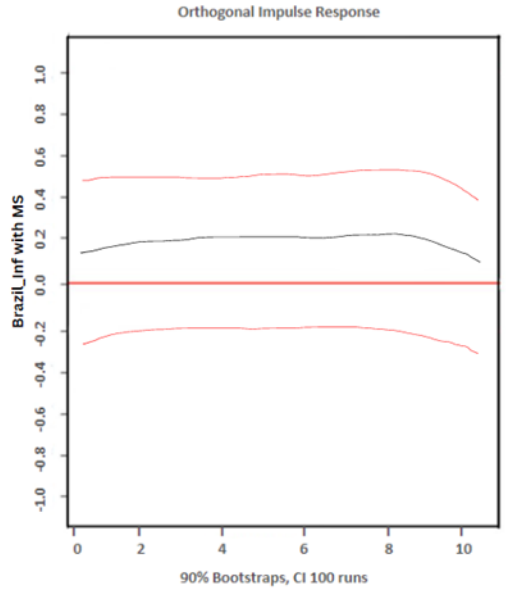

Figure 3 Inflation of Brazil when Money Supply is shocked

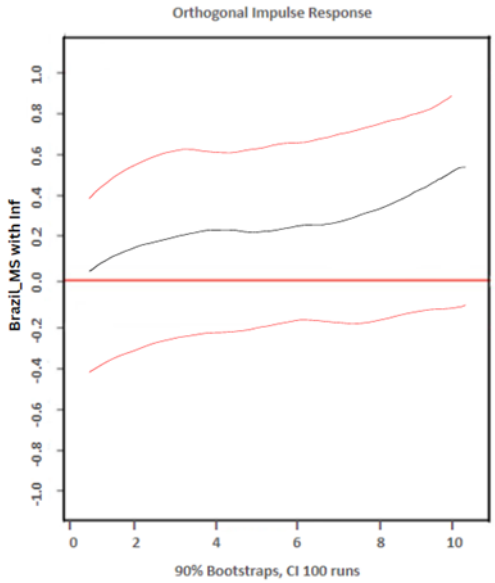

Figure 4 Money Supply of Brazil when Inflation is shocked

When Inflation was shocked in response to Money Supply, we saw a positive impact and vice-versa.

3.2.2 Russia

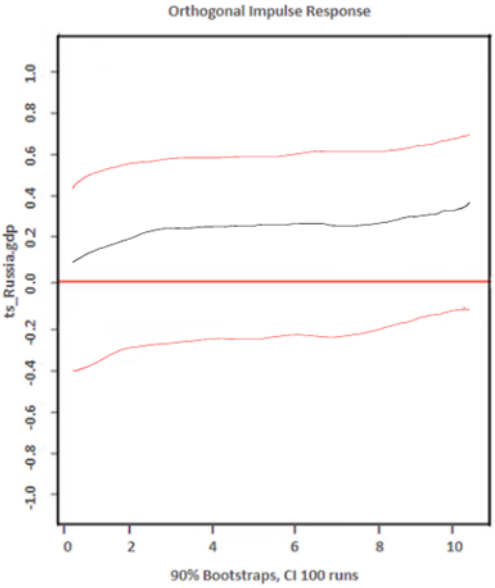

Figure 5 GDP of Russia when Money Supply is shocked

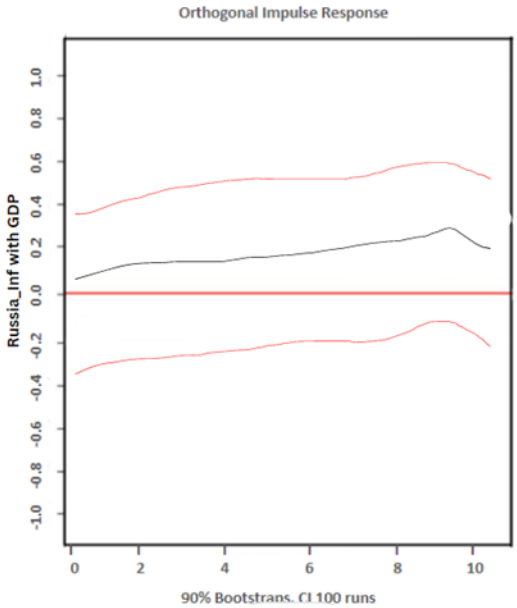

Figure 6 GDP of Russia when Inflation is shocked

There's a positive impact of Money Supply on GDP in the case of Russia. Indicating that with a rise in the money supply the GDP of Russia will increase.

In the case of shocking Inflation to check its impact on GDP a similar positive impact was seen, increasing inflation showed an increase in GDP.

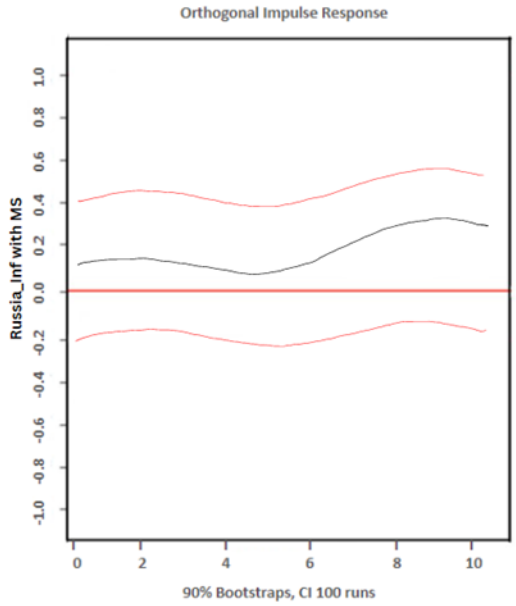

Figure 7 Inflation of Russia when Money Supply is shocked

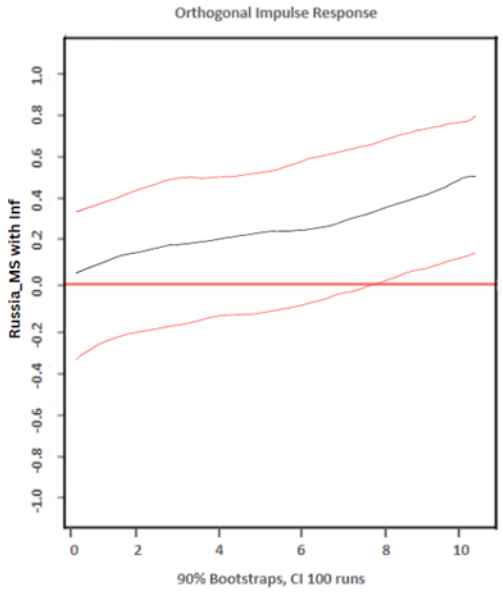

Figure 8 Money Supply of Russia when Inflation is shocked

When Inflation was shocked in response to Money Supply, we saw a positive impact and vice-versa.

3.2.3 India

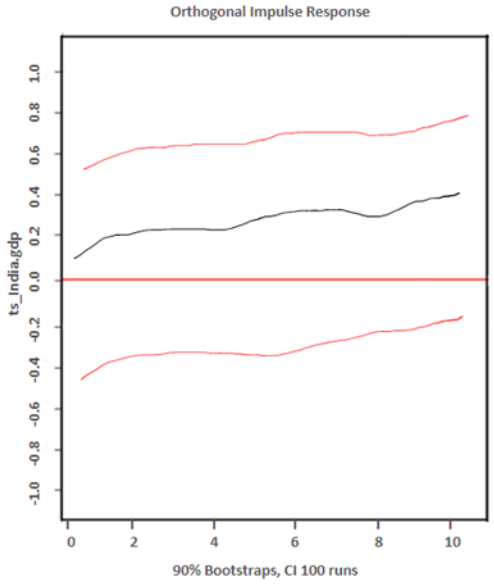

Figure 9 GDP of India when Money Supply is shocked

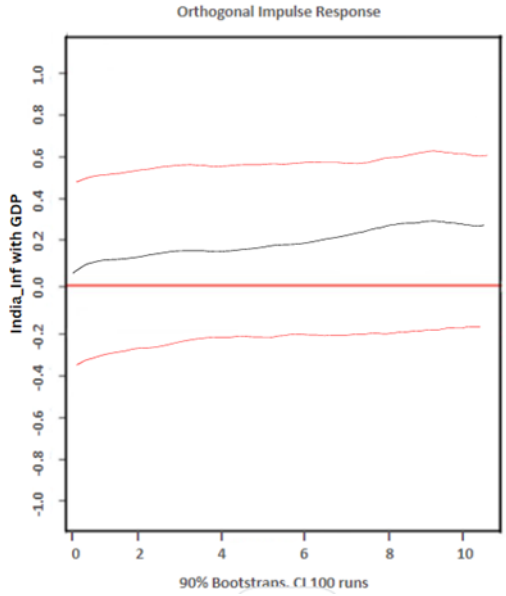

Figure 10 GDP of India when Inflation is shocked

There's a positive impact of Money Supply on GDP in the case of India. Indicating that with a rise in the money supply the GDP of India will increase.

In the case of shocking Inflation to check its impact on GDP a similar positive impact was seen, increasing inflation showed an increase in GDP.

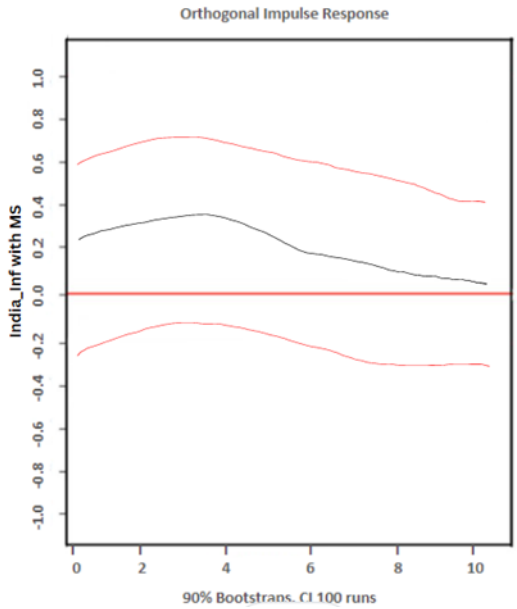

Figure 11 Inflation of India when Money Supply is shocked

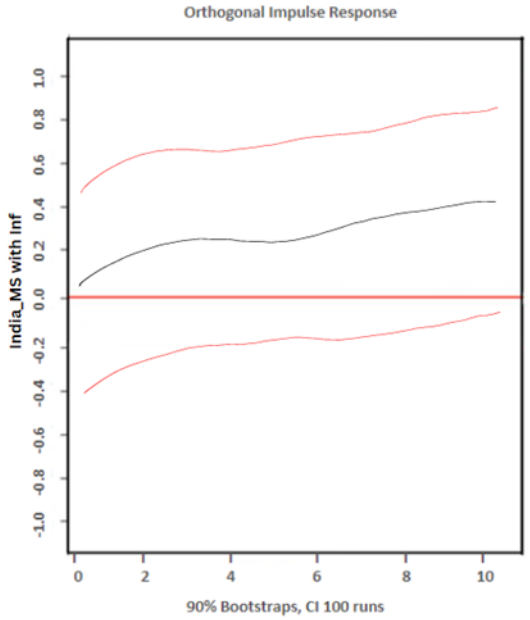

Figure 12 Money Supply of India when Inflation is shocked

When Inflation was shocked in response to Money Supply, we saw a positive impact and vice-versa.

3.2.4 China

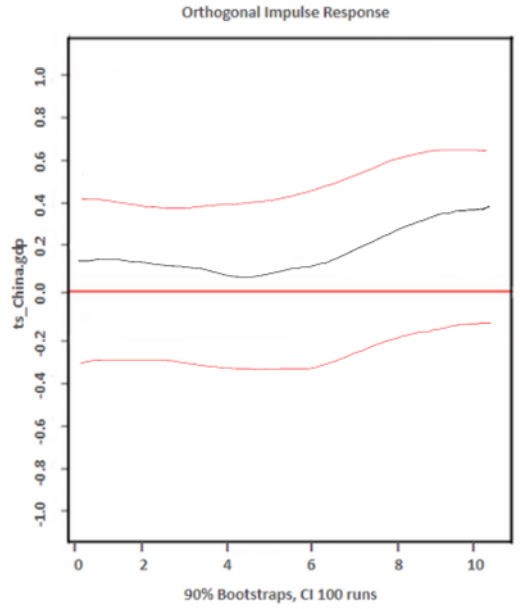

Figure 13 GDP of China when Money Supply is shocked

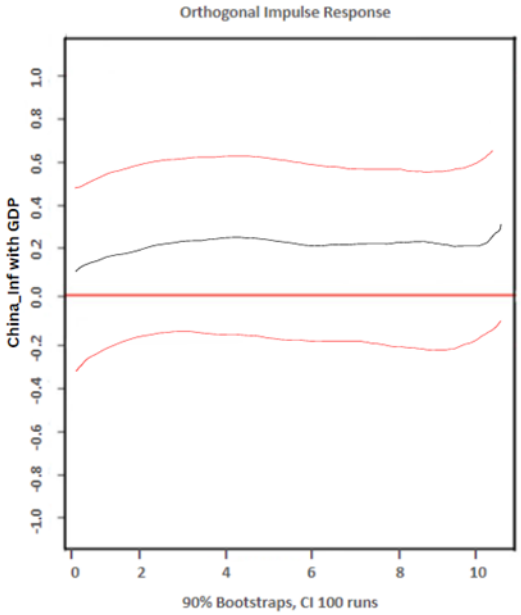

Figure 14 GDP of China when Inflation is shocked

There's a positive impact of Money Supply on GDP in the case of China. Indicating that with a rise in the money supply the GDP of China will increase.

In the case of shocking Inflation to check its impact on GDP a similar positive impact was seen, increasing inflation showed an increase in GDP.

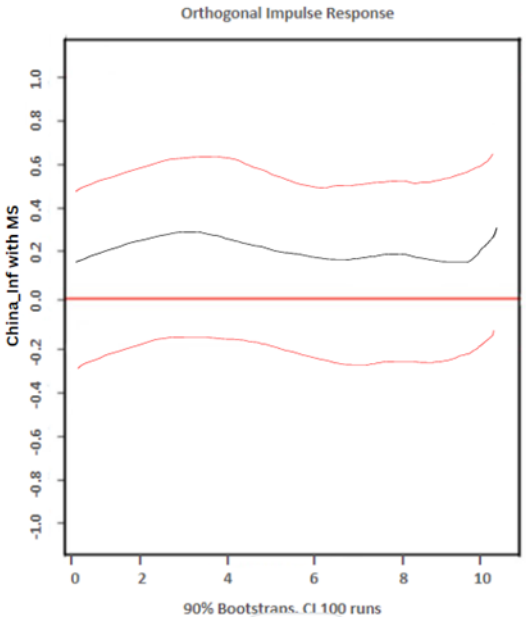

Figure 15 Inflation of China when Money Supply is shocked

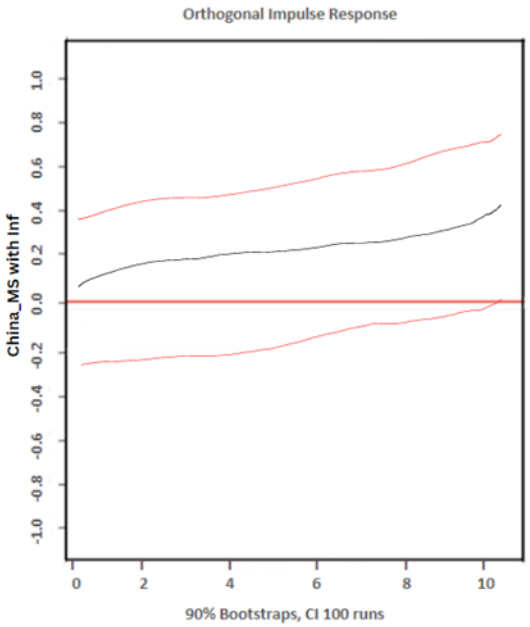

Figure 16 Money Supply of China when Inflation is shocked

When Inflation was shocked in response to Money Supply, we saw a positive impact and vice-versa.

3.2.5 South Africa

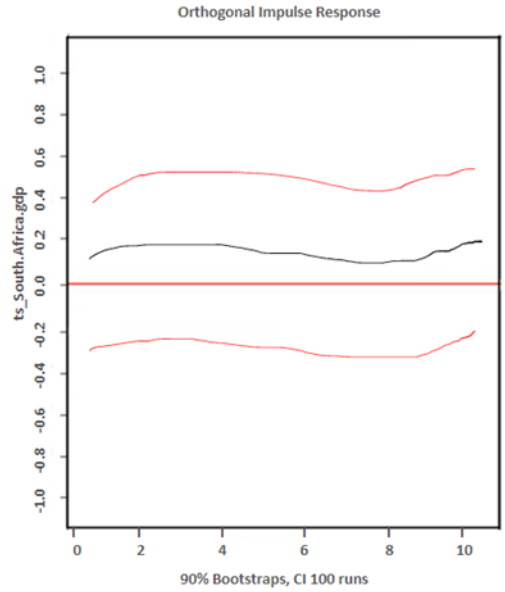

Figure 17 GDP of SA when Money Supply is shocked

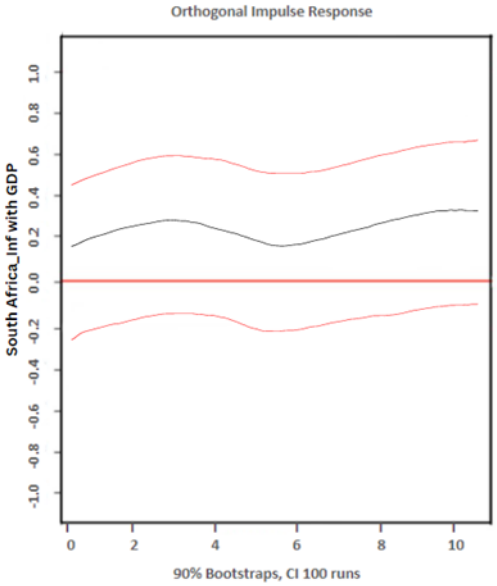

Figure 18 GDP of SA when Inflation is shocked

There's a positive impact of Money Supply on GDP in the case of South Africa. Indicating that with a rise in the money supply the GDP of South Africa will increase.

In the case of shocking Inflation to check its impact on GDP a similar positive impact was seen, increasing inflation showed an increase in GDP.

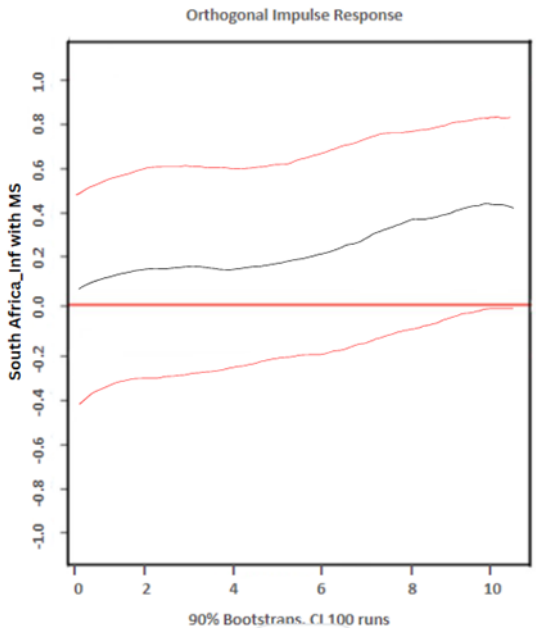

Figure 19 Inflation of SA when Money Supply is shocked

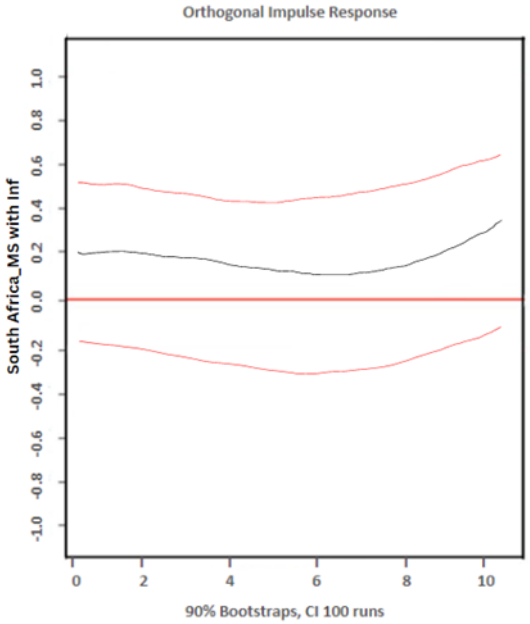

Figure 20 Money Supply of SA when Inflation is shocked

When Inflation was shocked in response to Money Supply, we saw a positive impact and vice-versa.

CONCLUSION

Inflation and economic production, or GDP, have a very delicate dance-like relationship. An important factor for stock market investors is annual GDP growth. Most businesses won't be able to improve their earnings if general economic activity is dropping or even holding steady (which is the primary driver of stock performance). Nevertheless, excessive Economic growth is also risky since it almost certainly accompanies an increase in inflation, which reduces the value of our money and undermines stock market gains.

Throughout time, inflation is brought on by Economic growth. If inflation is not controlled, it could develop into hyperinflation. Once established, this procedure can easily develop into a feedback loop that reinforces itself. This is due to the fact that people will spend more money in an environment where inflation is on the rise since they are aware that it would lose value over time. In the short run, this results in additional rises in GDP, which in turn produces additional price increases. Moreover, inflation's impacts are not linear. Hence, inflation of 10% is more than twice as damaging as inflation of 5%.

The money supply of a country is a major contributor to whether inflation happens. A government implements specific monetary and fiscal policies to advance the long-term welfare of its citizens as it assesses economic conditions, price stability objectives, and public unemployment. These monetary and fiscal measures could alter the amount of money in circulation, which could lead to inflation. If the money supply increases more quickly than economic output under otherwise normal economic conditions, inflation may result. Inflation, or the rate of average price increases over time, can be influenced by variables other than the money supply. Changes in the money supply may cause similar economic situations in addition to inflation. The value of a currency starts to rapidly depreciate and the nation enters a phase of hyperinflation if the gap between the money supply and economic growth widens enough.

More borrowing opportunities result from an expansion of the money supply. According to the law of supply and demand, this increase in supply tends to drive down the cost of borrowing money. Consumption, lending, and borrowing rates all tend to rise when borrowing is more convenient. In the near run, higher rates of consumption, lending, and borrowing are associated with higher levels of expenditure, total economic output, and, presumably, GDP. Although economists predict this outcome, it is not necessarily what happens in reality.

It is more challenging to foresee how a rise in the money supply will behave over the long term. The price of assets—such as homes and stocks—has a significant tendency to artificially rise after an increase in the money supply or anything else that causes a lot of liquidity to flow into the economy. This capital misallocation can result in wasteful and speculative investments, which can quickly increase asset prices and then cause a contraction or an economic recession, which is a sharp fall in economic activity.

IMPLICATIONS

The research highlights the need for greater transparency in policy-making or more effective mechanisms for controlling inflation. It contributes to the body of knowledge on monetary policy and economic growth in developing countries. By providing a more nuanced understanding of the complexities of monetary policy and its impact on economic growth in the BRICS countries, the research informs future research in this area. It also helps identify areas where these countries can work together to address common economic challenges. It highlights the need for greater coordination in monetary policy and the development of regional trade agreements to boost economic growth.

It even provides insight into the potential impact of BRICS policies on global economic conditions to inform international economic policy discussions. It suggests that if certain policies are effective in boosting economic growth, other countries or international organizations may adopt them. By understanding the relationship between monetary policy and economic growth, investors make more informed decisions about where to allocate their resources. The research suggests that if a country has a strong monetary policy, it can attract more foreign investment.

Overall, research on the growth and monetary policy of BRICS has significant implications for policy makers, international investors, and global economic institutions. The insights and recommendations provided by the research helps to inform decision-making and promote economic growth and stability in these important emerging economies.

LIMITATIONS

The data available for BRICS countries may be limited, especially for certain time periods or specific variables. This makes it difficult to draw accurate conclusions and could limit the scope of the research. The BRICS countries have different economic systems and structures, which could make it difficult to compare them directly. China’s economy is largely state-controlled, while India’s is more market-oriented. These differences could affect the interpretation of data and the conclusions drawn from the research.

Monetary policy is a complex area, and it can be challenging to fully understand the impact of different policies on economic growth. Additionally, the effectiveness of monetary policy may be influenced by a range of factors, such as political stability, international relations, and global economic conditions. The findings of this research paper on the growth and monetary policy of BRICS may not be applicable to other countries or regions. This is because each country has unique economic, political, and social factors that influence its growth and monetary policies.

The BRICS countries are constantly evolving, and economic conditions may change rapidly. This could make it difficult to generalize findings over a longer period of time, as the economic landscape and policy priorities may shift.

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