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THE USE OF UNCONVENTIONAL MONETARY POLICY IN EMERGING MARKET ECONOMIES

By

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ABSTRACT

This paper investigates the use of unconventional monetary policy, quantitative easing (QE) in emerging market economies (EMEs). This study establishes conditions under which emerging economies may follow to implement QE without being exposed to the risks associated with the use of QE, which include fiscal dominance and the loss of central bank independence and credibility. We also analyse the impact of the programme on bond yields, stock markets and the banking industry a few months after the announcement. We provide empirical evidence using the event study and basic vector autoregression (VAR) method with monthly data from January 2011 to December 2021 to estimate the effects of QE on domestic financial markets during the Covid-19 pandemic. We find that QE effectively lowered bond yields and positively affected financial markets; however, the impact on stocks and banks was not as significant as the bond market. The impact on bond yield is identified through the signalling channel, and on other financial markets is through the portfolio-rebalance channel.

Key Words: Quantitative easing, financial markets, Emerging market economies, event study and VAR.

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CHAPTER 1: INTRODUCTION

1.1 Background

The rapid global spread of the Corona Virus (Covid-19) triggered by the acute respiratory syndrome which was made known in late 2019 has disrupted the global economy and raised worries of a global recession. IMF (2020) announced that the global growth rate had experienced a 2.9% contraction, this was after most countries went into lockdowns to assist in limiting the spread of the infection and as a result, economies were faced with financial stress. In response to the Covid-19 crisis, advanced and emerging economies implemented both expansionary fiscal and monetary policies to combat the crisis, and a combination of different other monetary policies were also coordinated, including unconventional monetary policy tools.

Advanced economies additionally made use of unconventional monetary policy tools as there was no longer room for them to use the conventional monetary policy tools, as they had reached zero lower bound whereas emerging economies employed conventional monetary policy tools including interest rates on reserves, discount rates, and open market operations. However, for other emerging economies, the conventional monetary policy tools could not meet the monetary authorities' objectives to combat market dysfunction and were deemed ineffective. Therefore, the monetary policy authorities introduced unconventional monetary policy tools measures in the form of asset purchase programme (APP) known as quantitative easing (QE) following the footsteps of advanced economies such as the Bank of Japan, the Federal Reserve Bank, and the Bank of England (Adrian et al., 2021).

Quantitative Easing (QE) is defined as an unconventional monetary policy in which the central bank purchases government bonds and other financial assets with newly created money, typically long-term government bonds in an open market funded through money creation with the intention to stimulate economic growth (Bouraoui, 2015). The purchase of these assets increases liquidity in the financial market and expands the central bank’s balance sheet. As a result, QE lowers yields on long-term government bonds, which subsequently lowers the cost of borrowing, increases investment spending in other financial asset classes, and is said to increase inflation. Mimir and Sunel (2021) highlight that an increase in inflation tends to diminish the effectiveness of the asset purchase programme, therefore, to maintain the effectiveness of QE, a persistent large-scale asset purchase must be executed.

According to Adrian et al. (2021), the asset purchase programme in emerging markets economies (EMEs) has been relatively small in coordination with other conventional monetary policy tools, so the central bank balance sheets have not expanded significantly. However, Brazil, Mexico, Turkey, and India are among other emerging economies that have expanded their asset purchase programmes to reduce market and financial stress. The asset purchase programmes are designed to influence the sovereign yield curve, alleviate financial stress, and increase financial market liquidity (Fratto et al., 2021).

A major skepticism among observers towards this unconventional monetary policy implementation is emerging market economies' concerns about the de-anchoring of inflation expectations, fiscal dominance, and increases in exchange rate volatility (Mimir & Sunel, 2021). South Africa, Poland, and Thailand's central banks have embarked on asset purchase programmes during the covid-19 pandemic on a smaller scale to protect their economies from the risk of fiscal dominance and financial market instability, one major risk that is said to be associated with the

large-scale purchase of government assets is fiscal dominance (Fowkes, 2022). Most emerging economies had policy rates above zero and did not face deflation when their central banks started with the purchase of long-term government bonds. It has been observed that foreign investors have responded positively to the announcements of QE in emerging markets (Benigno et al., 2020).

1.2 Research Gap

The lack of both theoretical reasoning and empirical evidence in support of the large-scale purchase of government securities by central banks in emerging economies is the gap intended to be filled by this study. There is limited related research done on the conditions under which emerging markets can successfully implement quantitative easing (QE), risks associated with the programme in EMEs, and the impact on domestic financial markets but a significant amount of empirical literature was done on the use of QE in advanced economies. Before the Covid-19 pandemic, QE had primarily been the purview of reserve currency central banks, partially out of concern that the monetary policy in EMEs may de-anchor inflation expectations and lead to exchange market pressures (Arena, et al., 2021).

This study aims to investigate the conditions under which central banks in EMEs may purchase financial securities on a larger scale without exposing themselves to the risks associated with the implementation of QE such as hyperinflation in developing countries through a literature review and the effects of the programme on domestic financial markets through the analysis of data collected. Adrian et al. (2021) present guiding principles that EME central banks may follow when embarking on QE to avoid the risk of fiscal dominance and debt monetization. Given the principles provided, the study seeks to establish additional conditions under which central banks in EMEs followed when they implemented QE during the Covid-19 crisis and may use beyond the pandemic, the downside risks that they might have suffered as a result of the implementation of the policy, and the response of financial markets to the implementation of QE. The study will further provide central banks in EMEs with policy recommendations and effective guidelines to follow when implementing the unconventional monetary policy tool beyond the Covid-19 predicament.

Our study is building and expanding on the already limited existing literature, we will use the literature to analyze the conditions under which central banks in both emerging and advanced economies followed when they embarked on a large-scale asset purchase programme and minimize exposure to the risks. Benigno et al. (2020) note that some central banks, for the first time, even before reaching the zero lower bound on policy rates have started to engage in long-term government asset purchases. Using the guideline principles presented in a study conducted by Adrian et al. (2021), we will look at empirical studies conducted to analyse whether the principles have been followed since the introduction of QE in EMEs. We first look at the central banks' governance, the scale and duration of assets purchased, and the prices and market of the assets purchased in emerging market economies during the Covid-19 crisis and beyond. Further, analyze the aspect of risk by reviewing the literature, and assess the level of fiscal dominance, capital outflow pressure, and central banks' independence.

To estimate the impact of the programme on financial markets, we will collect data from four emerging countries to determine the impact of QE on bond yields, the stock market, and banks. Analysing the effects of the programme on financial markets during a financial crisis will help us conclude whether the monetary policy tool is relevant in stabilising the financial markets when under distress.

It is also significant to understand fiscal dominance in relation to EMEs, Arslan et al. (2020) emphasize that fiscal dominance is deemed as a constraint to implementing QE in EMEs, as fiscal dominance may lead to direct financing of fiscal deficits and hyperinflation. This would tell whether the countries are at risk of experiencing fiscal dominance should they persistently implement QE even beyond the Covid-19 pandemic. The potential effectiveness of the asset purchase programme can be determined by looking at whether the financial markets are stabilized after the implementation.

1.3 Objective of the study

The objective of this study is to establish the conditions under which central banks in EMEs can follow when implementing unconventional monetary policy through the already existing literature on QE in EMEs and the effects of the programme on domestic financial markets through the analysis of data collected. The specific objectives include analyzing the risks associated with the implementation of QE by central banks in EMEs through literature and the impact of the programme on financial markets (bonds, stocks, and banks) and helping with the stabilization of the markets. The movement of the variables of interest will provide an idea of whether the unconventional monetary policy tool is the most suitable in developing countries and can be used beyond the Covid-19 crisis.

1.4 Research questions

i. Under which conditions may emerging market economies (EMEs) effectively implement quantitative easing (QE)?
ii. What are the risks that EMEs may face as a result of implementing QE?
iii. What are the effects of quantitative easing implementation on domestic financial markets in emerging countries?

1.5 Contribution of the Study

The study adds to the body of knowledge on the use of quantitative easing (QE) in emerging market economies, as it assesses the literature of both advanced and emerging countries that have undertaken QE to address market dysfunction and stimulate their economic growth during the Covid-19 crisis. According to Adrian et al. (2021), both experiences of developed and developing economies during financial distress suggest that the asset purchase programmes may be beneficial to EMEs under certain conditions. Studies appear to agree on the favourable impact of QE announcements on stock and bond prices (Papadamou et al., 2019). The study further attempts to contribute to the theoretical knowledge of conditions under which EMEs can use QE, the concern of risks including fiscal dominance and central banks' independence, and empirical knowledge of the effects of the programme on their domestic financial markets.

Benigno et al. (2020) argue that emerging markets with flexible exchange rates, well-anchored inflation expectations, and issuing local currency sovereign debt should embrace quantitative easing more aggressively during the financial crisis and beyond. This study is significant as it hopes to provide policymakers with recommendations on how to effectively use unconventional monetary policy tools to alleviate market dysfunction. Cecioni et al. (2019) emphasize that the choice of the instruments that should be included in the crisis toolkit of central banks requires a fuller knowledge of the relative contribution of the various unconventional measures to averting disruptions and restoring normal circumstances in the financial markets. Central banks will be able to embark on unconventional monetary policies during the financial crisis and beyond without compromising the central bank's balance sheet and independence.

1.6 Significance of the Study

The findings of this study will assist and provide emerging market monetary policymakers with a new informative perspective to propose and implement the asset purchase programme during crises and periods of country-specific economic distress; for example, when the country is facing severe recession. The asset purchase programme provides policymakers with additional tools to meet their various monetary objectives (Benford et al., 2009). Understanding the conditions under which large-scale asset purchases can be successfully implemented is critical for monetary policymakers to prevent problems with fiscal policy competing with monetary policy and to reduce perceptions of fiscal dominance and the risk of central banks losing their independence. For market participants, it is crucial to understand how QE may affect asset portfolio holders and the financial markets they participate in. Joyce et al. (2012) enforce that it is required that the portfolio changes not be an issue of investors' apathy for QE to have an impact and meet the policymakers' objectives. QE used systematically can partially replace policy rate easing, as noted by Hofmann et al. (2021) by reducing term premia on long-term interest rates, quantitative easing frees up fiscal space that supports expansionary fiscal policy and lowers the danger of debt-deflation.

1.7 Outline of the study

The report is structured as follows:

I. Chapter 2 Presents the literature review of previous studies conducted on the conditions under which large-scale asset purchase of government securities and the risks associated with QE.
II. Chapter 3 Outlines the research methodology, data collection, and problems with data.
III. Chapter 4 Presents the empirical results and discusses the findings.
IV. Chapter 5 Concludes the paper and makes policy recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 Theoretical Background

2.1.1 Quantitative Easing (QE)

Quantitative easing (QE) is defined as an unconventional monetary policy tool used by central banks to purchase assets, mainly government securities on a large scale using newly printed money to influence the quantity of money circulating or the liquidity in the market and stimulate economic growth (Bouraoui, 2015). Quantitative easing is also referred to as the asset purchase programme (APP). The procedure includes exchanging assets owned by financial institutions, such as government bonds, corporate bonds, and mortgage-backed securities, with cash produced throughout the money-creation process (Papadamou et al., 2019).

Altavilla et al. (2021) evaluate the European Central Bank Asset Purchase Programme transmission channels and effects on bond yields, the programmes' target market includes long-term sovereign assets with varying levels of creditworthiness. Due to the ineffectiveness of conventional monetary policy tools, Beckmann et al. (2020) identify that in an effort to raise inflation expectations and drive economic growth in the context of low-interest rates, quantitative easing has evolved into a common policy tool used by central banks to meet their monetary objectives. Alternatively, the central bank is still able to keep inflation at its desired rate, as soon as QE meets the central bank's objective, the bank can sell the financial securities back in the market and/or guide the policy rates to keep the inflation at the targeted rate (Agur et al., 2022).

According to Arslan et al. (2020), central banks in emerging markets alternatively used QE to provide liquidity to domestic bond markets with the main goal of addressing market dysfunction compared to advanced economies where most of them used the monetary tool to stimulate economic growth. A study by Benigno et al. (2020) finds that several central banks in EMEs have implemented QE even before policy rates reached the zero lower bound. This indicates that EMEs can still use QE without reaching zero lower bound, however, Havemann (2022) argues that because it is impossible to reach zero lower bound in EMEs, therefore embarking on QE seems to be unrealistic and farfetched.

Adrian et al. (2021) note that typically when QE and other unconventional monetary policy tools are implemented during financial crises or recessions, they are deemed as the most useful tools when conventional monetary tools have been exhausted or no longer achieve monetary objectives. The Bank of Japan's initiative, which started in 2001, appears to have been the first prominent application of QE (Williamson, 2017). And thereafter, other central banks followed suit, with the majority of the central banks embarking on the programme after the global financial crisis in 2008. However, the effectiveness of large-scale asset purchase programmes has recently been the subject of increased debate, which has been sparked in part by the beginning of strategic reviews by significant central banks worldwide (Altavilla et al., 2021).

Meaning and Zhu (2011) find that similar to how traditional conventional monetary policy tool operates, QE is meant to reduce bond yields while increasing expenditure, inflation, and overall GDP. On the other hand, Andrade et al. (2016) observed that since the announcement of the asset purchase programme by the European central bank in January 2015, sovereign yields on long-term bonds have been significantly and consistently dropped, and the share prices of banks with larger holdings of government bonds have increased. Bond prices are anticipated to rise as a result of embarking on QE, and lower yields will subsequently lower the cost of borrowing.

Arslan et al (2020) highlight that one of the central banks' objectives is to increase market liquidity and increasing market liquidity in the economy will therefore increase the number of deposits held by businesses and households. As a result, aggregate demand for goods and services will also increase. The purchase of assets during the Covid-19 pandemic has been somewhat effective for central banks in emerging economies, the programme restored investors' confidence and did not raise inflation expectations as fiscal dominance is deemed to be the main risk associated with QE (Havemann et al., 2022).

Adrian et al. (2021) point out that QE may be beneficial for emerging market economies albeit it presents a risk of fiscal dominance and debt monetization. An economy facing the risk of fiscal dominance is where monetary policymakers are put under pressure by the fiscal policymakers to keep policy extremely low for the government to borrow at a lower cost or the central bank may be pressured to directly finance fiscal deficits (Gros & Shamsfakhr, 2021). Emerging economies with unstable financial systems and poor fiscal management have fiscal deficits linked to monetary financing (Bordo & Levy, 2020).

Benigno et al. (2020) suggest that central banks with the strongest operational independence and policy credibility may aggressively embark on QE and the purchase of assets to be conducted mostly in the secondary markets. IMF (2020) further stresses that central banks in EMEs that plan to announce the asset purchase programme for the first time should purchase the assets in the secondary markets for the reason that purchasing in the primary markets and/or below market value may lead to fiscal dominance. Although there is less empirical literature on EMEs that experienced fiscal dominance after announcing the purchase of assets prior to or during the Covid-19 crisis, we will further attempt to determine whether the notion of fiscal dominance as a risk to QE holds in emerging market economies or generally when central banks utilize this monetary policy tool.

2.1.2 The Relation Between the Expansion of Fiscal and Monetary Policies

The expansion of both fiscal and monetary policies' aims during economic and financial distress is to increase aggregate demand, the two policies co-exist. In normal times, central banks alter the interest rates and inform the public as to how the alteration will meet the authorities' monetary objectives. Moreover, the central banks are concerned about providing liquidity to the market and price stability. During a financial crisis, central banks face a difficult task in implementing timely and effective monetary policies since disruptions in the financial markets could jeopardize the transmission mechanism (Vermeulen, 2020).

As the Covid-19 pandemic intensified and economies started to feel the financial pressure of the lockdowns implemented in various countries, emerging markets still had room to utilize conventional monetary policy tools such as the policy rates to fight the economic contractions, however, there are some emerging economies (others for the first time) expanded their monetary policy by introducing quantitative easing (QE), an unconventional monetary used by central banks to purchase financial assets at most on a large scale to effectively stimulate economic growth (Bouraoui, 2015).

Akiyama et al. (2020) find that the purchase of bonds by the central banks increases the price of bonds above those in the benchmark treatment without QE; conventional economic theory states that there is an inverse relationship between bond prices and interest rates. QE reduced long-term interest rates and as a result, bond prices rose. The range of financial securities purchased in QE

includes mortgage-backed securities, government bonds, corporate bonds, and equities but the majority of the central banks that have embarked on QE have purchased government bonds. The experiment by Akiyama et al. (2020) has additionally observed that the peak price impact appears earlier in later rounds of the programme, as participants begin to expect higher prices from the start. The evidence suggests that QE could operate solely through behavioural mechanisms. The asset purchase programmes expand the central banks' balance sheet, before the Covid-19 pandemic central banks in EMEs had little to no government bonds on their balance sheet other than as collateral for repossession of underlying repo rates.

There are emerging market economies (EMEs) that have embarked on quantitative easing (QE) to provide their markets with liquidity and ensure efficiency in the financial system considering that the conventional monetary policies were ineffective (Al-Jassar et al., 2018). Benigno (2020) states that countries with dynamic exchange rates and well-anchored inflation expectations may embark on QE to ease financial stress with less risk of rapidly increasing inflation. Unfortunately, not all emerging economies can aggressively expand their monetary policy by embarking on QE to provide fiscal stimulus. Expansionary monetary and fiscal policies are important as they play a vital role in promoting economic growth.

QE is one of the unconventional monetary policy tools that central banks in advanced economies implement aggressively when expanding their monetary policies (Casiraghi et al., 2013). QE lowers interest rates resulting in a decrease in borrowing costs, with lower borrowing costs, households and businesses can borrow to finance their respective expenses, and thus, aggregate demand increases and GDP subsequently rise as well, basic economics. Ghosh et al. (2016) observed that central banks in emerging market economies are to stabilize inflation and pursue exchange rate and financial stability goals, therefore to achieve several monetary objectives the central banks are required to implement multiple monetary policy tools. The literature is following the same direction in terms of the impact of QE and it can be effectively utilized.

Negro and Sims (2015) present an economic model that investigates the significance of the central banks' balance sheet and the repercussions of the central banks' lack of fiscal support. It states that fiscal support comes when fiscal authorities pledge to recapitalize the central bank if it is required to do so, the central bank might need fiscal support to hit its inflation target without allowing more inflation than it would have liked to reach. Larger balance sheets of central banks raise concerns such as the central bank losing significantly as interest rates are lowered and therefore, fiscal support is required. The model presented illustrates that concerns to provide a stable price level between the fiscal policy and the central bank's balance sheet are different, higher inflation will determine whether the central bank's balance sheet requires fiscal support.

Celasun et al. (2004) recommend that strengthening public finances should be prioritised during stabilisation periods to build fiscal creditability because it has been discovered that lower primary fiscal balances considerably lower inflation expectations. The use of unconventional policies including the purchase of assets programmes before the Covid-19 outbreak was not a common practice, especially in emerging markets, and even during the pandemic, countries such as South Africa were not expecting the implementation of the programme (Havemann et al., 2022). Although Karadi and Nakov (2021) find that there are economies that have been using a different combination of monetary tools, QE is included to optimally alleviate market dysfunctions.

2.2 Empirical Evidence

2.2.1 Conditions under which emerging market economies (EMEs) may effectively use quantitative easing (QE).

IMF (2020) reports that central banks in at least 18 emerging market economies that have been faced with liquidity crises have implemented the asset purchase programme during the Covid-19 pandemic, purchasing government bonds in both the primary and secondary markets. Agur et al. (2022) assert that most of these emerging markets that have made use of the asset purchase programme, implemented the programme on a smaller scale compared to advanced economies which implemented the programme on a larger scale, with hopes to stabilise inflation. However, the study further recommends that emerging markets with slightly larger financial markets may implement the programme on a larger scale so that the impact on bond yields and other financial asset prices may be visible.

Havemann et al. (2022) in an effort to determine the impact of the asset purchase programme by the central bank of South Africa, the South African reserve bank (SARB) on market liquidity, bond yields, and price volatility by identifying the impact of QE on financial markets using an event study methodology with intraday data to develop a GARCH model. The study was specifically made following the GARCH model due to its reliability when modelling financial market volatility and it permits mean and variance to be modeled at the same time. Results of the study show that the market gained confidence as bond prices were slowly adjusted and contributed 1% towards the total GDP which was smaller compared to other economies that implemented QE on a larger scale during the pandemic.

Emerging markets implemented the asset purchase programme for various reasons, one of the objectives that the policymakers hoped to achieve is that the tool has the potential to reduce market volatility and stabilise financial markets (Drakopoulos et al., 2020). Havemann et al. (2022) realize that when the SARB introduced the asset purchase programme to the market intending to maintain financial market stability, although the programme did not specifically target the bond yields, eventually the programme influenced the bond yields. Again, Ha and Kindberg-Hanlon (2021) also point out that the intention of EMEs that implemented QE for the first time was aimed at providing market liquidity and improving market dysfunction.

Fratto et al. (2021) state that the main objective of emerging market economies announcing the purchase of assets during Covid-19 is to provide direct support to the pandemic-related fiscal needs. Further outlined that the monetary intervention was intended to improve market functioning. A study specifically conducted in European emerging markets discovered that the most common goal of implementing the purchase of assets programmes is to address market dysfunction and impaired monetary transmission (Arena, et al., 2021). Therefore, previous literature is in the same tune regarding the main objectives for emerging markets to use QE.

Adrian et al. (2021) provide and recommend guiding principles under which emerging market economies (EMEs) may follow to implement the asset purchase programmes on a larger scale. The conditions are provided to minimize the risk of fiscal dominance and direct government financing/debt monetization potentially faced by EMEs when implementing quantitative easing (QE). These guidelines are believed to be critical when EMEs central banks strive to strengthen market functioning in their economies, not only during the financial crisis but during country-specific economic recessions too. The study recommends that the central banks should purchase the assets from the secondary market first before they can consider the primary market, purchasing

from the primary market is considered direct financing and direct government financing poses a risk to the central bank's balance sheet and independence.

IMF (2020) indeed discovers that the majority of the central banks in EMEs have purchased government bonds from the secondary market, this was to avoid risks borne by direct financing by purchasing the bonds directly from the treasury or primary markets, however, there are still countries that directly purchased the government bonds in the primary bond market. Ha and Kindberg-Hanlon (2021) observe that most central banks purchase the bonds in the secondary market, although there are central banks that have directly acquired the bonds from the government or primary markets.

Fratto et al. (2021) and Cecioni (2019) on the functioning of unconventional monetary policy tools identify two significant transmission channels in which central banks may effectively implement QE, the channels are signalling and portfolio rebalancing. Bauer and Rudebusch (2013) describe the signalling channel process as the announcement of the asset purchase programme and the communication of the programme's objectives of restoring confidence in the markets by the central bank to financial market participants. The study by Adrian et al. (2021) did not outline the transmission channels which central banks may follow when implementing QE. Gagnon et al. (2011) emphasize that a central bank can expand its balance sheet by increasing the quantity of short-term, risk-free bank reserves held by the private sector while simultaneously decreasing the amount of security that the private sector owns through asset purchases, displacing some investors and the liquidity provided may be used to rebalance the investment portfolio.

Portfolio rebalancing is the reallocation of funds to other financial asset classes such as equities and real estate. Hesse et al. (2018) point out that the portfolio-rebalancing channel may be stronger during a period of strained financial markets and, as a result, weaker once those conditions return to normal. Further, Al-Jassar and Moosa (2018) also note that portfolio adjustment is one direct result of QE, as a result of monetary expansion and the keeping of extra cash balances, agents move to other assets, such as stocks.

Thornton (2012) states that the portfolio rebalance channel is thought to reduce long-term rates by lowering the term premium required by investors to keep government assets which can be achieved by implementing the asset purchase programme. Joyce et al. (2010) mention that portfolio rebalancing plays a vital role in asset prices when the central bank increases liquidity in the market by purchasing privately held assets which as a result reduces the assets held by private market participants, therefore, the price of other assets will have to increase for private investors to accept the change.

Bauer and Rudebusch (2013) explain that it is the central bank's responsibility to effectively communicate to the financial market participants of the asset purchase programmes' goals, conception and time of exit. It has been observed in European emerging markets that central banks communicate their plans to implement the asset purchase programmes and as a result, the favourable market impression, perceived risks of bond yield volatility, currency depreciation, or risk of fiscal dominance have been significantly reduced (Arena, et al., 2021).

The announcements of asset purchase programmes inform market players of any changes in the central bank's view of the present or future state of the economy. Bauer and Rudebusch (2013) further emphasise that by more securely establishing expectations, improved and reliable information about the outlook and policy course can lower risks and uncertainties. For example,

the Federal reserve bank's QE pronouncements had a significant impact on long-term rates by changing market expectations for the direction of monetary policy going forward (Gagnon et al., 2011).

Havemann et al. (2022) find that central banks in advanced economies frequently signal their government bond-buying plans months in advance and adequately explain them to market participants of the programme and its objectives. The large asset purchase programmes are anticipated to stimulate economic activity and growth by affecting a wide range of asset prices (Gagnon et al., 2011). Gagnon et al. (2011) draw a lesson from the implementation of QE in 2008 by the Federal Reserve Bank and note that lowering the net supply of long-term assets in the financial market ultimately reduced the term premium over time. The study further discovers that when central banks purchase assets with long durations on a larger scale from the market, there is less duration risk to carry in total, and therefore, the market should demand a lower premium to hold that risk.

Bowdler and Radia (2012) suggest that to keep inflation well anchored, the market participants should be signalled when the central bank announces the unconventional monetary policy to maintain its credibility. De Michelis and Iacoviello (2016) present a VAR model using Japanese data to determine how macroeconomic variables react to high inflation target shock during a liquidity trap. Using the DSGE model, the study finds that while Japan has made some strides in fighting deflation, further steps are still needed to bring inflation steadily up to 2 percent. Abed et al. (2022) stipulates that inflation plays a vital role in the country's economic growth.

Ha and Kindberg-Hanlon (2021) provides some features of asset purchase programmes in EMEs similar to those that have been recommended by Adrian et al. (2021), the study notes that the size of the assets purchased by the central banks ranges between 1 to 6 percent of the total GDP whereas on average, advanced economies contribute about 14 percent towards the GDP. Both studies emphasize that the scale of the programmes should be clearly outlined and recommend that the central banks should at least purchase the assets on a larger scale to achieve similar and effective results as those of advanced economies.

Compared to advanced economies, the scale at which EMEs executed QE was smaller in quantity and implemented the programme without reaching a zero percent interest rate. Additionally, IMF (2020) reports that with the exception of Poland, Chile, and Indonesia, the majority of asset purchase programmes in EMEs were carried out on a lower scale. The scale of the assets purchased in advanced economies is normally larger than that in emerging economies, EMEs asset purchase programmes range from small to more sizable to keep a safe distance from the risk of fiscal dominance (Arena, et al., 2021).

According to IMF (2020), countries including Croatia and Turkey implemented their programmes on a smaller scale of 5 to 7 percent of the GDP and the FED purchased 23 percent of their GDP. Normally advanced economies implement QE when they have exhausted the policy rates or reached zero lower bound when their central banks intend to stimulate economic growth whereas EMEs' central banks' objective to implement the programme was to not provide macroeconomic stimulus but to simply provide market liquidity and correct the market dysfunction (Gros & Shamsfakhr, 2021). Adrian et al. (2021) suggest that central banks in EMEs that make use of QE should announce the scale and type of assets being purchased and Ha and Kindberg-Hanlon (2021) find that a lot of EMEs that have announced the asset purchase programme during the Covid-19

pandemic, however, did not disclose the type of assets they had planned to purchase, the scale of the programme, or even the duration of the unconventional monetary policy tool.

Contrary to Adrian et al. (2021), Fowkes (2022) argues that central banks in EMEs that would experience the effectiveness of QE are economies with very low inflation and limited conventional monetary policy, therefore, the central banks may aggressively implement QE on a larger scale to provide their markets with liquidity and significantly increase both output and inflation rates. The study states that QE would be a more effective stimulus monetary policy tool that would not result in hyperinflation and not undermine price stability.

Fowkes (2022) shares the same sentiments as Adrian et al. (2022) that for large-scale asset purchase programmes to be effective in EMEs; they must have a solid and stable fiscal stance. IMF (2020) finds that the type of assets purchased is mostly long-term government bonds and others have purchased mortgage bonds, majority of the central banks in EMEs did not disclose the maturity and parameters of the bonds purchased. Most literature conducted on QE recommends government bonds as the primary assets that should be purchased by the central banks when embarking on the programme.

i. The effectiveness of the unconventional monetary policy tool (QE) in EMEs

There have been debates on whether central banks in emerging markets can effectively implement QE to stimulate economic growth and correct market dysfunction. Fowkes (2022) argues that the implementation of the unconventional monetary policy, quantitative easing in emerging economies is unrealistic as it requires the economy to be facing deflation and either be at or approaching zero percent short-term nominal interest rate. He further emphasizes that QE should only be executed by economies where short-term interest rates are ineffective but if there is still room for cutting down short-term interest rates, then the central banks must continue with conventional monetary policy tools.

A study by Arena et al. (2021) find evidence that European emerging markets that have previously embarked on the asset purchase programme without reaching zero lower bound have received an immediate positive impact and were successful in resolving market dysfunction and easing pressure. Havemann et al. (2022) indicate that the purchase of government bonds restored market confidence and resolved market instability, it also appears to have enhanced the Reserve Bank's liquidity management. Agur et al. (2022) empirical analysis find that EMEs that embarked on QE during the Covid-19 pandemic did not have any statistically or economically significant impact on inflation rates.

The effectiveness of the asset purchase programmes may differ across countries, depending on the countries' fiscal stance. The exchange rate implications on the financial market determine the effectiveness of QE as it is a primary source of volatility. Fratto et al. (2021) confirm that the announcement of asset purchase programmes reduces bond yields at different maturities and that the effects of the direct and signalling channels of transmission are larger in magnitude for asset purchase programmes compared to that of policy cuts and stronger in emerging economies compared to advanced economies. 10-year government bond rates declined by around 10 basis points on the day of the announcement, and yields dropped even further in the following trade days, dropping up to 50 basis points after five days (Arslan et al., 2020). Rebucci et al. (2021) conclude that the implementation of quantitative easing in emerging market economies has a greater impact on bond yields.

Vermeulen (2020) developed a small open-economy dynamic stochastic general equilibrium (DSGE) model to evaluate the effects of the temporary emergency purchases of government bonds by the central bank of South Africa in 2020. The study's findings show that the South African central bank's bond purchases could have a broader stimulatory macroeconomic impact than the bank's core goal of supplying liquidity to the domestic financial system. The model is useful to other similar EMEs with similar economic traits as that of South Africa that have not yet implemented the large-scale asset purchase programme. The SARB introduced the asset purchase programme to alleviate the instability of the financial markets; actively influencing rates was not its primary objective (Havemann et al., 2022).

Studies conducted by Arslan et al. (2020) and Akiyama et al. (2020) discovers that asset purchases by the central bank in emerging economies on average reduced long-term bond yields largely and persistently and subsequently interrupted depreciation trends. Joon Baak et al. (2019) present a qualitative VAR model to determine whether the effects of QE are statistically significant on the Japanese and Korean economies. QE has been highly effective in advanced economies; it has worked for the U.S Federal Reserve Bank as they have been using unconventional monetary policy from 2009 to 2014 and during the Covid-19 pandemic. According to Lim (2014), the first round of QE by the Federal Reserve Bank also called QE1 was from the first quarter of 2009 to the third quarter of 2010 and the programme was able to successfully stimulate economic growth, although as they further introduced more programmes it becomes less effective.

The literature conducted on the effects of QE on the credit market by Fratto et al. (2021) confirms that asset purchase programmes significantly affect the credit market. The announcement of QE by central banks managed to boost the confidence of investors leading to and decreasing the cost of borrowing as short-term interest rates decrease. Although, this does not necessarily apply all the time (Karadi and Nakov, 2021). The purchase of government bonds in the secondary market by the central banks from private financial intermediaries/banks and households in exchange for currency increases the liquidity in the financial market and further increases consumption, output, and inflation (Drakopoulos et al., 2020). In addition, players in the financial markets rearrange their asset portfolios to reflect the present economic situation. Arena, et al. (2021) find that the liquidity stress in the banking sector was widely predicted to harm non-financial firms, consumers, and the government, which would face income and tax shortfalls while still being required to fulfil expenditures. Karadi and Nakov (2021) conclude that the QE programme is effective when there is credit scarcity or banks are facing balance sheet constraints.

Matousek et al. (2019) developed a model when studying the effectiveness of quantitative easing by the Central Bank of Japan (BOJ), the model assumes that there is competitive equilibrium in the credit market. Gertler and Karadi (2010) present a DSGE quantitative monetary model with banks that faced constraints in expanding their balance sheets, the model is used to determine the effects of QE on the financial markets. The study notes that, unlike central banks, private banks do not have the flexibility to expand their balance sheets by issuing government bonds and are restricted to providing credit. Therefore, it is recommended that EMEs use QE during the financial crisis and provide liquidity to private banks for the programme to be effective. According to Piotr (2018), the unconventional monetary policy tool can influence more than what the conventional monetary policy can influence which includes inflation, asset prices, credit, bank lending, exchange rate, and risk premium.

2.2.2 Risks associated with the use of unconventional monetary policy tool (QE) in EMEs

Drakopoulos et al. (2020), Adrian et al. (2021), and Arena et al (2021) highlight that the asset purchase programme in EMEs comes with fundamental risks such as fiscal dominance, diminishing the central bank independence and credibility, increased pressure on capital outflows, and market instability. Havemann et al. (2022) note that emerging market economies have been experiencing positive policy rates and raising inflation rates making their central banks hesitant to embark on the asset purchase programme. However, a study conducted by Agur et al. (2022) finds that the asset purchase programmes in emerging market economies had no significant impact on inflation or led to any hyperinflation for countries with stable inflation, independent central banks, and a healthy fiscal position.

This section singlehandedly outlines potential risks related to the use of the unconventional monetary policy tool in EMEs. The study seeks to establish how fiscal dominance, direct financing, the risk of the central bank losing its independence and credibility, and capital outflow pressure and market instability come about when central banks in EMEs make use of QE. It is important to analyse the movement of asset prices in emerging markets in order to determine whether they can implement QE and stabilise the financial markets. Fiscal dominance can result from the fiscal authorities ordering direct financing, where the government deficit is financed by central banks and subsequently leads to hyperinflation and market instability.

i. Fiscal Dominance

The asset purchase programme eased government-financing conditions, approximately a quarter of the EMEs programmes named pandemic-related fiscal needs as a primary goal (Fratto et al., 2021). However, the central banks' large-scale asset purchases pose a threat to fiscal dominance. Zoli (2005) presents a VAR model to test for fiscal dominance in emerging economies including Brazil and Argentina. During the 2002 financial crisis, fiscal decisions had a considerable impact on sovereign spreads. The history of fiscal dominance in emerging economies threatens the effectiveness of the asset purchase programme, central banks become skeptical of introducing QE as it threatens its independence and credibility (Gros and Shamsfakhr, 2021).

European emerging markets that embarked on QE during the Covid-19 pandemic would like to remain consistent and stick to the fundamental goals of mitigating financial market dysfunction, providing liquidity, keeping the market stable, and staying away from the risk of fiscal dominance (Arena, et al., 2021). The macroeconomic instability previously experienced by emerging market economies during the monetary financing of government deficits is a reminder to the monetary policymakers of how QE could go wrong and lead to hyperinflation and fiscal dominance.

There are debates among market participants and some economists that quantitative easing can lead to hyperinflation as this is suggested by the conventional economics theory that the increase in the monetary base in the market lowers the purchasing power of money which leads to an increase in inflation. However, several empirical studies including that of Leung and Yue (2011) and Loonstra (2017) dispute the concept that QE always automatically leads to hyperinflation but there is no empirical evidence that there is a relationship between QE and hyperinflation.

Leung and Yue (2011) study the impact of quantitative easing on inflation in the United States just after the global financial crisis, the study finds that there was no evident significant increase in inflation prior to and after the implementation of QE1 by the Federal Reserve Bank, in contrast to theory, inflation decreased with the introduction of QE1. Similar to Loonstra (2017), finds that the

effects of asset purchase programmes on multiple macroeconomic variables including inflation in the Eurozone and found the programme has had a significant negative effect in Germany. However, there are countries including Italy and Spain where the announcement of QE has had a positive effect on inflation. The theoretical explanation that QE may always lead to hyperinflation appears unjustified.

Ahmed et al. (2020) find that QE and unconventional monetary policies resulted in the secular decline of interest rates and the growing risk of fiscal dominance. A decline in interest rates subsequently lowers the cost of borrowing. When governments face high levels of debt, fiscal authorities may exert significant pressure on central banks to implement unconventional monetary policies to keep interest rates as low as possible to obtain credit on favourable terms.

Zoli (2005) states that models of price level fiscal theory have argued that fiscal policy is the primary determinant of inflation. Hyperinflation has often stemmed from fiscal dominance, and large government deficits are largely linked with hyperinflation and poor macroeconomic performance (Fischer et al., 2002). Hooley et al. (2021) observe that central banks lending to governments without limits has a long history in Sub-Saharan African countries, and has been linked to hyperinflationary occurrences, countries including Angola and the Democratic Republic of Congo suffered hyperinflation as a result of financing fiscal deficits.

Debt monetization has frequently been preceded by large and persistent fiscal deficits along with high levels of government debt; the ability to achieve and sustain market stability depends on fiscal sustainability (Arena, et al., 2021). One example is when the government uses a printing press to fund domestic debt, increasing inflation, and possibly hyperinflation. Governance weakness increases the risk of fiscal dominance; fiscal authorities can order the central bank to direct-finance government spending. The central bank is obliged to respond to the financial strain when needed.

Farhi and Tirole (2012) mention that market participants may opt to increase their advantage as they expect the central bank to bail them out by purchasing government assets if the financial system fails because of a financial crisis or country-specific issues such as a recession. Central banks aim to keep the economy stimulated at all times and to reduce the negative effects of the financial crisis. In tough economic times, the central bank is under pressure to cut the interest rates and as a result, there are no losses for leveraged investors. Market participants may expose themselves to higher systematic risk because they are aware or expect that should the market experience any financial pressure; the central bank will implement policies that will rescue them (Blanchard, 2004).

QE is one type of intervention to rescue over-leveraged debtors by lowering interest rates (Gros & Shamsfakhr, 2021). Farhi and Tirole (2012) further elaborate that during financial crises or recessions, fiscal authorities are supposed to rescue insolvent financial institutions but unfortunately, that never occurs instead the monetary authorities are the ones doing the bailout. Cecchetti et al. (2020) prove that financial market players tend to upsurge leverage post-domestic monetary policy easing, the study comprised 1000 financial institutions from 21 different countries over a duration of 15 years. As a result, fiscal dominance may arise because the central bank believes that it is obligated to support the financial system by lowering interest rates since the fiscal authorities fail to act due to possibly high levels of debt. Hence Adrian et al. (2021) emphasize that the central banks need to be independent and implement QE when needed to meet their monetary obligations.

Ersel and Özatay (2008) present lessons on the relationship between the public debt ratio and GDP to monetary policymakers in emerging market economies. The study explains that during a financial crisis, governments would introduce programmes in which they provide financial support to small emerging businesses to be able to function under tough economic times, covid-19 pandemic for example. Therefore, there is a need to coordinate fiscal and monetary policies to achieve the intended effects, as well as the fact that the degree of fiscal dominance influences the time of new policy implementation. Fiscal dominance operates indirectly by affecting the way central banks respond to domestic objectives under limited fiscal space.

Hooley et al. (2021) studied 45 sub-Saharan countries and find that the majority of the countries have strong and effective legislation in place that limits the central banks from lending government to a certain extent for fiscal purposes as a means of avoiding fiscal dominance. Although the practice of central banks financing government deficits is common and has been rapidly increasing over the years. The empirical evidence shows that fiscal dominance is an issue in emerging economies and contributes to macroeconomic problems, but monetary authorities have put in efforts to follow the legislation to avoid the risk of fiscal dominance (Beckmann et al., 2020). The legal limits determine the extent to which the central bank can finance the fiscal activities before the government can opt for other financing opportunities including borrowing abroad or from domestic banks. There is a positive correlation between the size of both fiscal deficits and central bank lending. With legislation in place, fiscal dominance has steadily declined.

Rebucci et al. (2021) used an event study methodology to conduct a study on quantitative easing (QE), the study carried out an analysis of 30 QE announcements from 21 central banks to determine the impact of the programme on daily government bond yields and cross-border US dollar exchange rates. In the literature we find that the theory suggests that direct financing may lead to fiscal dominance, the study performs a fiscal dominance test on ten emerging market economies to determine whether these economies are at risk of experiencing fiscal dominance.

Studies conducted by Canzoneri et al (2001) and Tanner and Ramos (2002) used a VAR model to assess the impact of fiscal dominance on macroeconomic variables including inflation and exchange rate. Rebucci et al. (2021) used prior Covid-19 data to examine how innovations are transmitted to long-term interest rates using the GVAR model, the model allowed for exploring potential serious repercussions within a cogent multi-country empirical framework that considered implications on global equilibrium.

ii. The risk to the central bank independence and credibility

Central banks that gained and sustained their credibility were successful with the purchase of asset programmes, it was because of their operational independence from democratically elected leaders and their distinct separation from the fiscal authorities (Agur et al., 2022). However, the study is concerned that the purchase of assets in the primary market may dent the central bank’s independence. Adrian et al. (2021) emphasize that central banks should be able to take decisions that will help achieve their objectives without being coerced by any external organization and purchase most of the assets in the secondary market. Drakopoulos et al. (2020) discuss that for the unconventional monetary policy to be effective, the central bank must have a credible monetary policy framework in place.

Ha et al. (2019) state that the asset purchase programmes should align with the central bank's monetary objectives such as price stability, in that case, the programme would not pose a risk to

the operational independence of the central bank. The impression of losing independence would undermine the central bank's credibility and lessen the impact of monetary policy activities and a weak central bank independence has the potential to influence the rise in prices (Agur et al., 2022). IMF (2020) emphasize that it is important for a central bank to have good governance together with a credible monetary policy framework when they are embarking on an unconventional monetary policy.

iii. Direct Government Financing

Generally, when there is a government deficit, one of the ways to finance the fiscal deficit is to borrow directly from the central banks, although direct financing of government expenditure is expected to result in hyperinflation, fiscal dominance, and diminish the central bank's independence (Agur et al., 2022. The most recent cases of central banks financing government deficit were during the Covid-19 crisis when central banks were purchasing government bonds directly from the primary bond market, governments had fiscal pressures due to lockdowns implemented during the pandemic and central banks purchased bonds from the primary market with intentions to maintain stability in the sovereign debt market (Fowkes, 2022).

Economists suggest that central banks should apply quantitative easing and purchasing government assets in the secondary market to ease off the financial pressure rather than directly finance the fiscal deficits or purchasing the assets from the primary market because direct financing leads to fiscal dominance (Hooley and Saito, 2021). The purchase of government bonds can either occur on primary or secondary financial markets and purchasing bonds on the primary market is considered direct financing, however, QE performed on primary markets could lead to fiscal dominance as emphasized. Because of the Covid-19 Pandemic and lockdowns, fiscal policymakers also expanded their fiscal programmes subsequently increasing the fiscal deficit for some developing countries. Bordo and Levy (2020) state that another reason behind the fiscal expansion that took place was driven by low-interest rates and central banks purchasing government bonds, which reduced debt service costs.

There are alternative financing options that the fiscal authorities may exploit except borrowing directly from the central bank which reduces risks of fiscal dominance. In most emerging economies, central banks limit direct financing to ten percent of the previous fiscal revenue (Jácome et al. 2012). Legal limits imposed on central banks on the extent to which they can lend or purchase government bonds in the primary market significantly reduce the risk of fiscal dominance. An alternative way to finance fiscal deficit is through a combination of borrowing abroad and from domestic banks (central banks and/or commercial banks).

Significant fiscal deficits financed by money creation are commonly regarded as the driving force behind protracted periods of hyperinflation, therefore, imposing legal limits on central banks when financing government deficits is essential to avoid the risk of high inflation rates. Kiguel (1989) presents a model of hyperinflation in which it shows that small increases in the budget deficit can throw the economy off balance and lead to hyperinflation; stabilizing the rate of inflation may necessitate much larger cuts in the fiscal deficit.

Zoli (2005) analyse the impact of direct financing of fiscal deficits on inflation and discovered that the impact on inflation is through the exchange rate channel. Emerging countries have adopted inflation-targeting regimes that prevent the risk of fiscal dominance and its impact on macroeconomic variables (Jácome et al., 2012). As anticipated by the theory of the price level,

Baldini and Ribeiro (2008) also discover that changes in nominal public debt have an aggregate demand influence on price volatility, implying that fiscal outcomes could be a direct source of inflation fluctuation.

Garriga and Rodriguez (2020) conducted a study on a sample of 118 developing countries between 1980 and 2013; the study finds that central banks that have maintained their independence over the years are associated with lower inflation rates. The central bank's independence is important because it enables the bank to preserve the economy's price stability. Price stability is an important objective in emerging market economies; the central bank of Indonesia has implemented legislation that requires the central bank to be independent of political and fiscal pressures when utilizing monetary tools to meet its objectives (Kuncoro & Sebayang, 2013). A central bank is required to tighten the policy rates often to achieve its mandate objectives; a weak balance sheet may prevent the central bank from reaching its objectives.

iv. Capital Outflow Pressure and Market Instability

The extent of central bank asset purchases varied significantly, but they often assisted domestic investor bases in absorbing much of the pressure from outflows and dealing with the government's increased funding needs (IMF, 2020). Ha and Kindberg-Hanlon (2021) find that during the Covid-19 pandemic, EMEs were facing large capital outflows due to the increased market volatility that the markets were experiencing during that period. Therefore, central banks saw it best to announce the asset purchase programme with hopes of stabilizing the markets. IMF (2020) asserts that emerging countries with weak fundamentals may experience capital outflow pressure when implementing QE on a large scale, and foreign investors would rebalance their portfolios as they perceive the market to be risky.

Park et al., (2014) explain that QE can lead to capital outflow which will result in financial market instability. The study was conducted to determine the effects of the asset purchase programme by the US Federal Reserve Bank in Asia, Asia is a developing economy and the study has noted that QE in advanced economies increases the capital inflow in developing countries. Lopez and Stracca, (2021) underline the importance of capital flow to monetary authorities as it poses a risk to the stability of the financial markets. According to the study, emerging economies (EMEs) were able to react countercyclically to the Covid-19-induced capital outflows and the upheaval in the financial markets because some of them had stronger economic fundamentals and could withstand the pandemic, and because the use of QE in advanced economies created favourable tailwinds that allowed the use of QE in EMEs to be successful.

2.2.3 The Impact of quantitative easing on domestic financial markets

Evaluating the impact of QE on financial markets may provide a timely and clear picture of how the policy was effective in stabilising the financial markets and its effectiveness (Joyce et al., 2011). As discussed in Ha and Kindberg-Hanlon (2021), during times of extreme volatility and limited market liquidity, asset purchase programs can be employed to stabilise the financial markets and enhance market performance, especially in emerging markets. This study strictly focuses on the markets that can result in a loss of investors' confidence; therefore, an overview of the financial markets can provide investors with some understanding regarding the monetary policy tool. We look into the banking system and stock markets as a sufficient amount of empirical literature focusing on the impact of QE only on fixed asset securities/bond markets. Joyce et al.

(2010) highlight the fact that other assets are not absorbed for the reason that they are more difficult to separate from other impacts on the financial markets such as business cycle shocks.

Our study attempts to include the most common assets (bonds and stocks) and banks to be able to understand the overview of the financial markets through the recent asset purchase programmes implemented in EMEs. To determine the impact of QE on asset prices, Joyce et al. (2010) make use of several approaches to isolate the impact of other external influences on the selected asset classes. A survey by Lombardi et al. (2018) notes that it is significant to evaluate the financial markets in order to tell whether the announcement made by monetary authorities is effective as the financial markets tend to react to the surprise or announcements made.

2.3 The Financial Markets

2.3.1 Stock markets

In the wake of the Covid-19 pandemic in late 2019/beginning of 2020 stock markets across the globe crashed and interest rates started increasing. The announcement of the asset purchase programme in EMEs has had a significant impact on both stock and bond markets, equity prices increased as bond yields decreased without exerting any pressure on the exchange rate (Ha and Kindberg-Hanlon, 2021). In our model, the stock and bank markets are represented by an index on the stock exchange. Arslan et al. (2021) find that the asset purchase programmes in EMEs assisted with the stabilization of rising long-term bond yields and asset prices. Ha and Kindberg-Hanlon (2021) made use of panel regression to determine the reactions of daily asset prices to the announcement of asset purchases in EMEs, including long-term government bond yields, equity prices, and exchange rates. The regression model is estimated using a local projections framework, the regression takes into account lags of the dependent variables, policy rate changes, and cross-section fixed effects in addition to time and time-fixed effects. Additionally, Event studies were carried out to test the panel regressions' robustness.

Joyce et al. (2010) evaluate the financial markets' response to the Bank of England's quantitative easing (QE) programme in 2009–2010 using an event study and news-based calibration approach, in a 2-3 days window the study found that there was a significant decrease in gilt yields when the announcement of asset purchases was first introduced compared to when market participants were expecting the central bank to further purchase gilts. Corporate bonds and equity prices were also affected by the QE programme through portfolio rebalancing as investors and/or portfolio managers adjusted their portfolios away from gilts to corporate bonds and equities, the prices of both corporate bonds and equities increased for the risk that investors incurred. Loonstra (2017) study findings prove that quantitative easing had a notable and positive effect on the actual stock prices of the Eurostoxx50 index, with the index reportedly rising by almost 25% due to QE.

IMF (2020) uses the event study methodology to show the significant impact of asset purchase programme announcements on financial asset prices, the model that the study uses controls for policy rate cuts by EMEs and global factors including the announcement of QE by the Federal reserve bank and the exchange volatility index. To analyse the impact, the study uses daily data from 15 EMEs from January to May 2020. The study finds that most of the literature has discovered that the asset purchase programme lowers bond yields. Papadamou et al. (2019) also assert that the announcement of QE impacts both bonds and stock prices. Tillmann (2016) believes that the impact of the spillover of advanced unconventional monetary policy on emerging markets began in 2008, and the increased liquidity influenced the EMEs' asset price boom and exchange rate appreciation.

Tillmann (2016) presents a qualitative VAR model that estimates the effects of QE on macroeconomic factors in emerging countries. Quantitative easing is believed to have led to the asset price boom and exchange rate appreciation in emerging markets. Arena, et al.(2021) analysed the country's primary stock market index of the emerging markets that announced the asset purchase programme, and the stock markets responded positively, there was a noticeable increase in equity prices. Kuncoro and Sebayang (2013) state that to attain price stability, fiscal and monetary policies must be appropriate, according to the principles of the fiscal theory of price level.

Quantitative easing is considered effective when corporate bond yields are lowered and equity prices are high, when corporate bond yields are lower it will encourage more investments and boost the wealth of the financial participants (Bernanke, 2010). Therefore, it is important to analyse the impact of quantitative easing on financial markets, specifically the stock and bank markets in EMEs. Inoue and Okimoto (2021) investigated the impact of the unconventional monetary policy used by the Bank of Japan and the Federal Reserve Bank under two different regimes on both the domestic and global financial markets, the study found that both central banks' policy implementation impacts their domestic financial markets and the Fed's impact on the global financial markets is greater than of BoJ.

2.3.2 The Banking System

Gertler and Karadi (2011) developed a quantitative macroeconomic model that is used to examine the implications of the unconventional monetary policy on the central banks' balance sheets with banks that occasionally face low liquidity. The monetary Dynamic stochastic general equilibrium (DSGE) model is developed using financial intermediaries that have experienced balance sheet constraints during tough times such as financial crises, the financial intermediaries in this case include institutions that facilitate transactions between households and non-financial private companies, it can either be a commercial or investment bank. The study finds that the central banks are not limited to expanding their balance sheets compared to financial intermediaries, the central banks can purchase government bonds from banks, insurance companies, pension funds, and households at market value to increase the deposits held by commercial banks to be able to lend more and for the private non-financial companies to rebalance their investment portfolios.

McLeay et al. (2014) state that quantitative easing can enhance or limit bank lending in the economy. The purchase of government securities from private and non-financial institutions increases the deposits held by the institutions, fostering an increase in spending and investment, highlighting that the assets purchased from banks may not always increase the money supply (Barrie, 2021). Abed et al. (2022) emphasize that the banking sector is crucial to the progress of economies, and therefore, is considered to be a country's pillar when it comes to economic growth. Matousek et al. (2019) explain that financial intermediaries play a vital role in providing private and non-financial companies with credit. When the financial intermediaries are facing limited liquidity, the central bank can ease the credit constraints through quantitative easing for the intermediaries to expand the credit provided, and immediately after the capital shortage has been resolved, it is recommended that the monetary authorities should end the QE programme (Karadi & Nakov, 2021).

Casiraghi et al. (2013) provide evidence that the use of the asset purchase programme in Italy resulted in a significant increase in credit supply. As banks deal with rising asset prices and more affordable lending from the central bank and interbank markets, the asset purchase programme

may potentially have a favourable impact on their profitability (Loonstra, 2017). Also, the banking industry's growth is influenced by the growth of credit lending (Dang, 2019). Dang (2019) further finds that the Vietnam banking system significantly grew due to the expansion of loans by commercial banks.

Both studies by Gertler and Karadi (2011) and Karadi and Nakov (2021) ascertain that the asset-purchase programme can suppress the balance sheet constraints faced by financial intermediaries and emphasize that the programme should be discontinued as soon as the banking sector's constraints have been alleviated. Bowdler and Radia (2012) point out that during the global financial crisis (GFC) banks found themselves illiquid which led to financial market instability, central banks used a combination of conventional and unconventional monetary policy tools to ease off the dysfunction. The influence of quantitative easing on bank credit lending is found to be hindered by low capitalization when it is excessively utilized (Matousek et al., 2019). Negro and Sims (2015) point out that when a central bank has a larger balance sheet, fiscal authorities are liable to provide support of capital injection for the monetary authorities to reach their monetary objectives and control inflation.

2.3.3 Exchange Rate

Similar to inflation, theory suggests that QE can have a negative impact on the exchange rate or domestic currency. However, IMF (2020) reports that the asset purchase programmes that were implemented in EMEs did not lead to any foreign exchange depreciation but alleviated the downward pressure on exchange rates. The exchange rate can be overly sensitive to the asset purchase programme when both domestic and foreign investors when altering their investment portfolios with limited risk-free asset options, investors may opt to exit the country together and invest in other countries. Although, Dedola et al. (2020) when assessing the impact of QE on the EUR/USD exchange rate during the Covid-19 pandemic, the study finds that there was a persistent depreciation of the exchange rate of 7 percent. The exchange rate in the Eurozone shows that the exchange rate may be impacted by quantitative easing, but the evidence is inconclusive or not significant (Loonstra, 2017).

Jácome et al. (2012) find that the most stringent regulations for central bank financing of the government are found in economies with flexible exchange rate regimes. Economies with substantial foreign investor engagement in government debt markets and less flexible exchange rates may be at higher risk of sudden increases in risk premia (Ha and Kindberg-Hanlon, 2021). Europe and most of America have the most powerful economies; limits are linked to prior periods of hyperinflation, which were tied to central banks' persistent financing of fiscal deficits. With respect to the exchange rate, Drakopoulos et al. (2020) find that the domestic rate has not depreciated against the US dollar by the announcement.

Announcements of asset purchase programs in emerging markets appear to have contributed to the stabilization of the bond markets and the rise of stock prices without exerting pressure on exchange rates (Ha and Kindberg-Hanlon, 2021). Fratto et al. (2021) conducted a study on 27 emerging markets to determine the effects of asset purchase programmes on bond yields, exchange rates, equities, and debt spreads. The study confirms that QE has reduced bond yields and the effects of the programme are stronger than those of policy cuts signifying that QE may be used during economic and financial fallouts and beyond. The evidence on the impact of fiscal policy on exchange rate movements is mixed from an empirical standpoint.

2.4 Conclusion

Quantitative easing successfully eased off the pressure that markets were faced with, despite the conventional emerging market fear of upsetting the exchange rate or inflation expectations (Arena, et al., 2021). Given the accompanying reductions in policy rates in Poland and Romania, the lack of exchange rate depreciation is even more noteworthy. The majority of the central banks in EMEs had not yet opened up to the idea of QE before the Covid-19 pandemic because it was believed that the programme would de-anchor inflation expectations and exacerbate exchange market pressures but implementing the unconventional monetary during the pandemic borne different results.

Since the Covid-19 lockdowns were put in place, QE in EMEs has stabilised markets and increased monetary transmission (IMF, 2020). According to the literature, the implementation of the asset purchase programme by central banks in the emerging market did not result in a major adjustment in the exchange rate. Arena et al. (2021) and IMF (2020) find that the asset purchase programmes implemented by emerging market economies in Europe show no indication of exchange rate pressure and help with stabilising financial markets. The portfolio modifications of international investors are significantly influenced by the exchange rate. The portfolio modifications of international investors are strongly influenced by the exchange rate (Hofmann et al., 2020).

The literature has established that central banks in emerging market economies may benefit from the large-scale purchase of assets in financial markets to achieve their monetary objectives and sustain price stability. The main risk with central banking purchasing government bonds, especially from the primary markets is fiscal dominance; the literature has further revealed how the risk of fiscal dominance materializes. The study aims to provide monetary policymakers in emerging markets with an overview of how emerging markets have been reacting to the asset purchase programme.

CHAPTER 3: RESEARCH METHODOLOGY AND DATA

3.1 Event Study and Vector Autoregression (VAR) Literature

For the third research question, our goal is to evaluate and analyze the medium-term effects of the asset purchase programme on financial markets which includes the stock market, bond market, and banking in emerging markets to be able to conclude whether QE is a proper monetary policy tool to be implemented by their central banks to stabilise financial markets. Agur et al. (2022) highlight that central banks in emerging markets normally tend to be hesitant to directly finance government spending, therefore it is difficult to pinpoint historic instances of central banks purchasing government bonds in the primary market. The methodology approach to answering our third research question is the Event Study Methodology together with a basic vector autoregression (VAR) model to estimate and determine the movement of asset prices after the announcement and their stability over time.

The vector autoregression (VAR) is the most commonly used econometric approach used to measure the effects of monetary and fiscal policies. The vector autoregression (VAR) model estimates and determines any movement changes in the selected variables as a result of the implementation of the asset purchase programme. Similar to Tillmann (2016), Hesse et al. (2018), Lombardi et al. (2018), and Beckmann et al. (2020) we use the VAR model to determine the impact of the asset purchase programme on financial markets including the bond market, equity market, and banks. Similar to Joyce et al. (2010), to establish the immediate response of bond yields over a short period of time following the monetary authorities' announcements excluding other elements that might have also had an impact on asset pricing, we adopt the event study approach. The literature cited below explains the choice of our methodology approach and how it relates to this research study.

Our study seeks to evaluate the medium to long-term effects of quantitative easing on the domestic financial markets of four selected emerging market economies. In the literature review section, we find that the announcement of the asset purchase programme boosted investors' confidence in the financial markets, determined using VAR and event study approach. Therefore, the event study and VAR methodology will assist in answering the third research question. MacKinlay (1997) describes the event study methodology as a tool that can be used to measure the impact of a particular event on specific variables, the variables will therefore reflect the event's effects. Furthermore, Liu et al. (2020) consider the methodology useful and beneficial in economics and finance empirical studies to identify the effects of certain events. The response of the financial markets to the programme and their stability over time will paint a picture and we will therefore conclude on the plausibility of implementing the unconventional monetary policy beyond the Covid-19 crisis.

Thornton (2017) and Wang (2019) evaluate the effects of quantitative easing by the US Federal reserve bank on economic activity and the bond market using the event study methodology, the method proves that QE does reduce long-term bond yields. The event study methodology allows us to individually study the impact of quantitative easing on each of the selected EMEs' financial markets. Furthermore, Huston & Spencer (2016) state that the event study approach lessens the possibility of endogeneity issues and omits variable bias, plausible to analyse the market's immediate reactions to policies implemented but difficult to determine long-term effects, we then apply the vector autoregression model.

Beckmann et al. (2020) made use of a combination of event studies and vector autoregression (VAR) models to establish the impact of asset purchase programmes on financial variables, the study discovers that the programme persistently lowered long-term yields and determine the policy tool's systematic relationships with the key macroeconomic factors, respectively. Arena et al. (2021) examine the effectiveness of the asset purchase programme in European emerging markets, the study used event studies and local projection analysis to evaluate the level of spillovers from the programme into other financial asset classes, exchange rates, equity markets, and corporate credit defaults to see whether systematic reactions are present.

Agur et al. (2022) note that QE anticipates increasing investment and consumption, but it may also increase the dangers of financial market instability. To estimate the impact of the announcement of quantitative easing on market liquidity, bond yields, and volatility of the bond yields; Havemann et al. (2022) use the event study methodology to evaluate the effects of bond asset purchase and constructed alternative bond pricing models. According to the study, to model the financial market volatility they used a combination of GARCH and ARCH models because they are proven to be the best econometric approach and as the study made use of intraday data, the daily GARCH model is deemed appropriate because it is typically used for daily data.

Wang (2019) evaluates the effects of quantitative easing by the US Federal reserve bank on economic activity and the bond market using the event study methodology, the method proves that QE does reduce long-term bond yields. The event study methodology is used to determine the shift in the yield before and after the announcement of the programme. The use of event study methodology is common in economics and finance, the method is normally used to determine the effects of economic events on economic variables (MacKinlay, 1997). The methodology can be used to create a measure or measure effects on variables with ease similar to the study conducted by Drakopoulos et al. (2020), the study used a combination of event study and local projections methodology to assess the impact of the unconventional monetary policy tool on domestic financial markets.

IMF (2020) discusses that the local stress index (LSI) combines factors into an indicator that might aid central banks in making choices about whether to intervene to support local market functionality. Cecioni et al. (2019) recommend two approaches for studies on the financial market effects, the VAR analysis and structural models including the DSGE model or central banks' large-scale econometric models. The dynamic stochastic general equilibrium (DSGE) model is often severely criticized by researchers because it previously disregarded the financial system's function and frequently falls short of providing a thorough explanation of macroeconomic reality (Lombardi et al., 2018). Joyce et al. (2010) and Tillmann (2016) attempt to link the event study and VAR models, including the binary information of QE announcement, dates into a standard monetary policy VAR.

Liu et al. (2020) assess the short-term impact of the Covid-19 pandemic on stock market indices in most affected countries such as the US and UK with the aid of the event study methodology. The study finds that the markets experienced a decrease in returns, as the event study theory suggests that efficient markets will reflect the event that occurred through stock prices. Gagnon et al. (2010) employed the event study methodology to estimate the effects of asset purchase prices on interest rates after the announcement of the asset purchase programme in 2008. It is stated that the event study methodology can be utilized for unexpected events that occur over time.

Beckmann et al. (2020) made use of a combination of event studies and vector autoregression (VAR) models to establish the impact of asset purchase programmes on financial variables, the study discovers that the programme persistently lowered long-term yields and determine the policy tool's systematic relationships with the key macroeconomic factors, respectively. Arena et al. (2021) analyzed the effectiveness of the asset purchase programme in European emerging markets, the study used event studies and local projection analysis to evaluate the level of spillovers from the programme into other financial asset classes, exchange rates, equity markets, and corporate credit defaults to see whether systematic reactions are present.

3.2 Research Methodology

The study seeks to answer three-research questions, one of the questions being to determine the effects of quantitative easing on domestic financial markets in emerging countries using an event study and vector autoregression (VAR) methodology. Estimating the medium to long-term effects of the asset purchase programme on financial markets six to twelve months after the implementation of the programme. Evaluating the effects can be challenging, the financial markets are influenced by different factors but at the same time, it is important to understand the movement of the asset prices to understand the effect of the monetary policy tool in stabilising the financial markets. Identifying the effects of the asset purchase programme can be achieved using various methods, however, the most commonly used methods to determine the effects of QE on financial markets are event-study and VAR. Joyce et al. (2011) noted that the most part of the impact of the asset purchase programme is through the Portfolio-rebalancing channel, therefore, assessing the effects of the monetary policy tool can be achieved using portfolio model estimates.

The financial markets included in this study are the bond market, stock markets, and banks as these are the markets that are most likely to be affected by the programme. We are evaluating the medium to longer-term effects of the programme on financial markets as the majority of researchers are looking at the immediate reaction of the markets (at most bond markets) to the announcement of the programme. Following a similar approach to that of Joyce et al. (2011), we are evaluating the long-term effects of the programme using one of the recommended portfolio model estimates, a VAR model.

The VAR Equation:

$$Y_t \equiv \alpha + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{j=0}^{k} \gamma_j X_{t-j} + \varepsilon_t \qquad (1)$$

Where:

Y_t is a vector of dependent variables at time t

X_t is a vector of independent variables at time t

α is a vector of constants.

ϵ_t is a vector of error terms.

3.3 Data Description

We collect monthly data from January 2011 to December 2021 for our VAR analysis and daily data from March 2020 to April 2020 for event study. The VAR framework consists of variables – the stock market index, banking market index and 10-year treasury bill rate, total production, and

consumer price index (CPI). The excess returns of the assets are endogenous variables and yields, total production, and consumer price index (CPI) as exogenous variables. Using one lag determined by the Akaike (AIC) and Schwarz (SC) information criterion. All the variables are in levels and seasonally adjusted. The four chosen emerging countries are countries that have implemented the unconventional monetary policy before - South Africa, Brazil, Poland, and India.

The study will make use of secondary data obtained from reliable economic sources including the OECD statistics, EquityRT, IMF statistics, WorldBank data, the Reserve Bank of St Louis Database (FRED), and national sources. The four emerging economies that have embarked on or implemented the unconventional monetary policy tool, quantitative easing are used for this study. The study evaluates and analyses quantitative data extracted from the selected database.

3.4 Problems with data

Investigating the effects of quantitative easing on financial markets can be challenging, financial markets, especially during the Covid-19 pandemic were influenced by different factors, so detangling the direct impact of the asset purchase programme is a bit tricky (Barrie, 2021). Given that this study strictly focuses on emerging markets, it is important to note that the data availability in developing countries is limited compared to developed countries, the total number of observations may give blurred results. The majority of emerging countries have recently started publishing data compared to advanced economies that have been publishing data for quite some time now. The study makes use of Monthly data from January 2011 to December 2021.

CHAPTER 4: RESULTS AND DISCUSSION

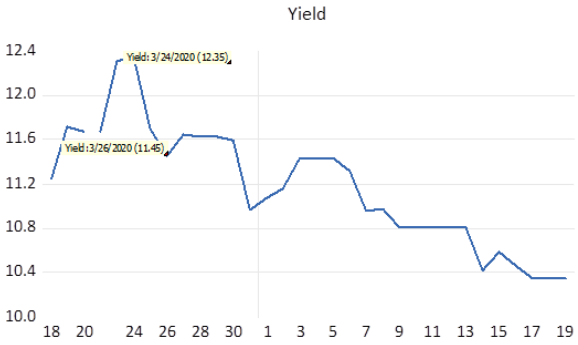
This chapter presents detailed results for our empirical research question using a combination of event study and vector autoregression (VAR) approach. The section is divided into two parts, presenting the empirical results and a discussion of the findings for each of the four selected emerging countries. We interpret and discuss the bond yield reactions and the VAR application.

4.1 Government bond yields' reaction to the announcement of QE

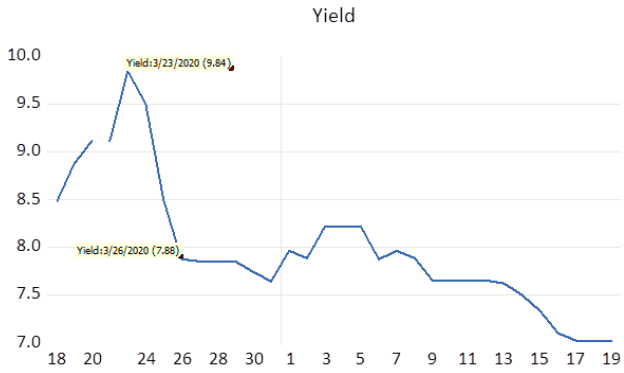
We would expect that bond yields to respond immediately after the announcement of the programme. Similar to Beckmann et al. (2020), Gagnon et al. (2011), and Joyce et al. (2011) we use an event study approach to assess the impact of QE on 10-year government bond yields. The event study is suitable for assessing the immediate reactions of asset prices, normally on a very short window period. For this study we assess the bond yields a day after the announcement and 3 days after the announcement. Joyce et al. (2011) point out that the time interval is significant as a very short window may not capture the full market reaction whereas a very long window may cloud the reaction because of other market news. The analysis is achieved using daily government bond yields data to determine the changes in bond yields days after the announcement of the asset purchase. The data is from mid to late March 2020 (Depending on the countries' announcement date) to mid to late April 2020.

Figure 1: 10-Year Government Bond Yields' Reactions to the QE Announcement

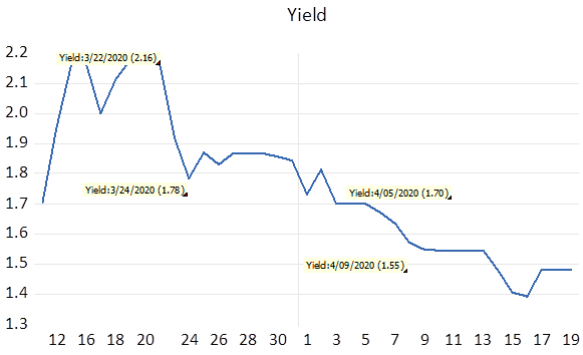
a) South Africa



b) Brazil



c) Poland



d) India

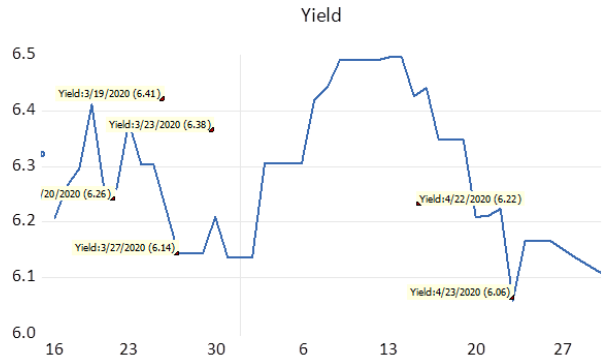


Figure 1 (a-d) depicts the government bond yields' reaction to the announcement of the asset purchase programmes by the central banks of the four emerging countries. The announcement of

the asset purchase programme in all four countries had a significant impact on government bond yields a few days after the announcement. Figure 1(a) shows South African government bond yields in response to the announcement of QE by its central bank, the programme was announced on the 24th of March 2020, and the bond yields declined by a total of 90 basis points since the announcement. Similar to Brazil shown in Figure 1(b), there was a decline of 196 basis points, the programme was announced on the 23rd of March. Poland and India's central banks announced their purchasing plans more than once. Figure 1(c) shows Poland's bond yields, the first announcement was on the 22nd of March 2020 where there was a decline of 38 basis points, and the second announcement was on the 05th of April 2020 which lowered the yields by 15 basis points. Figure 1(d) shows India's bond yield curve, the first announcement of the programme was made on the 19th of March 2020 which lowered 15 basis points, the second announcement was made on the 23rd of March 2020 and lowered 24 basis points, and the last announcement was made on the 22nd of April 2020 and lowered 16 basis points.

To curb the spread of the Covid virus, various countries implemented lockdowns which subsequently led to the contraction of their economic growth (IMF, 2020). As a result, central banks explored different monetary policy tools to prevent the malfunction of the economy, and some of the monetary tools used include the asset purchase programme (QE). Therefore, both the announcement of the Covid-19 lockdowns and QE relatively happened around the same time. South Africa announced its 21-day lockdown on the 23rd of March 2020 and the following day, the 24th of March 2020 the central bank announced the asset purchase programme. India announced its lockdown on the 24th of March 2020, which was 6 days after the announcement of their first asset purchase programme, 18th of March 2020. The Polish government declared a state of epidemic on the 20th of March 2020 and tightened the lockdown restrictions on the 31st of March, this was 14 days after the first announcement of the asset purchase programme. Finally, Brazil announced its lockdown on the 27th of March 2020 which was 4 days after the announcement of its asset purchase programme, 23rd of March 2020. The lockdown announcement dates are reported by the World Health Organisation (2020). Out of the four countries under this study, only South Africa announced its lockdown first, followed by QE. Conversely, prior to announcing their lockdowns, Brazil, India, and Poland announced QE.

Looking at ***Figure 1 (b-d),*** the bond yields reaction around the lockdown announcement dates (27th, 31st, and 24th) is not as significant as the reaction around the announcement of the asset purchase programme dates. We therefore can conclude that the bond yields fell as a result of the announcement of QE not necessarily Covid-19 lockdowns.

The results corroborate with that of Gagnon et al. (2010), Breedon et al. (2012), Drakopoulos et al. (2020), Kole et al. (2021) and others. Previous studies on the effects of quantitative easing on government bond yields find that the announcement of the asset purchase programme had a significant influence on the reduction of bond yields. It is also evident that when the central bank announces the programme more than once, the effect of the announcement on the bond yield becomes less impactful on bond yields compared to the first announcement.

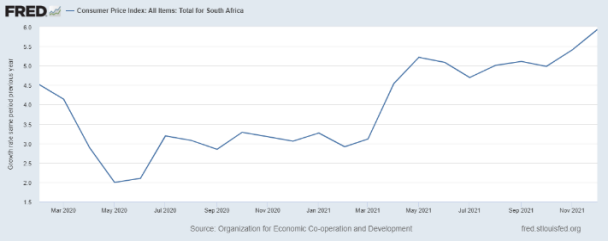
4.2 Inflation response to QE

In basic economics, there is an inverse relationship between inflation and interest rates (when interest rates are lowered, the inflation rate should increase), central banks often use interest rates to tackle inflationary challenges faced by the economy. In the literature, we find that an increase in inflation tends to diminish the effectiveness of the asset purchase programme (Mimir & Sunel,

2021). Havemann et al. (2022) add that emerging market economies have been experiencing positive policy rates and rising inflation rates making their central banks hesitant to embark on the asset purchase programme. Taking into consideration that inflation rates do not respond immediately to interest rate changes, analysing the inflation rate trends after the announcement of the asset purchase programme can paint us a good picture of whether or not inflation positively responded to QE. Using the consumer price index as a measure of inflation in the four countries, the figures show the reaction to the inflation a few months after the announcement.

Figure 2: Consumer Price Index (CPI) Response the QE Announcement

a) South Africa



b) Brazil



c) Poland



d) India



The inflation rates for all four countries (See ***figure 2 a-d***) in the first three months after the announcement declined. Interestingly, in Poland there was deflation. The decrease in inflation in South Africa and Poland was more significant than in Brazil and India. The programme shows some effectiveness in all four countries as it did not lead to any hyperinflation, also considering the scale at which the programme was implemented. Similar to Agur et al. (2022), the asset purchase programmes in emerging market economies had no significant impact on inflation or led to any hyperinflation for countries with stable inflation, independent central banks, and a healthy fiscal position. Central banks in emerging economies ought to embrace the programme as an alternative monetary policy instrument because it serves to avert economic dysfunction during the crisis.

4.3 Descriptive statistics

In the appendix ***Table 3 (a-d***) reports selected summary statistics including the mean, standard deviation, minimum, and maximum of the assets for all four selected countries. The summary statistics present excess returns on stocks and banks, government bond yields, and broad money supplied (M3) returns. The broad money supply is used as a benchmark relative to the assets selected. The summary descriptive is to provide an informative overview and characteristics of variables included in our sample.

Based on the descriptive statistics tables, we observe that banks are generally riskier assets compared to stocks, the volatility of banks tends to be slightly higher than that of stocks, and higher risk also indicates a higher average return. At most, banks have a lower minimum value, indicating larger downward fluctuations. We also note that on average both stocks and banks have a negative return compared to government bonds and M3, the average return of the risk-free asset (government bonds) in all four countries is slightly higher than both the average monthly excess returns of stocks and banks. Although government bonds and M3 have positive average returns, the government bonds average return is higher relative to M3 however, the volatility of government bonds is lower relative to M3.

The average excess returns for both stocks and banks between January 2011 and December 2021 are negative indicating an underperformance in the financial markets. The maximum excess returns experienced by the stock markets between the four countries is between 1.57% and 5.03% whereas the maximum excess returns in the banking industry range between 3.31% and 15.93%.

4.4 The VAR Application

The VAR model is estimated using variables – assets' excess returns, consumer price index (CPI), total production, money supply, and slope of the yield curve which may have the potential to influence the demand and supply of assets over time. The VAR is estimated using Ordinary Least Squares (OLS). The appendix provides figures on the selection of lags, stability conditions, and residual diagnostics. The optimal lags are chosen using the Akaike (AIC) and Schwarz (SC) information criterion, the number of lags recommended for the three countries is one lag and two lags for Poland for the explanatory variables included in this model (see the lag length criteria and VAR stability conditions in figures provided in appendix v).

The VAR estimations for all four countries indicate that government bond yields have a negative effect on both the excess returns of stocks and banks. The explanation is that a decline in government bond yields will ultimately increase the excess returns of stocks and banks. To generate excess returns of financial assets, we differentiate bond yields from total returns implying that the lower the bond yields, the greater the excess returns.

4.3.1 Impulse Response Functions

The impulse response functions (IRFs), trace out the effects of endogenous variables to one of the innovations or shocks, the effect of one unit shock in government bond yields on excess returns of stocks and banks. We use the estimated VAR model to generate the IRFs, the IRFs assess how the excess returns are predicted to respond to the government bond yields shock (Joyce et al., 2011). For this study, innovations to the government bond yields decline are considered as the quantitative easing shock. To compute the IRFs, we make use of a Cholesky decomposition. We present the impulse response functions of the financial variables to one standard deviation QE shock over a horizon of 24 months.

Figure 3: Impulse response functions of the asset's excess returns to a one standard deviation shock in government bond yields

a) South Africa



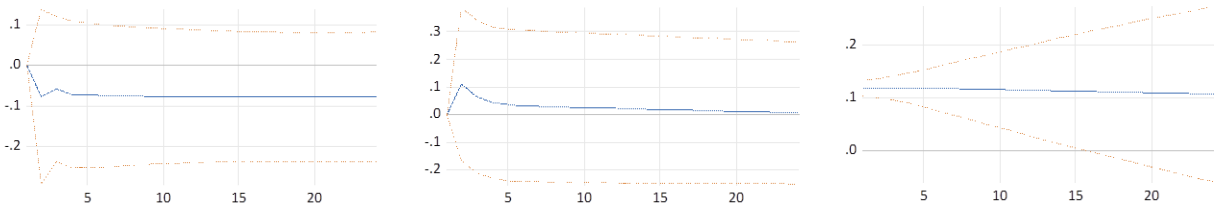


Figure 3(a) shows the estimated responses of the assets' excess returns to one standard deviation shock to South African government bond yields. Based on the figures above, the stocks' excess returns response to a one-standard deviation shock to government bond yields initially declines in the first month, then sharply increases in the second month and in the third month there is a slight decline until the fifth month when it hits stable state value and remains in the negative region. Interestingly, banks move in the opposite direction to that of stocks in the first month. The banks' excess returns response to one-standard deviation shock to bond yields in the first months increases then gradually declines from the second month until it reaches its stable state value from the fifth month and remains in the positive region. One standard deviation shock of bond yield on yields remains steady in the positive region throughout.

b) Brazil

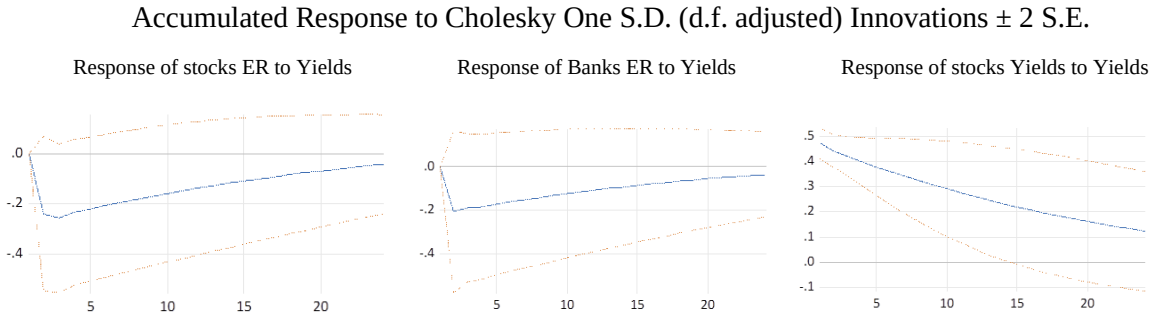
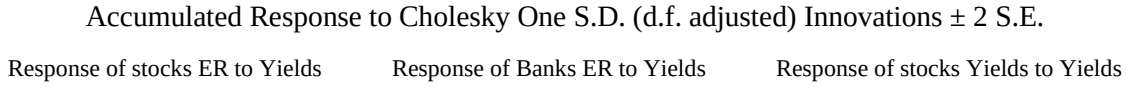


Figure 3(b) shows the estimated responses of the assets' excess returns to one standard deviation shock to Brazilian government bond yields. The stock's excess returns response to a one-standard deviation shock to government bond yields initially declines in the first month, then gradually increases from the second month but remains in the negative region. The banks' excess returns response is more likely the same as the stocks' response, the banks' one-standard deviation shock to bond yields in the first month declines and then gradually increases from the second month until it reaches its stable state value but remains in the negative region. One standard deviation shock of bond yield on yields gradually declines but remains in the positive region.

c) Poland



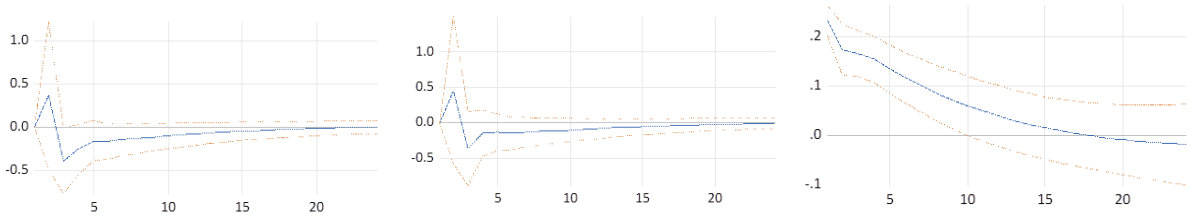


Figure 3(c) shows the estimated responses of the assets' excess returns to one standard deviation shock to Polish government bond yields. The stock excess returns response to a one-standard deviation shock to government bond yields initially increases for the first month, then sharply declines in the second month and in the third month there is a sharp increase until the fifth month where there is a gradual increase into the positive region and then hits stable state value. The banks' excess returns response to one-standard deviation shock to bond yields in the first month sharply increases, in the second month there is a sharp decline, another sharp increase in the third month and from the fourth month there is a gradual increase into the positive region. One standard deviation shock of bond yield on yields gradually declines then it hits a stable state value in the negative region.

d) India

Accumulated Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Response of stocks ER to Yields | Response of Banks ER to Yields | Response of stocks Yields to Yields

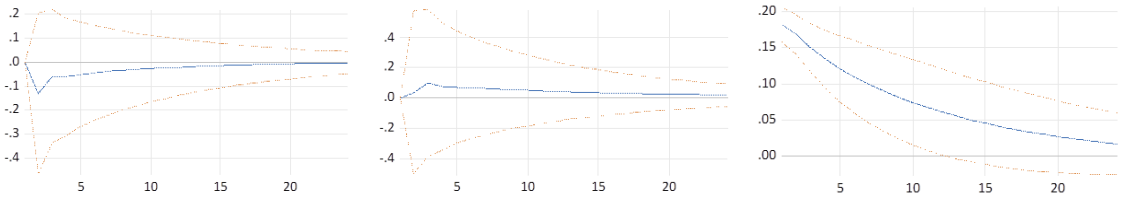


Figure 3(d) shows the estimated responses of the assets' excess returns to one standard deviation shock to Indian government bond yields. The stock excess returns response to a one-standard deviation shock to government bond yields initially declines in the first month, then sharply increases in the second month and from the third month there is a gradual increase into the positive region, and it hits stable state value. Interestingly, banks move in the opposite direction to that of stocks in the first month. The banks' excess returns response to a one-standard deviation shock to bond yields in the first month sharply increases the gradually declines from the second month reaches its stable state value and remains in the positive region. One standard deviation shock of bond yield on yields gradually declines and remains in the positive region.

4.3.2 Variance Decomposition

The variance decomposition ***table (a-d)*** reports the variability of the dependent variables (stocks and banks) explained by the independent (yields, total production, and CPI) variables included in this model at different forecast horizons (6, 12, 18, and 24). The variance decomposition also applies the Cholesky decomposition. The results from the variance decomposition indicate that 6 to 12 months after the announcement of the excess returns of both stocks and banks are largely explained by their own shocks while other variations are explained by the government bond yields more than the total production and CPI.

The general overview of the standard errors for banks indicates greater variability compared to stocks, implying that there is more uncertainty in the forecasted values for banks compared to stocks and the forecasted values for banks are more subject to changes (due to the unpredictability associated with banking operations) compared to those for stocks. The stock variable strongly predicts itself, on the other hand, the bank variable is not a strong influencer of itself into the future. Yields seem to have a strong influence in predicting both the stock and bank market compared to the other two independent variables. Total production and the consumer price index (CPI) seem not to have a greater influence on both the stock and bank market.

Table 1: The Variance Decomposition of Stocks and Banks

a) South African

Forecast Horizon	Standard Error	Variance Decomposition - Stocks			
		Stocks	Yields	Total Production	CPI
6	3.572	98.139	0.201	0.071	0.025
12	3.580	97.716	0.471	0.072	0.046
18	3.588	97.291	0.747	0.073	0.066
24	3.597	96.865	1.025	0.074	0.083

Forecast Horizon	Standard Error	Variance Decomposition - Banks			
		Banks	Yields	Total Production	CPI
6	4.462	49.521	0.112	0.911	0.089
12	4.465	49.454	0.134	0.921	0.192
18	4.468	49.395	0.144	0.928	0.293
24	4.471	49.343	0.147	0.935	0.388

b) Brazil

Forecast Horizon	Standard Error	Variance Decomposition - Stocks			
		Stocks	Yields	Total Production	CPI
6	5.955	97.775	0.766	0.347	0.009
12	5.987	97.090	1.220	0.376	0.024
18	6.000	96.792	1.399	0.394	0.043
24	6.008	96.671	1.454	0.407	0.064

Forecast Horizon	Standard Error	Variance Decomposition - Banks			
		Banks	Yields	Total Production	CPI
6	7.065	15.710	0.332	0.157	0.003

12	7.081	15.723	0.528	0.169	0.008
18	7.088	15.729	0.608	0.177	0.016
24	7.091	15.732	0.633	0.183	0.024

c) Poland

Forecast Horizon	Standard Error	Variance Decomposition - Stocks			
		Stocks	Yields	Total Production	CPI
6	4.551	94.188	1.903	0.087	0.288
12	4.561	93.747	2.231	0.099	0.303
18	4.567	93.510	2.279	0.101	0.465
24	4.577	93.121	2.271	0.108	0.829

Forecast Horizon	Standard Error	Variance Decomposition - Banks			
		Banks	Yields	Total Production	CPI
6	5.539	24.141	1.280	0.412	0.153
12	5.549	24.108	1.478	0.518	0.159
18	5.553	24.083	1.524	0.544	0.227
24	5.559	24.040	1.526	0.559	0.387

d) India

Forecast Horizon	Standard Error	Variance Decomposition - Stocks			
		Stocks	Yields	Total Production	CPI
6	4.468	95.321	0.145	0.012	0.006
12	4.450	95.276	0.173	0.013	0.018
18	4.470	95.253	0.180	0.013	0.034
24	4.471	95.235	0.182	0.013	0.053

Forecast Horizon	Standard Error	Variance Decomposition - Banks			
		Banks	Yields	Total Production	CPI
6	7.134	19.516	0.056	0.016	0.013
12	7.136	19.508	0.091	0.027	0.025
18	7.137	19.504	0.106	0.032	0.034
24	7.138	19.502	0.113	0.034	0.042

4.3.3 Dependent sample t-test analysis

The t-statistics reports the difference between means of stocks, bonds, and banks before and after QE, we use a dependent samples t-test which consists of two datasets of the variables of interest before and after the announcement of the programme. We analyse the difference in the mean values to determine whether or not QE has affected our variables of interest at a 5% significance level (95% confidence interval). This test provides preliminary insights into the impact of QE on the financial markets and the economy.

Hypotheses

The null hypothesis (H_0) assumes that QE does not have a positive effect on the financial markets and the alternative hypothesis (H_1) assumes that QE has positively affected the financial markets. The mean differences between the variables of interest will indicate whether we reject or fail to reject the null hypothesis. The representation of the null and alternative hypotheses are as follows:

$$H_0 : \mu_d = 0$$

$$H_1 : \mu_d \neq 0$$

Table 2: Paired Samples Tests

a) South Africa

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Stock Before - Stock After	-6.531374915	5.4445680769	1.1607858142	-8.945361165	-4.117388665	-5,627	21	<,001	<,001
Pair 2	Bank Before - Bank After	-7.929288167	8.7534682204	1.8662456952	-11.81035855	-4.048217781	-4,249	21	<,001	<,001

b) Brazil

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Stock Before - Stock After	-2.278855035	11.477184898	2.4469440419	-7.367553742	2.8098436715	-,931	21	,181	,362
Pair 2	Bank Before - Bank After	-1.263288957	14.379661760	3.0657541882	-7.638873811	5.1122958976	-,412	21	,342	,684

c) Poland

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Stock Before - Stock After	-4.561328379	6.9496845846	1.4816777319	-7.642645903	-1.480010854	-3,078	21	,003	,006
Pair 2	Bank Before - Bank After	-7.331537615	13.001235972	2.7718728227	-13.09596271	-1.567112517	-2,645	21	,008	,015

d) India

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Stock Before - Stock After	-5.245796649	8.1261927489	1.7325101153	-8.848748671	-1.642844627	-3,028	21	,003	,006
Pair 2	Bank Before - Bank After	-5.658821267	13.716932014	2.9244597315	-11.74056821	.42292567851	-1,935	21	,033	,067

Table 2 (a-d) provides the paired sample tests for the four countries in this study, the tables show the mean difference between stock returns before and after the QE programme as well as mean differences between bank returns before and after the QE programme. South Africa, Poland, and India's t-test results are quite similar. The p-values are less the 0.05 for both variables implying that the mean difference is statistically significantly different from zero. From the t-distribution table, the t-values are greater than the critical value (2.080) at 21 degrees of freedom and 5% significance level, also suggesting that the mean difference is statistically significantly different from zero. We therefore reject the null hypothesis and confirm that the programme had some effect on the financial markets. However, Brazil's results are the complete opposite of the other three, so in the case of Brazil we fail to reject the null hypothesis based on the p-values.

4.5 Discussion

Although emerging markets' central banks' objective when implementing QE was to provide market liquidity and tackle market dysfunction rather than stabilising financial markets, the purchase programme has had a significant visible impact on the financial markets, especially the bond market (IMF, 2020). Based on our empirical findings and those of previous studies, we can see that the unconventional monetary policy tool has had some impact on financial markets but is very minimal. Agur et al. (2022) recommend that emerging markets with slightly larger financial markets may implement the programme on a larger scale so that the impact on bond yields and other financial asset prices may be visible.

Estimating and untangling the direct effects of quantitative easing on financial markets remains a difficult task amongst researchers, there is little to no reference when it comes to studying the effects of QE on financial markets in emerging markets compared to advanced markets as this is a fairly new concept in EMEs. The most common methods used to estimate the effects of the programme on financial markets are the event study and vector autoregression analysis among others, this study also follows the same approach. The general response of the assets' excess returns to one standard deviation shock to government bond yields, we observe that in the first two months, the stock and bank markets did not respond positively to the programme but showed a positive response three months after the announcement.

We find that the programmes' announcement significantly reduced the bond yields by more than 50 basis points in all four countries, the impact on bond yields can be explained through the signalling channel. Fratto et al. (2021) confirm that the announcement of asset purchase programmes reduces bond yields at different maturities and that the effects of the direct and signalling channels of transmission are larger in magnitude for asset purchase programmes

compared to that of policy cuts and stronger in emerging economies compared to advanced economies. Kumar and Prabheesh (2022) substantiate that QE signals and gives the market participants the impression that the central bank is committed to maintaining an accommodative monetary policy stance.

The effects of QE on other financial markets can be explained through the portfolio-rebalancing channel (see Joyce et al. (2011); Breedon et al. (2012); Beckmann et al. (2020); and Kole et al. (2021) for more insights). Compared to government bond yields, other financial asset classes may take time to react to the programme, as outlined in the literature the portfolio rebalancing channel may take time to feed through, and portfolio holders and managers may take time to rebalance their portfolios. When the central banks purchase government bonds and the yields are subsequently lowered, it encourages portfolio managers to rebalance their portfolios towards other financial assets to make up for the loss (Kumar & Prabheesh, 2022). From the literature, we see that the most effective asset purchase programmes are through the portfolio-rebalancing channel. The programme does not have a significant visible impact in the short term or immediately after the announcement but rather a couple of days or weeks later. As one of the transmission channels, portfolio rebalancing played a significant role in transmitting central banks' asset purchasing to the financial markets (Gagnon et al., 2011).

We find that the asset purchase programme positively affected the stock and bank market returns, in all four countries, there is a gradual increase in both the stock and bond market returns after the announcement of the programme. However, the impact of the programme is visible but very little. It is evident that the asset purchase programme was useful in reducing bond yields and providing market liquidity (Kumar & Prabheesh, 2022). Based on the variance decomposition findings, we see that bond yields have a greater influence on forecasting stock and bank values compared to total production and consumer price index.

We need to be cognizant that other variables may influence the financial markets between the announcement of the QE program and after three to six months analyzed in this study. Also, the programme was implemented amid the Covid-19 pandemic when the economy was in crisis. Hence some researchers are skeptical about the impact of QE on financial markets, most studies focus on the immediate response of the financial markets to the announcement of QE. We have opted to look at months after the announcement to see if the markets were stabilized and indeed there has been a gradual stabilization of the financial markets a few months after the announcement of the asset purchase programmes and the programme has been effective at lowering the long-term government bond yields. Overall, the findings are consistent with those of Joyce et al. (2010), Loonstra (2017), Papadamou et al. (2019), Ha and Kindberg-Hanlon (2021), and Kumar and Prabheesh (2022) that QE has effectively impacted the financial markets and has the potential to stabilise financial markets during the crisis.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This paper investigates the use of unconventional monetary policy tools, quantitative easing (QE) in emerging market economies (EMEs) conducted during the Covid-19 pandemic for the first time with intentions to alleviate market dysfunction and provide market liquidity. The paper answers three research questions: Under which conditions may emerging market economies (EMEs) effectively implement quantitative easing (QE)? What are the risks that EMEs may face as a result of implementing QE? What are the effects of quantitative easing implementation on domestic financial markets in emerging countries? The first and second questions are answered through literature and findings of previous researchers and the third question is the empirical question answered using event-study and basic VAR methodology.

The study finds that EMEs may implement QE under certain circumstances to avoid risks of fiscal dominance, the central bank losing its independence and credibility, and capital outflow pressure and market instability. It is recommended that any central bank that may wish to implement QE, should purchase the securities in the secondary market rather than the primary market to minimize the risk of fiscal dominance. QE may be aggressively implemented by central banks with the highest levels of operational independence and policy credibility. Additionally, the asset purchase programme may be implemented more widely and large scale in emerging countries with marginally bigger financial markets so that the effect on bond yields and other financial asset prices may be visible. Another condition to consider when implementing the programme is for the central bank to effectively communicate to the financial market participants about the asset purchase programmes' goals and their conception and time of exit.

The empirical results indicate that the asset purchase programme has had some effects on domestic financial markets and as a result, restoring investors' confidence. The programme significantly reduced bond yields, however, the impact on stocks and banks was positive but minimal, and the assets' excess returns slightly increased from the third month after the announcement of QE. Adrian et al. (2021) mention the asset purchase programme in emerging markets economies (EMEs) has been relatively small in coordination with other conventional monetary policy tools. As suggested by Mimir and Sunel (2021), it is recommended that EMEs implement the programme on a larger scale for a significant impact on other financial markets and help with the stabilisation of the markets. The impact of QE on bond yields was through the signalling channel and other financial markets were through the portfolio-rebalancing channel.

5.2 Recommendations

We see that Brazil, Poland, and India's asset purchase programme was larger scale than South Africa, South Africa implemented the unconventional monetary policy tool on a smaller scale. Based on this study and other studies' findings, we recommend central banks in emerging markets implement QE on a larger scale for a significant impact on financial markets and stimulating economic growth. We also recommend that before considering purchasing the assets in the primary market, the central bank should buy from the secondary market until there is a significant effect on financial markets. The programme can also be used during country-specific crises and alleviate market pressure.

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Appendix

i. The names of the stock index for each country are collected from EquityRT.

1. South Africa - FTSE/JSE All Share Index
2. Brazil - Brasil Ibovespa Index
3. Poland – Warsaw Stock Exchange (WIG20) Index
4. India – NIFTY 50 Index

ii. The names of the bank index for each country are collected from EquityRT.

1. South Africa – FTSE/JSE SA Financials Index
2. Brazil – Brasil Ifinanceiro Index
3. Poland – WIG Banki Index
4. India – India BSE Bank Index

iii. The countries' asset purchase programmes' announcement dates

Table 3: QE and Lockdown Announcement Dates in 2020

3.1 QE Announcement Dates

Emerging Market Countries	***QE Announcement Dates***
South Africa	March 24th
Brazil	March 23rd
Poland	March 17th and April 8th
India	March 18th, March 20th, and April 22nd

3.2 Lockdown Announcement Dates

Emerging Market Countries	***Lockdown Announcement Dates***
South Africa	March 23rd
Brazil	March 27th
Poland	March 31st
India	March 24th

iv. Summary of Statistics: Assets Excess Returns before the introduction of Quantitative easing

Table 4: Descriptive Statistics

a) South Africa

Assets	***Mean***	***Standard Deviation***	***Minimum***	***Maximum***
Stocks	-5.9037	3.7609	-19.1593	3.5223
Banks	-6.0731	4.7958	-36.0445	3.3172
Government Bonds	6.2839	0.8845	4.9300	7.6100
M3	0.5814	0.7645	-1.9245	3.3320

b) Brazil

Assets	***Mean***	***Standard Deviation***	***Minimum***	***Maximum***
Stocks	-10.8184	6.5174	-36.6843	1.5767
Banks	-10.0421	7.4911	-39.4128	9.0086
Government Bonds	11.1150	2.0621	6.4400	16.4900
M3	0.4360	1.0219	-2.3710	3.9973

c) Poland

Assets	***Mean***	***Standard Deviation***	***Minimum***	***Maximum***
Stocks	-3.6720	4.5246	-17.3085	5.0318
Banks	-3.9165	5.8380	-31.2613	8.5101
Government Bonds	3.6598	1.1841	1.7400	6.3400
M3	0.6665	0.9352	-1.6848	3.2991

d) India

Assets	***Mean***	***Standard Deviation***	***Minimum***	***Maximum***
Stocks	-7.1962	4.8499	-29.6164	3.8732
Banks	-6.8851	7.6228	-40.6894	15.9209
Government Bonds	7.7241	0.7259	6.2400	9.0399
M3	0.8784	3.2415	-23.4537	15.9964

v. Lag length criteria and VAR stability conditions

Figure 3: Lag length criteria and VAR stability conditions

a) South Africa

VAR Lag Order Selection Criteria
Endogenous variables: ER_BANKS ER_STOCKS M3_RETURNS TBILL TOTAL_PR...
Exogenous variables: C
Date: 06/05/23 Time: 17:09
Sample: 2011M01 2020M02
Included observations: 104

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1644.94...	NA	2474726.	31.74890	31.90146	31.81071
1	-1116.56...	985.6362	191.3243	22.28001	23.34794*	22.71266*
2	-1078.87...	65.95652	186.4464*	22.24752*	24.23081	23.05101
3	-1047.62...	51.06947	207.8130	22.33901	25.23767	23.51334
4	-1012.13...	53.91967*	216.8271	22.34879	26.16282	23.89396
5	-978.149...	47.71322	237.9830	22.38749	27.11688	24.30351
6	-948.238...	38.53917	290.7603	22.50459	28.14935	24.79145

Roots of Characteristic Polynomial
Endogenous variables: ER_BANKS
ER_STOCKS M3_RETURNS TBILL
TOTAL_PRODUCTION CPI
Exogenous variables: C
Lag specification: 1 1
Date: 06/05/23 Time: 17:15

Root	Modulus
0.995652 - 0.007932i	0.9956835677945104
0.995652 + 0.007932i	0.9956835677945104
0.339123	0.3391227131137156
-0.236233	0.2362326706409132
0.064138	0.06413762618510...
0.053717	0.05371699076346...

No root lies outside the unit circle.
VAR satisfies the stability condition.

b) Brazil

VAR Lag Order Selection Criteria
Endogenous variables: ER_STOCKS ER_BANKS M3_RETURNS TBILL TOTAL_PR...
Exogenous variables: C
Date: 06/06/23 Time: 00:39
Sample: 2011M01 2020M02
Included observations: 103

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2247.64...	NA	4.07e+11	43.76015	43.91363	43.82231
1	-1673.00...	1071.186*	11698691*	33.30099*	34.37535*	33.73614*
2	-1651.44...	37.66248	15594137	33.58155	35.57678	34.38969
3	-1620.54...	50.41472	17518582	33.68040	36.59651	34.86153
4	-1594.01...	40.16910	21779667	33.86444	37.70143	35.41855
5	-1566.71...	38.17277	27273429	34.03329	38.79115	35.96039
6	-1530.08...	46.93723	29359811	34.02115	39.69989	36.32124

Roots of Characteristic Polynomial
Endogenous variables: ER_STOCKS
ER_BANKS M3_RETURNS TBILL
TOTAL_PRODUCTION CPI
Exogenous variables: C
Lag specification: 1 1
Date: 06/06/23 Time: 00:37

Root	Modulus
0.992677	0.9926766249630914
0.961074	0.96107415463211
0.462957	0.4629574885123798
-0.170977 - 0.101909i	0.1990439077147446
-0.170977 + 0.101909i	0.1990439077147446
0.052585	0.05258498481802...

No root lies outside the unit circle.
VAR satisfies the stability condition.

c) Poland

VAR Lag Order Selection Criteria
Endogenous variables: ER_STOCKS ER_BANKS M3_RETURNS TBILL TOTAL_PR...
Exogenous variables: C
Date: 06/06/23 Time: 00:55
Sample: 2011M01 2020M02
Included observations: 103

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1528.06...	NA	348134.5	29.78760	29.94108	29.84977
1	-1111.20...	777.0476	214.0872	22.39239	23.46674*	22.82754*
2	-1073.25...	66.32509*	207.5408*	22.35447*	24.34970	23.16261
3	-1054.08...	31.27161	292.8292	22.68122	25.59733	23.86234
4	-1027.57...	40.15515	364.1198	22.86544	26.70242	24.41955
5	-1000.08...	38.42736	454.3570	23.03075	27.78861	24.95785
6	-974.652...	32.59180	607.8644	23.23597	28.91470	25.53605

Roots of Characteristic Polynomial
Endogenous variables: ER_STOCKS
ER_BANKS M3_RETURNS TBILL
TOTAL_PRODUCTION CPI
Exogenous variables: C
Lag specification: 1 2
Date: 06/06/23 Time: 00:54

Root	Modulus
0.997946	0.997946055533546
0.912453 - 0.049578i	0.9137992528314012
0.912453 + 0.049578i	0.9137992528314012
0.454299	0.4542992793744077
-0.268230 - 0.321803i	0.4189324899540229
-0.268230 + 0.321803i	0.4189324899540229
0.126306 - 0.388540i	0.4085543132829073
0.126306 + 0.388540i	0.4085543132829073
-0.405970	0.4059701118226424
-0.287624	0.2876235998100231
-0.001177 - 0.077290i	0.07729882071284...
-0.001177 + 0.077290i	0.07729882071284...

No root lies outside the unit circle.
VAR satisfies the stability condition.

d) India

VAR Lag Order Selection Criteria
Endogenous variables: ER_STOCKS ER_BANKS M3_RETURNS TBILL TOTAL_PR...
Exogenous variables: C
Date: 06/06/23 Time: 01:31
Sample: 2011M01 2020M02
Included observations: 103

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1789.47...	NA	55743336	34.86353	35.01701	34.92569
1	-1333.09...	850.7158	15913.61*	26.70093*	27.77529*	27.13608*
2	-1312.36...	36.23121	21552.59	26.99739	28.99263	27.80553
3	-1282.92...	48.02158	24912.08	27.12474	30.04085	28.30586
4	-1259.47...	35.51968	32873.79	27.36839	31.20537	28.92250
5	-1221.20...	53.50166*	33271.81	27.32434	32.08220	29.25143
6	-1202.38...	24.11891	50610.36	27.65793	33.33666	29.95801

Roots of Characteristic Polynomial
Endogenous variables: ER_STOCKS
ER_BANKS M3_RETURNS TBILL
TOTAL_PRODUCTION CPI
Exogenous variables: C
Lag specification: 1 1
Date: 06/06/23 Time: 01:30

Root	Modulus
0.999734	0.9997336896117588
0.920279	0.9202790071582724
0.675750	0.6757499595145297
0.150620	0.1506201236137257
-0.136457	0.1364569432488706
0.016914	0.01691401189031...

No root lies outside the unit circle.
VAR satisfies the stability condition.