Master of Management in Finance and Investment

Research Report

Quantitative Easing in Developed Countries and Middle Income Countries' financial markets

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Abstract

This study examines Quantitative Easing policy programs of developed countries and their potential impact on Middle Income Countries through capital inflows. The study specifically focuses on the United States and European Union Quantitative Easing programs and investigates potential effects through the various transmission channels. An Autoregressive Multifactor MIDAS approach is used to carry out the empirical analysis and the study finds that lagged capital inflows are highly significant across the different models run and that there is evidence of transmission of quantitative easing to capital inflows to Middle Income Countries along the portfolio rebalancing and liquidity channels.

Key words: *Quantitative Easing, Middle Income Countries, Financial/Capital inflows, Mixed Data Sampling.*

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1. Introduction

Since the 2008 eruption of the Global Financial Crisis (GFC), the likes of the U.S. Federal Reserve, Bank of Japan, England, and European Central Bank (ECB) have implemented unconventional monetary policies in a bid to absorb the impact of the crisis. As a response to grave economic downturns brought about by the 2008 GFC and the 2013 European Debt crisis, monetary policy was generally loosened. The height of the crisis forced the hand of policy makers and pushed them to formulate effective policy responses. The traditional monetary measures normally employed by Federal Reserves had already been exhausted by the end of 2008 and policy makers had to become creative about their responses.

Monetary Policy committees through the Federal Reserve in the United States (U.S.) and the European Central Bank (ECB) in Europe undertook Asset Purchase Programs, known as Quantitative Easing (QE), which were financed by these Central Banks. These policy programs, typically implemented when short-term interest rates are near the zero bound, are aimed at influencing prices and output by increasing liquidity. Some of the central banks, such as those in Europe and Japan, focused their QE programs on lending to their commercial banks whereas the U.S. Federal Reserve and Bank of England directed their efforts towards the purchasing of bonds. Although the initial intent of these QE programs was to alleviate distress in the financial markets, the scope of the policy goals was widened to include managing inflation and containing the Euro Sovereign debt crisis (Fawley and Neely, 2013; Mishkin, 1996). The Large Scale Asset Purchase Programs (LSAPPs) introduced also aimed to ease the unfavorable credit conditions.

Some studies have stated the objective of Quantitative Easing to be the reduction of long-term interest rates in an endeavor to spur economic activity (Krishnamurthy and Vissing-Jorgensen, 2011). The great recession of 2007 – 2008 saw the Federal Reserve push down fund rates to almost zero, by engaging in two rounds of QE. The first round of QE in the U.S. was in December 2008 in the midst of extraordinarily strained financial markets and QE2 was initiated in November 2010 (Palley, 2011). In order to provide a stimulus to the economy - when the federal funds rate reached the

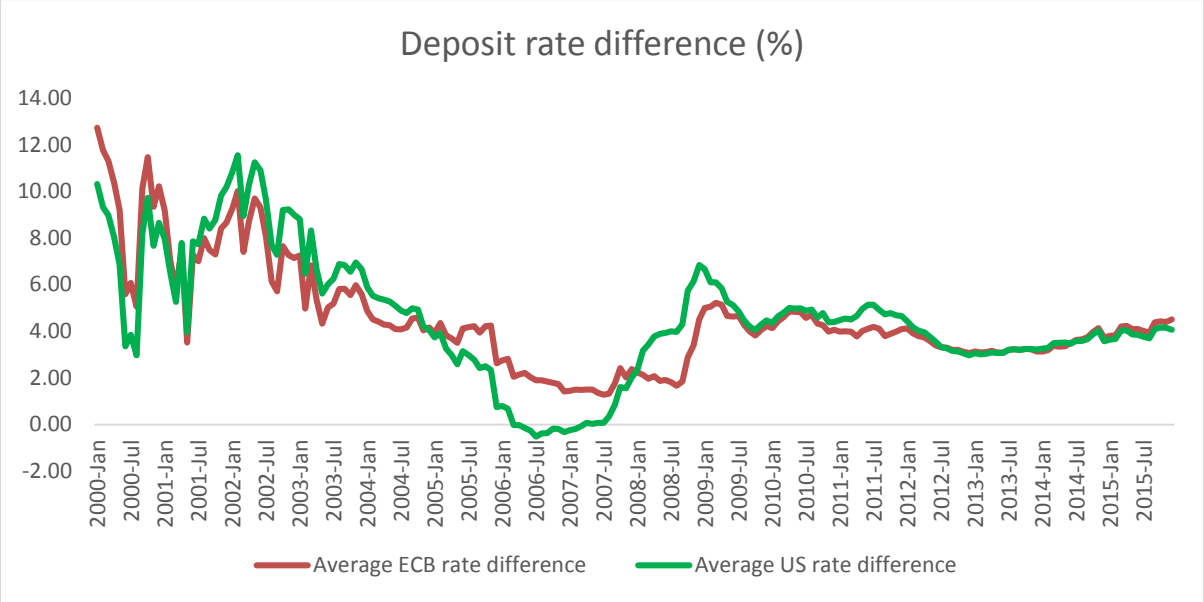
Zero Lower Bound (ZLB) towards December 2008 – the Federal Reserve in the U.S. undertook the non-conventional monetary policies.

The unconventional monetary policies were facilitated through what is known as a Large-scale Asset Purchasing Program (LSAP), which is the acquisition of Mortgage Backed Securities (MBS) and long-term bonds, be it government or agency bonds (Bhattarai and Chatterjee, 2015). On 08 December 2008, the European Central Bank reduced the main refinancing rate by 50 basis points and its other key interest rates by a total further 325 basis points over a 7-month period to May 2009. The main refinancing rate was brought down to 1% which is a level that had not been reached for a long time, and down even further to 0.75% in January 2013 (Cour-Thimann and Bernhard Winkler, 2012).

Mario Draghi, the ECB president, announced a QE program of 1 trillion Euros that was intended to help support the economy as it was still healing from the crisis. The initial announcement made on 22 January 2015 (ECB, 2015) stated that monthly asset purchases would amount to 60 billion Euros. The Financial Times (2016) subsequently reported that the ECB raised the amount of Euro-bonds to be purchased on a monthly basis from 60 billion to 80 billion Euros. On this same day of this announcement, 10 March 2016, the ECB also cut its deposit rate by 10 basis points, bringing it down to minus 0.4%.

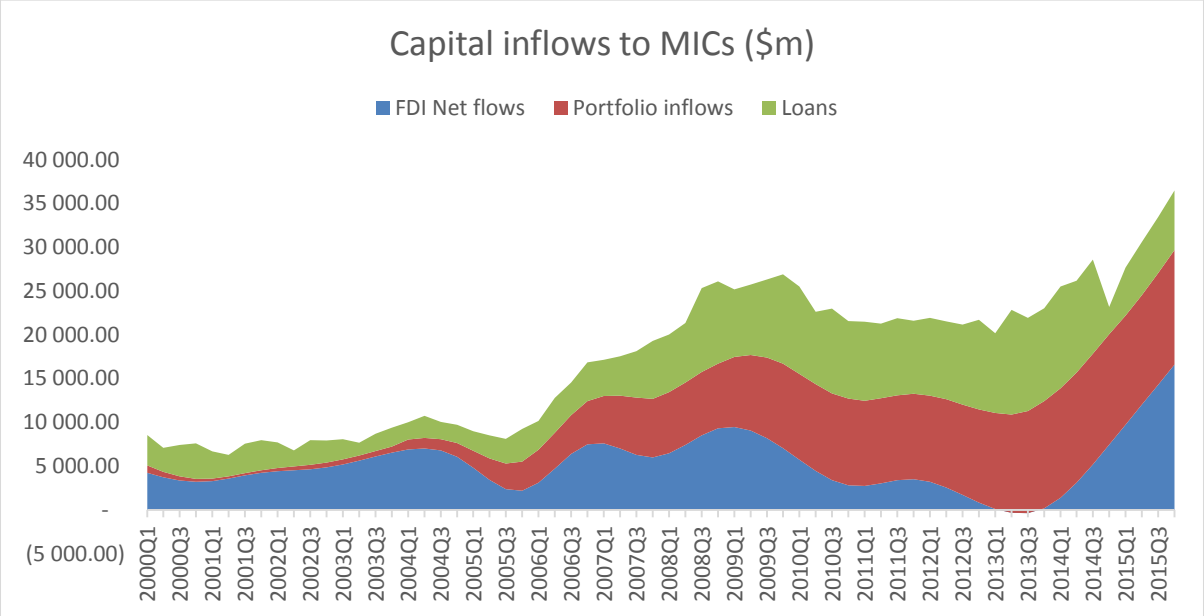
When the U.S. Federal Reserve began its QE program in 2008, there were enormous amounts of bond portfolio flows (Bhattarai and Chatterjee, 2015) that were received by emerging economies which resulted in currency appreciations of receiving countries. QE programs of developed countries seem to affect emerging countries' interest rates and money markets through portfolio flows – this is what the paper seeks to examine. When capital was faced head on with zero-bound interest rates, it found itself in a corner and had to seek alternative destinations for yields. Figure 1 shows the significant interest rate difference between the ECB, Federal Reserve and Middle Income Countries' (MICs) official interest rates post the 2008 GFC, the significant interest rate differential appears to have presented a viable investment alternative.

Figure 1: Interest rate difference between Developed Economies and Middle Income Countries, January 2000 – December 2015



Source: Bloomberg, McGregor BFA, Central Bank websites.

Figure 2: Capital inflows composition in Middle Income Countries, 2000Q1 – 2015Q4



Source: International Financial Statistics, Bank of International Settlements.

The study focuses on effects on Middle Income Countries' financial markets of capital inflows from QE operations of developed countries (U.S. and Europe in this case) which can be seen through various channels such as the liquidity, portfolio balance and confidence channels. Although a QE program may have been targeted at a single

economy such as the U.S. in the case of the U.S. QE program, concerns have been expressed by policy makers in emerging economies around spillover effects on global liquidity and the financial stability of the economies (Park, Ramayand and Shin, 2016). Various studies have in fact uncovered the tangible impact of QE on capital flows into emerging market economies i.e. Cho and Rhee (2014) discovered that QE1 (which took place from Q1 of 2009 till Q3 of 2010) in particular had a significant hand in the inflows to Asian economies. Alongside this Lim, Mohapatra and Stocker (2014) also learnt in their research that emerging markets outside Asian economies experienced a surge in capital inflows following QE operations in the U.S.

Other studies such as Chen, Cúrdia, and Ferrero (2012); Moore, Nam, Suh and Tepper (2013) showed that QE had a substantial effect on asset prices in emerging markets. Park et al. (2016) outline that the four main types of capital flows which they looked into are bank loans, bonds, equity and Foreign Direct Investment (FDI). These studies mainly focused on Asian economies and the period under study did not cover recent events such as the European debt crisis that later ushered in the European QE program. None of these papers engage substantively with the question being raised by this study around impacts of QE operations specifically on MICs' financial markets which this study assumes will be short-term rather than long-term. Lim et al. (2014) found that along the observable transmission channels or their QE indicator, it is portfolio flows that vary rather than FDI.

This paper is interrelated with a number of papers in the literature that try to ascertain the impact of the U.S. QE program on various economic variables such as interest rates, nominal exchange rates and stock markets. This study evaluates the impact of the QE programs by the U.S. Federal Reserve and European Central Bank on the MICs' financial markets. The study particularly looks at a combination capital flows mainly in the form of portfolio and FDI net inflows as well as bank loans into these MIC markets (e.g. Krishnamurthy and Vissing-Jorgensen, 2011; Jarrow and Li, 2014; Lim and Mohapatra, 2016; Kapetanios, Mumtaz, Stevens, and Theodoridis, 2012). Since QE is believed to have short term effects through portfolio flows, the study evaluates whether there is an impact on money markets through these capital flows.

1.1. Background/Motivation

The recent financial crises are believed to have permanently changed the correlations between Brazil, Russia, India, China and South Africa (BRICS) and the developed U.S. and European stock markets (Zhang, Li and Yu, 2013). If indeed such a change has occurred, Zhang et al. (2013) suggest that it poses indelible implications for international stock portfolio management.

Drawing from the existing evidence, Lavigne, Sarker and Vasishtha (2014) postulate that the U.S. QE program likely increased the amount of capital that flowed to Emerging Market Economies (EMEs) which has, in turn, mounted undesirable pressures on nominal exchange rates and asset prices. They also acknowledge the ongoing debates amongst scholars and policy-makers with regards to the spillover effects of QE programs to EMEs. Given the rapid developments taking place in the stock markets of emerging economies, it is vital to look at issues such as the correlation between developed and emerging stock markets (Zhang et al., 2013).

Recent studies (see Grigoryev, 2010; Bianconi, Yoshino, De Sousa, and Machado 2013; Yang, Sun, Zhu, Li and Wu, 2012) have placed increased attention on four (China, India, Brazil and) of the top 10 emerging economies, by measure of Purchasing Power Parity, and if adjusted Gross Domestic Product (GDP) is included, Russia also features prominently. According to Zhang et al. (2013), the BRICS countries collectively account for 15% of the world's GDP and 40% of its population. The research areas of interest that spring from recent structural changes between Middle Income Countries such as the BRICS nations and developed market correlation such as the impact of QE programs on EME financial markets are therefore focal. As part of countries classified as Middle Income Countries, it can be seen how important MICs are, and any potential impact on their economies or financial markets would prove to be an interesting point for research.

The evidence shows increasing capital invested in BRICS stock markets and that those who invest in BRICS are also known to have a vested interest or shown interest in the U.S. and European markets. Between 1986 and 1995 the stock market capitalization of emerging countries grew exponentially, growing ten-fold from a total value of $171 billion to $1.9 trillion. The market share capitalization also increased

from 4% to 11%, particularly in the 9 largest emerging markets economies (Tarzi, 2000 and 2005). The study added that there was a notable increase in Foreign Direct Investment in the early 1990s to developing countries - from 7% to 21% - most of which went to Brazil, China and India. Following the dissolution of the Soviet Union and 1997 financial crisis, Russia saw inflation plummet from 215% in 1994 to 8.3% in 1998. Coupled with increased price, currency and political stability, Russia has also become an attractive destination for diversified asset holdings (Gay, Jr., 2008).

The concept of globalization has become more apparent following the recent financial and debt crises in developed economies. This has prompted a deeper integration of financial markets globally. Integration is known as the process (Mahajan and Verma, 2015) wherein there is increased openness of markets thus allowing investors globally to benefit from the open access to a myriad of assets. The increased integration of international financial markets would logically imply an increase in capital flows and increased probabilities for the equalization of stock returns and prices of similarly traded financial assets in various countries. The easing or removal of domestic and international controls on trade on financial assets may facilitate this, thus leading to the “free” flows of capital (to and fro) at a global level.

Between the year 2000 and 2013, annualized gross capital flows into developing economies increased to $1.8 trillion. Decomposing aggregate gross flows into their constituent components, Lim et al. (2014) find that FDI does not vary along either of the observable transmission channels in their analysis or their QE indicator as opposed to portfolio flows – particularly along global “push” factors that are related to economic conditions within high income economies.

Portfolio flows are more volatile in their nature, more than FDI and other types of investment flows (Kodongo, O. and Ojah, K., 2013). The literature has mainly concentrated on exchange rate appreciation and interest rate arbitrage when looking at the effects QE programs in developed countries have on emerging market economies. This literature seeks to focus more on the effects that QE programs in developed countries (mainly U.S. and Europe) have on Middle Income Countries through financial inflows.

1.2.1. Research problem

Quantitative Easing increases the supply of loanable funds in the financial markets of the concerned country. This typically has the effect of maintaining low levels of interest rates on financial instruments over a long period, making them less attractive relative to foreign instruments, everything held constant.

The result is that the prices of domestic financial assets increase and their expected returns decline relative to those of foreign assets, all else constant. Domestic investors might respond to the discrepancy between expected returns on domestic assets and expected returns on foreign assets by increasing their purchases of foreign assets which may, in turn, increase capital flows to those (foreign) countries. Increased capital inflows, especially of a term nature (such as portfolio flows), may cause volatility in exchange rates and prices of other financial assets especially bonds and equities.

QE can also impact asset prices and cross-border flows through the signaling channel. A persistence in wide interest rate differentials can be expected in reference to emerging market economies that triggers both carry trades and capital inflows into EMEs (Dahlhaus and Vasishtha, 2014).

1.2.2. Research question

What effect or impact have the U.S. and European Quantitative Easing programs had on the financial markets of Middle Income Countries?

1.2.3. Research objective

The research objective of this paper is to ascertain the impact QE programs of developed economies have on emerging financial markets through capital flows, particularly in the Middle Income Countries. Specifically, the study intends to:

1) Ascertain the effect of QE in the U.S. and EU on MICs through financial inflows;
2) Establish the effect of attendant QE effects on the different transmission channels in MICs financial markets.

2. Literature review

2.1. Theoretical framework

It is common practice for Central Banks to employ short-term interest rates and use them to carry out monetary policy to influence the economy in various ways. Central Banks can also control real interest rates – in the short to medium term - since there is no like-for-like change between inflationary expectations and nominal interest rates.

According to Fawley and Neely (2013), the effectiveness of conventional monetary policy can somewhat be argued to be finite and limited because short-term nominal interest rates do not have much leeway downwards, especially around the zero bound. This is mainly owed to the fact that consumers will almost always have the choice between holding physical currency as opposed to depositing their money into a bank, therefore nominal interest rates cannot really go much below zero. Although some commentators may argue that the hands of a central bank are tied when nominal interest rates are close to zero, other scholars such as Mishkin (1996) have rebutted and tabled that the central bank can still influence output in the midst of zero bound short term interest rates through increasing liquidity which can be done mainly by acquiring long term assets (more modernly known as a Large Scale Asset Purchasing Program).

Under normal circumstances, the manner in which a central bank will conduct its monetary policy is through the buying and selling of short-term debt instruments in order to influence nominal interest rates. This buying and selling of assets by a central bank does not only change short-term interest rates but also influences the amount of currency in circulation as well as the bank reserves, which is also known as the monetary base of an economy. A central bank can influence various economic leading indicators of an economy such as asset prices, exchange rates and the prices of securities by increasing the monetary base, its holdings of domestic short-term securities and by decreasing short-term real interest rates. The changes in such prices and rates may influence certain economic decisions and result in the stimulation of consumption and business investment; increase competitiveness of domestic goods through a lower foreign exchange rate and an increased appetite for borrowing to invest or consume lured by lower interest rates (Fawley and Neely, 2013).

New Keynesians such as Krugman (2010), De Long (2009) and Farmer (2009) have supported the QE policy and it appears that traditional and Post-Keynesians also subscribe to this policy. Contrary to this, some New Monetarist and Classical Economists (Meltzer, 2011 and Taylor, 2011) criticize the QE policy. Although its origins can be traced back to Tobin and Buiter's (1980) proposal for the Federal Reserve to stimulate investment by increasing asset prices (through the purchase of equities), the economic logic of the QE policy was first painted by Bernake, Reinhart and Sack (2004). Building on a Keynesian critique of Quantitative Easing, Palley (2011) highlights a few convincing logical arguments against the merits of QE. He argues that one of the weaknesses of this unconventional monetary policy is that in the event that a recession is severe and its effects far reaching, some of the channels of QE may not be accessible. A scenario in which long-term nominal interest rates rise by more than what inflation is expected to - resulting in the real interest rate rising in response to QE – brings about another weakness of QE.

The development of money markets in emerging markets is a relatively recent phenomenon compared to other advanced economies. Many central banks prefer to make use of open market operations as a key monetary policy tool to control market liquidity and also to influence the term structure of interest rates. One of the transmission channels through which spill-overs of QE are manifested into EMEs is the signalling channel – if future policy rates remain lower than previously expected, the component of bond yields that is risk-neutral may fall. The large difference in interest rates with reference to EMEs prompts carry trades and inflows of capital into EMEs; should the large differentials continue - this can be expected to persist further (Lavigne, Sarker and Vasishtha 2014).

According to Palley (2011) there are mainly five primary or principle channels in which the expansionary effect can be manifested which are the Keynesian interest rate channel, the Tobin stock market q channel, the consumption wealth effect, the expected inflation effect and the exchange rate channel. These channels operate through the term structure of interest rates, increased liquidity due to equity purchases, higher equity and bond prices, households bringing future consumption and investment spending closer, and some of the increased liquidity being used to purchase foreign currency to reduce the real exchange rate respectively.

The well-known traditional Keynesian IS-LM take on the monetary transmission mechanism highlights that it is in fact the real interest rate rather than the nominal that has an impact on spending and this presents a pivotal mechanism for the manner in which monetary policy is able to stimulate an economy even if nominal interest rates are at the lower zero bound. According to this Keynesian model, an increase in money supply is able to raise the expected price level – inevitably increasing expected inflation – thus ultimately lowering expected real interest rates albeit the nominal interest rate(s) being at zero. This will stimulate spending through the interest rate channel (Mishkin, 1996). QE has the potential to influence future interest rate expectations through increasing the duration in which the general public can expect interest rates to remain flat at zero (Svensson, 2000; Eggertson and Woodford, 2003).

LSAPs have the potential to affect market interest rates largely through portfolio balance and to a lesser extent through market functioning effects (Gagnon, Raskin, Remache and Sack 2011). LSAPs primarily work through having an effect on the risk premium of the asset being purchased. The purchasing of an asset by the Central Bank bids up the price of the asset and lowers the yield on the asset, displacing some investors.

In the event where interest rates increase abroad, the domestic country may experience a currency depreciation if its central bank does not intervene through the use of reserve management or by hiking its own rate (Hegerty, 2012). Eggertson and Woodford (2003) postulated that unconventional monetary policy may be beneficial in lowering long-term bond yields if such policies are deemed credible commitments by the central bank to keep interest rates low even after an economy recovers. If a central bank does choose to increase its interest rates, it may incur losses on long duration assets purchased in large quantity in QE (Clouse, Henderson, Orphanides, Small and Tinsley, 2000; Krishnamurthy and Vissing-Jorgensen, 2011).

A central bank can increase private sector balance sheet liquidity through increasing money supply in the economy in exchange for other assets (Joyce, Tong and Woods, 2011). There are a number of ways in which the increased liquidity may affect the economy. The purchasing of assets with central bank money should push up the prices of assets and higher asset prices reduce the cost of borrowing – this in turn should prompt both higher investment spending and consumption (Benford, Berry,

Nikolov, Young and Rosbbson, 2009). QE can also alter what makes up the balance sheet of a central bank and expand the supply of reserves and money stock (Bernake, Reinhart, and Sack 2004).

Economic theory suggests that the free flow of cross-border capital is beneficial for all countries due to the fact that it leads to efficient resource allocation. This in turn should raise productivity and economic growth in all countries where capital freely flows to (Ahmed and Zlate, 2014). Emerging Market Economies (EMEs) are predominantly sensitive towards capital flows, with specific regard to both magnitude and composition of these flows. FDI flows tend to be less sensitive towards global shocks as opposed to other types of capital flows (Bussiere and Phylaktis, 2016).

2.2. Empirical review

2.2.1. **International effects of QE**

A few researchers have studied the effects of QE using high-frequency data. Glick and Leduc (2013) used intraday data to extract the surprise component of the announcements from the futures market and found that an announcement significantly reduces the U.S. dollar value. They concluded that the size of the effect was similar to the announcement of a conventional monetary step. In the same breath, Neely (2015) studied the announcements of QE1 to show that international bond yields and U.S. dollar exchange rates are reduced by policy news, against mature economies.

Bauer and Neely (2014) estimated a term structure model for international interest rate dynamics to differentiate between signaling and portfolio rebalancing channels of monetary transmission. Using a global-vector error-correction model and U.S. term spread as a policy variable, Chen et al. (2012) investigated the impact of QE announcements on financial markets and were able to show the QE impact on a number of countries. To explain the QE effects on local currency bond markets - Moore, Nam, Suh and Tepper (2013) set up a panel model in their study. They showed that a decrease of 10 percentage points in the U.S. Treasury yield results in a 0.4 percentage point increase in emerging market debt foreign ownership and a significant decrease in government bond yields.

Lim et al. (2014) estimated that QE explained 3% of gross capital flows to developing countries and their results were derived using a panel model for capital flows. They differentiated the various channels of transmission by including appropriate control variables. Frazcher, Lo Duca and Straub (2012) used a unique database of high-frequency portfolio flows into emerging market investment funds and found that QE1 reduced interest rates and increased equity prices in several economies. Using macroeconomic variables in a panel VAR with countries that adopted QE programs (i.e. U.S., Japan and Europe) and sign restrictions on admissible impulse responses, Gambacorta, Hofmann and Peersman (2014) identified QE shocks. Bowman, Londono and Sapriza (2015) identified unconventional monetary policy through changes in the variation of policy shocks on QE announcement days by employing a VAR system of interest rates with different maturities that included emerging market rates.

In a research study that sought to unpack the relationship between QE and the surge in financial flows in developing countries post the 2008 GFC, Lim and Mohapatra (2016) found evidence for the possible transmission of QE along some observable channels viz. liquidity, portfolio balancing as well as confidence channel. Their estimates showed QE effects of around 5% of gross inflows above the trend of the average developing economy – this is a magnitude equivalent to a one standard deviation change in the traditional channels.

2.2.2. Capital flows

The capital flow landscape has changed from a dominance of FDI as a major cause of capital flows between the ‘80s and the ‘90s to equity and bond flows at the beginning of the early 2000s as a key source of capital flows. Through the liquidity channel, QE can affect portfolio flow decisions as well as asset prices by changing the liquidity premia and invariably the functioning of markets.

The most direct diffusion of the QE impact to MICs/emerging economies is through increased capital flows. Capital inflows are known to result in higher relative prices of non-tradables, thus appreciating Real Effective Exchange Rate (REER), through increased demand for both tradables and non-tradables. In the wake of a Balance of Payments (BOP) crisis, India followed an IMF structural adjustment program that

resulted in the liberalization (Shah and Patnaik, 2010) of flows in the early 1990s. Sustained increases in equity flows particularly from foreign institutional investors increasing investment holdings in Indian firms.

In their empirical analysis Sarno, Tsiakas and Ulloah (2016) found that China, India and Brazil exhibit a similar pattern of portfolio flows and that the pull factor for bond and equity flows in these countries is less than the world average but more so for India and Brazil[1]. The dominance in these countries was found to be more pronounced in the determination of international portfolio flows than domestic forces. Yu (2010) posited that a key support factor for China's economic growth "miracle" was the management of international capital flows. The nature of Brazil's portfolio flows is similar to India's in the sense of being susceptible to the domination of global economic forces. In 1975, gross cross-border equity and bond (portfolio) flows only amounted to 4% of GDP whereas in the early 1990s these surged to 100% and reached 245% in the early 2000s (Hau and Rey, 2006). In the same light, capital flows as a percentage of world GDP increased from 2% to 20% (Milesi-Ferretti and Tille, 2011) between 1975 and 2000.

French (2011) found a highly significant relationship between net flows and returns for the Johannesburg Stock Exchange. In a paper focusing on the importance of bank flows in the global economy, Milesi-Ferretti and Tille (2011) showed that during the GFC, bank flows were more significant than other flows. The authors used statistical techniques to assess the inconstancy of international capital flows to a group of 18 emerging markets and also found that over time, bank flows have become increasingly temporary.

Lim and Mohapatra (2016) found that during QE periods, an average developing country experienced an increase of close to 5% above the post-crisis trend in capital flows. Their results showed quarterly increases of 211% in capital inflows to developing countries between 2009 and 2013, and their estimates suggest that of this

[1] Pull factors represent domestic economic forces that would attract/pull capital into an economy and would hence reflect the attractiveness of various investment opportunities; these include variables such as high domestic interest rates, high growth potential and trade openness (Sarno et al., 2016).

increase, at least 27% (and up to 132% if standard channels are included) may be apportioned to QE program effects.

Similar to studies by Fratzscher et al. (2012), IMF (2011), and Moore et al. (2013) although employing different methodologies, Ahmed and Zlate (2014) found U.S. unconventional policy to be a significant determinant of capital flows (particularly gross inflows) to EMEs. In their study (Ahmed and Zlate, 2014) the indicator variable of the LSAP announcements indicated an economically and significant impact on net capital inflows which are only statistically significant for portfolio net inflows.

2.2.3. Money Markets, interest rates and asset prices

A number of studies have recently examined the potential effectiveness of Quantitative Easing (expansion of the current account when the funding rate has already hit the zero bound).

Since the era of Keynes (1936) there have been concerns relating to the ramifications of the zero bound of interest rates and quite a number of commentators on the side lines have believed that central banks really have their hands tied when short-term rates are zero bound. Mishkin (1996) argued that monetary policy cannot do much to stimulate the economy if short-term nominal interest rates approach the floor as "demonstrably false". In their announcement study where they used an event study and time-series analysis Gagnon, Raskin, Remache and Sack (2010 and 2011) found that LSAP announcements in the Americas reduced the ten year premium. They concluded that the overall reduction in the 10-year premium was between 30 and 100 basis points and that the LSAP programs reduced long-term private borrowings.

Joyce et al. (2011) also used an event study and time-series analysis and reported similar conclusions as those by Gagnon et al. (2011); finding that the Bank of England's QE program effected a reduction in bond yields. They found that based on market reaction to the news regarding QE purchases, gilt yields were 100 basis points less than what they would have otherwise been were it not for QE. Using a term structure model Hamilton and Wu (2012) also calculated the effects of the Fed's 2008-09 QE program.

Taylor (2000) tabled that the then current interest rate approach which targeted inflation at a rate close to zero would indeed run the risk of tending to the zero bound in a recessionary situation, citing that it would cause a reduction in the monetary policy's power to spur demand further. The issue that the study cited was that as an economy's nominal interest rates tend to zero, a monetary policy that is interest rate oriented is susceptible to the risk of a downward spiral in the economy. Meltzer (1999) challenged the argument of a monetary policy problem in a case where nominal interest rates reach the lower bound of zero, emphasizing non-interest rate and money stock channels of monetary policy.

In a study by Klau and Mohanty (2004) that focused on monetary policy rules in emerging market economies – in which they used a standard open economy reaction function – they tested whether EME central banks react to changes in inflation, exchange rates and output gaps and whether these reactions are consistent and predictable. They found that the interest rate reaction in a number of EMEs suggested a non-accommodative position of monetary policy towards price shocks. Their estimated relationship also suggested a strong response of interest rates to exchange rate movements which have an unavoidable contribution to interest rate volatility.

There is a significant amount of literature that has looked into the relationship between interest rates and stock prices. Studies by Campbell (1987); Cutler, Porteba and Summers (1989) and Hodrick (1992) have proved that to some modest degree, both short and long-term interest rates have forecasting power for excess stock returns. In support, other studies (Campbell and Shiller, 1991; and Fama, 1984) have argued that the slope of the term structure of interest rates is an important excess stock return forecast variable. Research by Campbell and Ammer (1993); Hamori and Honda (1996) proves that short-term interest rates have an effect on stock prices (Kurihara, 2006).

Financial economists and various practitioners have extensively examined the relationship between exchange rates and stock prices, and the relationship between these has taken form mainly in two ways. "Flow-oriented" models suggested by Dornbusch and Fischer (1980) postulate that exchange rate movements affect international competitiveness and trade balances, therefore ultimately having an influence on output and real income. "Stock-oriented" models of exchange rates as

positioned by Branson (1983) and Frankel (1983) table that innovation in the stock market influences money demand and exchange rates through their effects on aggregate demand (via wealth and liquidity effects).

Yang and Doong (2004) found that movement in stock markets have a substantial influence on the future exchange rates of G7 countries. Using the cointegration methodology and a Multivariate Granger Causality Test for a group of Pacific Basin countries, Phylaktis and Ravazzolo (2005) showed that stock and foreign exchange markets are positively linked. There is a strong bidirectional relationship that was found by Pan, Fok and Liu (2007) before the Asian crisis in a study they conducted for 7 East Asian countries. In a study examining 4 Latin American countries - i.e. Argentina, Brazil, Chile and Mexico - Diamandis and Drakos (2011) found that the stock and foreign exchange markets are positively related to the U.S. stock markets.

The study by Chkili and Nguyen (2014) argued that exchange rates do not affect stock market reruns returns of BRICS countries. Ajayi, Friedman and Mehdian (1999) provide evidence demonstrating unidirectional causality stock to currency markets in developed economies but no consistent directional movement in emerging economies. A study by Chiang and Yang (2003) showed a positive relation between stock returns and currency value for 9 Asian countries. The relationship between stock prices for the U.S. and other major countries is well researched and documented, however there is much less literature that looks at the same type of relation in emerging economies.

In a study by Hartmann, Straetmans, and de Vries (2004) financial crises depict strengthened exchange rate linkages for a comprehensive set of emerging markets. Fundamentals specific to a country in isolation were found not be central in understanding co-movements during times of financial crisis by Eichengreen and Rose (1999); Glick and Rose (1999) but rather the degree of bilateral trade was found to play a significant role in this.

Domestic and international financial markets around the world have become increasingly integrated, however extant literature is yet to fully comprehend the transmission channels through which shocks are dispersed and the nature of the integration. Erhman, Fratzcher and Rrigobon (2005) highlighted the importance of

international spillovers in their study, amongst financial markets and within different asset classes. They find evidence of the significance of international cross-market spillovers despite the strongest international transmission of shocks taking place within asset classes.

3. Methodology

3.1. Introduction

This chapter of the study focuses on the methodologies used to examine the potential effects of QE that the problem statement outlines. It also highlights the rationale for the selected empirical methods and scientific models employed to answer the research questions.

3.2. Base Econometric model specification

Following Lim and Mohapatra (2016), this study first looks at employing a baseline regression model which is a lagged dependent model and takes the following form[2]:

$$NFI_{it} = NFI_{i,t-1} + \Phi L_{it} + \lambda PB_{it} + \pi C_{it} + \alpha QE_t + \beta' X_{it} + CRISIS_t + POSTCRISIS_t + \chi_i + \psi_t + \epsilon_{it} \quad \text{..... (1)}$$

The high frequency of financial flows according to Becker and Noon (2008) have been widely known to display autocorrelative properties, thus a dynamic model in the methodology is intrroduced. In the *baseline regression* represented by equation (1), the effects of unconventional monetary policy on Net financial inflows to each of the Middle Income countries at time t, and the observable effects may be transmitted through the Liquidity (L_{it}), Portfolio Balance (PB_{it}) and/or the Confidence channels (C_{it}).

To measure or estimate unobservable underlying effects that may emanate from additional effects – that may be encompassed in the effects from unconventional monetary policy – these are proxied with an indicator variable, QE_t, which is country-invariant. QE is measured using a dummy variable, where it will either take the value of one (1) or zero (0). QE periods for both the U.S. and the E.U. are assigned a value

[2] The terms Capital inflows and Financial inflows are used interchangeably in this study but refer to the same thing.

of one and all non-QE periods are assigned a value of zero. The detail of QE periods is found in Figure 3. Dummy variables are introduced to see the effects of the various QE periods and their interactions with the different transmission variables through their respective channels.

The variable $CRISIS_t$ accounts for a drop in crisis flows and $POSTCRISIS_t$ represents the possibility of a "secular stagnation" after the financial crisis – both these variables are included as dummy variables. A vector X_{it} has been included for time-varying idiosyncratic controls (i.e. individual MICs country's GDP etc.), fixed effects that are country specific (χ_i) and ψ_t as a time trend has also been included in the baseline regression. The base regression (1) is a dynamic model with fixed effects and has three main transmission channels namely: Liquidity, Portfolio balance and Confidence channels. The first two both have primary and secondary indicators. However, the Confidence channel only has a primary indicator. The primary indicators for the channels are the 3-month Treasury Bill (T-bill henceforth), Yield curve and Standard and Poor's Volatility Index (VIX) respectively. The secondary indicators will be lagged Money Supply (M2) for the liquidity channel, interest rate differential, NAM PMI and Growth differential for the portfolio balance channel.

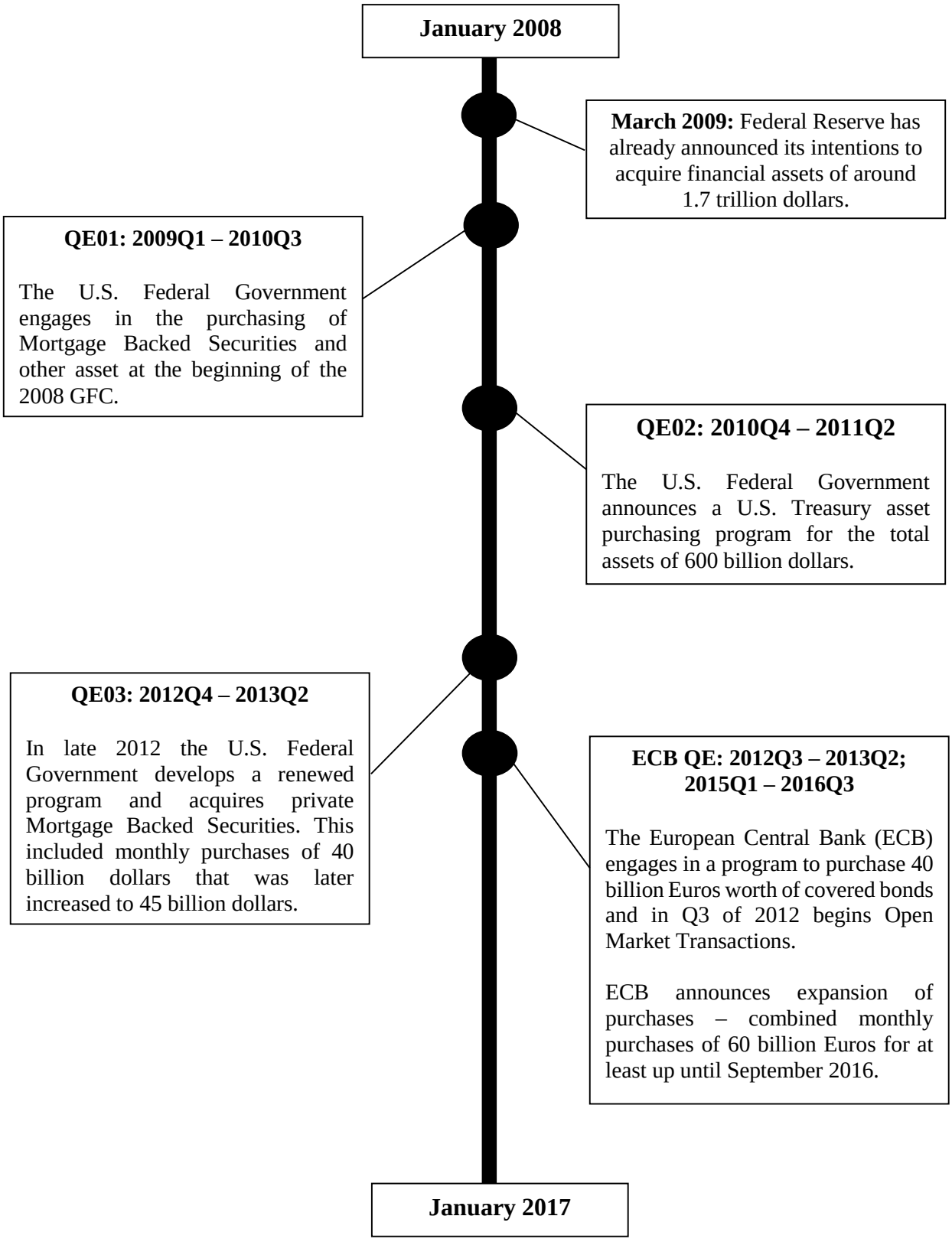
The seminal study by Nickell (1981) raised concerns about models such as the baseline model in equation (1), tabling the possibility of biasness by virtue of the regression being a dynamic model with fixed effects. On the contrary, Bruno (2005) highlighted the weakness of using Instrumental Variable (IV) and Generalized Method of Moments (GMM) as alternatives to Least Square Dummy Variables arguing the potential bias and vagueness for panel data sets that have a small number of cross-sectional units such as ours. To address this concern, Lim and Mohapatra (2016) employ Least Square Dummy Variables to measure the coefficients under stringent conditions.

In a number of instances, forecasters and analysts face a predicament where they have to deal with data that does not have the same frequency, especially in cases where both financial and economic data are being used in the research. Economic data often will be expressed in annual or quarterly frequencies whereas financial data may be presented in monthly, weekly and even daily frequency. There are fortunately

mechanisms and methodologies built to handle such variance in frequency of data and variables, some of which are straightforward and some not so much.

In a bid to circumvent concerns facing panels with a small number of cross-sections, the study turns to recently developed methodologies such as Mixed Data Sampling.

Figure 3: Quantitative Easing policy program timeline.



3.3. The MIDAS model

Traditional approaches to time series estimation and forecasting in economics require that the variables be of the same frequency but this often poses some challenges because most macroeconomic data are reported at different frequencies and intervals.

For example, a number of economies report on GDP on a quarterly basis whereas stock market prices are reported daily and unemployment figures monthly. A work around this that has normally been employed is to aggregate the higher frequency data into values of much lower frequency. A potentially adverse consequence or disadvantage of this is that through the aggregation, data can be discarded which can lead to less accurate estimations. Mixed Data Sampling is a method of estimating and forecasting where one or more of the independent variables are at a higher frequency than the dependent. Mixed Data Sampling employs all the information availed at the higher frequency level. This is fundamentally different to the traditional aggregation approach.

Ghysels, Santa-Clara and Valkanov (2004) presented a MIxed DAta Sampling (MIDAS from henceforth) approach which is able to model a lower frequency dependant variable with higher frequency independent variables. By way of a simplistic introduction of a basic MIDAS model - if for instance there is a dependant variable y_t that is only available once say between time *t* and *t-1* and on the other hand an explanatory variable $x_t^{(m)}$ that is available more than once (m times) within or during the same period, the model can be constructed as follows:

$$y_t = \beta_0 + \beta_1 B\left(L^{\frac{1}{m}};\, \theta\right) x_t^m + \varepsilon_t^m \quad \text{..... (2)}$$

Where $B\left(L^{\frac{1}{m}};\, \theta\right) = \sum_{\rho}^{K} B(\rho;\theta) L^{\theta/m}$ and $L^{s/m} x_{t-1-s/m}^{(m)}$ (lag operator). In this instance the basic time unit (lower frequency) is indexed by *t* and the higher sampling frequency is indexed by m. Fortunately, the Eviews MIDAS function does permit for a number of higher frequency explanatory variables to be included, yielding an M-MIDAS model:

$$y_t = \beta_0 + \sum_{j=1}^{n} \beta_{1j}\beta_j(L^{\frac{1}{3}};\theta_j)x_{j,t-z}^{(3)} + \varepsilon_t \quad \text{..... (3)}$$

The higher frequency indicators and their total number are represented by j= 1,….,n and n respectively. To add an autoregressive term to incorporate lagged inflows, the study follows the steps used by Ghysels et al. (2007) to reach an M-MIDAS-AR (Autoregressive Multiple Indicator MIDAS) model:

$$y_t = \beta_0 + \delta y_{t-z} + \sum_{j=1}^{n} \beta_{1j}\beta_j(L^{\frac{1}{3}};\theta_j)(1 - \delta L^z)x_{j,t-z}^{(3)} + \varepsilon_t \quad \text{..... (4)}$$

A seasonal response of *y* to $x^{(3)}$ is generated by the polynomial on $x_{t-z}^{(3)}$. A common factor restriction has been used to include autoregressive lags in the MIDAS model in a bid to alienate seasonality (Clements and Galvao, 2009). The initial baseline regression (eq. 1) has now been transformed into an M-MIDAS-AR model represented by equation 4, where the model now accommodates higher frequency explanatory variables.

3.4. Data and identification of key variables

This study seeks to ascertain the effects of the QE programs in the U.S. and EU on the capital flows to Middle Income Countries and their potential impact on the financial markets of each of the countries.

This study uses panel data and has a mix of both financial and economic data. The data used spans across different frequencies from the year 2000 to 2015. The period covered encompasses periods prior to, during and after the U.S. and European QE programs (including the recent European debt crisis, but does not include the full extent of the ECB QE program that has been extended beyond 2016). A total of 10 Middle Income Countries are studied and the effect of QE on their financial markets. An initially larger data set was looked at but a few key elements were then used to prune it down to the final data set used. The Emerging Market Economies covered in the study by Lim and Mohapatra (2016) have been eliminated (60 emerging economies), and the rest of the countries that were dropped from the remaining data set were those whose periods of missing data (controls and variables) were so much so that they could not be overlooked or statistically interpolated.

The first QE announcement for the U.S. was on the 25th of November 2008 and the last "QE3" announcement on the 12th of December 2012 (see Fawley and Neely, 2013). The dates of the announcements of the commencement and expansion of the European QE program also fall within the sample period, with the last wave taking place near the end of 2016 (ECB, 2015).

The study empirically examines the relationship between QE programs in the U.S., Europe and MICs' financial markets with datasets drawn from Balance of Payments data (net portfolio and Foreign Direct Investment flows) found in the IMF's International Financial Statistics database. The two types of flows (portfolio and FDI) are supplemented using bank lending data from the Bank of International Settlement's Location Banking Statistics. The main dependent variable in the model is defined as aggregate gross financial flows which is made up of the sum of changes in portfolio, FDI flows and bank loans/lending in the Middle Income countries, net of their disinvestment. The additional country specific control variables are extracted from the IFS and World Development Indicators from the World Bank's data series.

For the potential QE transmission channels, a number of measures are employed (primary indicators) to distinctly capture these, for each of the three channels of transmission. The three transmission channels are the Liquidity, Portfolio balance and primary Confidence channel. In this study, the Primary Confidence channel only has one indicator which is used in both the parsimonious and extended models, which is the Standard and Poor's 500 Volatility Index (VIX). The VIX is well positioned to display market sentiment for investing in risky assets. Although in other studies it has been used for various applications, here it is employed as a measure for broader financial market uncertainty. The Liquidity and Portfolio balance channels both have primary and secondary indicators. The primary indicators for the Liquidity channel are the 3-month Treasury bill rates (which are more of a price signal) of the developed countries, and for the Portfolio balance, the Yield curve is used (the long term minus the short term rate) and the interest rate difference between the MICs and developed economies as primary indicators. The Yield curve is a global variable and has the ability to display potential effects that QE can have on long-term yields.

Lagged Money Supply (M2) - which is a quantity based measure of available liquidity - for both the Federal Reserve and ECB is used as a secondary indicator for the

liquidity channel, and due to the structure of the QE programs (where asset purchases were being made on a rolling monthly basis), it was befitting to use a monthly frequency for the outstanding stock of money (M2) variable. Alongside a PMI index and growth rate difference between developed economies and MICs being used secondary indicators for the portfolio balance channel, a few control variables have been added which can be seen in the table of results. The NAMPMI index is more of a global measure as opposed to the growth difference indicator which is more idiosyncratic to the MICs.

Table 3. 1: Sources, definitions and composition of variables

The table defines the variables used in the study and also what the variables are made of and where the main sources of the data are. BOP represents the IMF Balance of Payments Statistics; FRB stands for the Federal Reserve Bank and the data source represented is the Board of Governors of Federal Reserve Statistical Release; LBS is the Location Banking Statistics from the Bank of International Settlements (BIS); IFS refers to the IMF International Financial Statistics; WDI = World Bank's World Development Indicators.

Variable	Definition and composition	Frequency	Source
Net Financial Inflows	Sum of net changes in FDI, portfolio flows and bank loans	Quarterly	BOP, LBS
QE episode	Indicator for QE periods (time line provided)	Periodic	Author
Central bank balance sheet expansion	U.S. Federal Reserve and European Central Bank Balance sheet expansion	Monthly	FRB, FRED, ECB
	Baseline regression		
3-month Treasury Bill	3-month treasury/government T-bill rate (U.S. and Euro Area)	Quarterly	FRED
Money Supply	M2 money supply stock level (U.S. and ECB)	Monthly	FRED
Yield curve	Long term rate minus the short term treasury rate	Monthly	ECB
Global NAMPMI	Manufacturing Index	Quarterly	Bloomberg
Growth differential	Difference in growth of developed and Middle Income country	Quarterly	WDI
VIX indicator	This is the Standard & Poor's Volatility Implied Index	Quarterly	Bloomberg
GDP	Nominal Gross domestic product	Quarterly	WDI

Table 3.1 outlines all the variables used in the baseline and parsimonious regressions. Their definitions and compositions have been detailed as well as the various databases or sources where the information or data has been retrieved and extracted. As can be seen in the table, although most of the main variables are in quarterly frequencies, there are also variables to test QE effects through various channels that have monthly frequencies. In a bid to have as accurate a measurement, the lower frequency data is not converted to lower frequencies.

A number of the countries in this study were left out in the research by Lim and Mohapatra (2016) that looked at the impact of QE on emerging economies due to the unavailability of data particularly in the same frequency as other variables used in the analysis. In this study there are countries that had a few data points missing and the use of the phenomenon known as cubic spline interpolation has been made to plot missing data point in the different series of variables. The main idea behind cubic spline interpolation is based on an engineering tool used to create a smooth curve(s) through various data points. In principle, the mathematical spline is similar to the engineering spline, but in the mathematical case the cubic polynomial coefficients are weights and are used for the data interpolation (McKinley and Levine, 1998).

4. Results

4.1. Introduction

This section of the study reports a summary of the characteristics of the data used and highlights the main findings from the empirical tests and models that have been run to answer the main questions of this study. This chapters also explains the extent and significance of the main findings.

4.2. Summary statistics

Table 4.1 presents the summary statistics for the main variables of interest. The mean growth differential between the MICs and the Euro area for both the QE and non-QE periods is similar to the growth differential reports between Emerging Economies and the United States of America (USA) in the study by Lim and Mohapatra (2016), however there is quiet a difference when it comes to the mean growth differential between MICs and the U.S. sighted below. It is less than one for both periods and is much higher during non-QE periods than during QE periods.

Money supply (M2) is available in both quarterly (as an index) and monthly frequency for the ECB and at a monthly frequency for the federal reserve of USA. The money supply variables for both QE programs reported in Table 4.1 are at monthly frequencies, which explain their higher number of observations. Table 4.2 indicates that there is a high negative correlation between EBC's M2 money supply and ECB's deposits. The correlation between these two variables is about -0.686 as indicated in the table. This is a fairly high correlation and is also consistent with correlations of similar nature from previous studies.

Further, there is also a highly negative correlation between M2 and the ECB's 3-month treasury bill of approximately 0.74. All the key correlation statistics are marked with a bold font in table 4.2's correlation matrix. Table 4.3. provides a slightly different dimension of correlation statistics, it provides a summary of the correlation between six variables – 3 rates versus country specific variables. This allows for the analysis of the correlations between the variables presented in table against the MIC variables.

Table 4 1: Summary statistics of the baseline variables (QE periods distinguished)[3]

The Summary statistics are provided for the period between 2000Q1 and 2015Q4 as well as between 2000M01 and 2015M12 for all Middle Income Country, financial and economic variables. The segmentation of the QE periods are based on episodes 1, 2 and 3 of the QE programs. QE03 encompasses a part but not all of the ECB QE program. All variables are in log form except for all indices and rates, they have been kept at level form. The summary has a mix of quarterly and monthly variables; hence the number of variables will not be identical. The same variables are reported for the different periods.

Definitions: 3M T-bill = 3-month Treasury bill rate; M2 = Outstanding stock of money supply; VIX = Volatility Index; NAMPMI = Purchasing Managers Index; GDP = Middle Income Country Gross Domestic Product (rate).

	N	Mean	Std. Dev.	Max	Min.
		Quantitative Easing periods			
	N	Mean	Std. Dev.	Max	Min.
Net Inflows	130	20.623	3.775	23.390	-19.680
3M T-bill (USA)	130	0.112	0.046	0.190	0.040
M2 Money Supply (USA)	490	9.163	0.142	9.420	9.020
M2 Money Supply (Euro Area)	490	29.800	0.077	29.764	29.955
USA Yield Curve	490	2.677	0.656	3.680	1.560
MICs GDP	130	2.675	2.760	6.000	-4.500
Growth Difference (Euro Area)	130	3.809	3.340	11.590	-3.260
Growth Difference (USA)	130	0.479	4.672	14.910	-12.850
VIX	130	22.553	8.319	44.140	12.700
NAMPMI	130	51.688	4.877	60.600	33.100
		non-Quantitative Easing periods			
Net Inflows	510	19.265	6.645	23.610	-20.940
3M T-bill (USA)	510	2.162	2.026	6.220	0.010
M2 Money Supply (USA)	1430	8.859	0.270	9.380	8.440
M2 Money Supply (Euro Area)	1430	29.465	0.273	29.445	29.910
USA Yield Curve	1430	1.717	1.225	3.680	-0.700
MICs GDP	510	4.321	2.837	10.200	-7.700
Growth Difference (Euro Area)	510	3.067	3.940	19.510	-8.280
Growth Difference (USA)	510	0.874	4.877	21.990	-10.450
VIX	510	22.266	7.912	42.960	11.390
NAMPMI	510	53.169	6.136	59.400	36.000

[3] All the computations for this study have been done using the Eviews (version 9.5) econometric analysis program.

Table 4.2: Correlation matrix of the main variables.

This correlation matrix table is for the main variables in the baseline regression for the measurement of potential QE effects through various channels. All capital inflows (net inflows) are in log form and all indices and rates are in level form. These variables are in quarterly frequencies and all various at higher frequencies have been left out. The correlation matrix is for the period between 2000Q1 and 2015Q4. The data is in the same form as Table 4.1.

Definitions: ECB = European Central Bank; M2 = Outstanding stock of money supply; EU = European Union; USA = United States of America; NAMPMI = Global Producer's Manufacturing Index; GDP = Gross Domestic Product (rate).

	ECB Money Supply (M2)	ECB deposit rate	ECB 3M T-bill	USA 3M T-bill	GDP	Net inflows	Growth differential (EU)	Growth differential (USA)	VIX	NAMPMI
ECB Money Supply (M2)	1.000									
ECB deposit rate	-0.686	1.000								
ECB 3M T-bill	-0.737	0.978	1.000							
USA 3M T-bill	-0.574	0.781	0.816	1.000						
GDP	-0.213	0.436	0.429	0.432	1.000					
Net inflows	0.089	-0.028	-0.023	0.007	0.157	1.000				
Growth differential (EU)	-0.083	0.202	0.198	0.185	0.891	0.198	1.000			
Growth differential (USA)	0.043	0.330	0.271	0.199	0.801	0.173	0.790	1.000		
VIX	0.104	0.089	-0.029	-0.326	-0.099	-0.014	0.026	0.265	1.000	
NAMPMI	-0.116	-0.245	-0.153	-0.029	-0.105	-0.029	-0.143	-0.516	-0.616	1.000

Table 4.3: Correlation of MIC factors and develop country selected rates and indices by country.

Key indices and rates from the developed countries conducting QE programs are tested for correlation with some key country specific measures the research study was interested in looking into. This is all quarterly data retrieved from various sources (see 3.1. for more information on data sources) and the tables reports correlation coefficients between variables for each of the 10 Middle Income Countries. The period used for these correlation matrices is 2000Q1 – 2015Q4.

Definitions: ECB = European Central Bank; Euro 3M T-bill = European Central Bank 3-month Treasury bill rate; M2 = Outstanding stock of money supply.

	Portfolio flows	MIC GDP	Real exchange rate (USD index)
	Angola		
ECB Money Supply (M2)	0.641	-0.227	0.588
Euro 3M T-bill	-0.269	0.667	-0.672
USA 3M T-bill	-0.016	0.804	-0.418
	Bosnia & Herzegovina		
ECB Money Supply (M2)	0.096	-0.660	-0.421
Euro 3M T-bill	-0.253	0.774	0.026
USA 3M T-bill	-0.297	0.740	0.060
	Cambodia		
ECB Money Supply (M2)	0.900	-0.463	0.409
Euro 3M T-bill	-0.689	0.591	-0.299
USA 3M T-bill	-0.488	0.735	-0.041

	Portfolio flows	MIC GDP	Real exchange rate (USD index)
	Bolivia		
ECB Money Supply (M2)	0.593	0.680	-0.862
Euro 3M T-bill	-0.312	-0.323	0.800
USA 3M T-bill	-0.007	-0.155	0.851
	Botswana		
ECB Money Supply (M2)	0.850	-0.095	0.910
Euro 3M T-bill	-0.422	0.385	-0.671
USA 3M T-bill	-0.109	0.298	-0.518
	Kyrgyz Republic		
ECB Money Supply (M2)	0.458	0.047	0.533
Euro 3M T-bill	-0.153	0.146	-0.746
USA 3M T-bill	-0.141	-0.090	-0.604

Table 4.3 (continued)

	Portfolio flows	MIC GDP	Real exchange rate (USD index)
	Sudan		
ECB Money Supply (M2)	-0.669	-0.521	0.630
Euro 3M T-bill	0.253	0.855	-0.648
USA 3M T-bill	0.055	0.728	-0.496
	Tunisia		
ECB Money Supply (M2)	-0.950	-0.429	0.693
Euro 3M T-bill	0.610	0.616	-0.644
USA 3M T-bill	0.477	0.536	-0.420

	Portfolio flows	MIC GDP	Real exchange rate (USD index)
	Swaziland		
ECB Money Supply (M2)	0.221	-0.500	0.693
Euro 3M T-bill	-0.558	0.627	-0.575
USA 3M T-bill	-0.351	0.658	-0.516
	Vanuatu		
ECB Money Supply (M2)	-0.250	-0.250	-0.771
Euro 3M T-bill	0.375	0.534	0.515
USA 3M T-bill	0.200	0.654	0.172

4.3. Baseline regression results and main findings

4.3.1. Test for stationarity

The variables used in the baseline regressions were tested for stationarity using the different panel unit root tests. All the variables that were found not to be stationary were differenced accordingly so as to achieve stationarity. All the variables that were stationary or I (0) were used in their level form.

4.3.2. M-MIDAS-AR results

Table 4.4. summarizes the results obtained for the parsimonious model measuring the potential Quantitative Easing effects of the U.S. program on the 10 Middle Income Countries considered in this study. The parsimonious model was estimated using equation 4. Further, the Almon weighting method was used for the MIDAS regression with a third degree polynomial and let Eviews select the appropriate number of lags for the monthly panel. However, the higher frequency data lags are restricted to a maximum of 12.

The quarterly explanatory variables are reported in the first segment of Table 4.4, and Table B.1. in Appendix B shows the results from the iterative process of fitting the best model for this regression. The results show that for this model, lagged inflows are positive and statistically significant up to the third lag at the 1 percent level of significance. All the subsequent lagged inflows are not significant. The Federal Reserve 3-month Treasury bill rate and S & P's VIX are both statistically insignificant, but the GDP for the MICs is positive and statistically significant at the 1 percent level. The dummy variables added to this model for the QE, Crisis and Post Crisis period show that they are statistically insignificant.

The Polynomial Distributed Lag (PDL) results are reported in the second segment (which is the monthly panel) of Table 4.4 which shows the results of the Yield curve. The overall effect of the Yield curve on capital inflows is negative, this is shown by the coefficient significant and negative at the 1 percent level, this is consistent with temporal portfolio rebalancing.

Table 4.4: Parsimonious USA QE program effects on MICs

The regression model represented in the table has been constructed using the stationary data, meaning that some variables have been differenced as per their original integration order, and are all I(0). Lagged inflows are the quarterly lag of net capital inflows and are a combination of FDI, portfolio net inflows and bank loans. The model was run using an PDL/Almon MIDAS regression with 3 polynomial degrees and the sample used was 2000Q4 – 2015Q4. The capital inflows are in log form and the rest of the variables at level form (except where the variable was differenced for stationarity). The equation for this model is Net Capital Inflows = Lagged Capital Inflows + USA 3M T-bill + USA Yield curve + VIX + GDP + QE + Crisis + Post Crisis + ε_t.

Definitions: VIX = Volatility Index; MIC GDP = Middle Income Country GDP; PDL = Polynomial Distributed Lag; 3M T-bill = 3-month Treasury bill rate.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.5981	1.2055	4.6440	0.0000
Lagged inflows(-1)	0.4168	0.0414	10.0611	0.0000
Lagged inflows(-2)	0.3529	0.0425	8.2977	0.0000
Lagged inflows(-3)	-0.1504	0.0428	-3.5121	0.0005
USA 3M T-bill	0.1383	0.1970	0.7018	0.4831
VIX	0.0261	0.0320	0.8145	0.4157
MIC GDP	0.1560	0.0601	2.5962	0.0097
QE period	0.5968	0.5974	0.9990	0.3182
Crisis	-0.3002	0.9728	-0.3086	0.7578
Post Crisis	0.7350	0.7591	0.9682	0.3333
USA Yield Curve (Monthly panel)				
PDL01	-13.8977	5.4244	-2.5620	0.0107
PDL02	16.8223	6.3043	2.6684	0.0078
PDL03	-4.1845	1.5806	-2.6473	0.0083
Regression model performance				
R-squared	0.3617			
Adjusted R-squared	0.3521			
Durbin-Watson stat.	1.9911			

The same model is run for the potential QE effects of the Euro Area program by the ECB on Middle Income Countries and the results are summarized in Table 4.5. The same procedure for lag selection for the Almon weighted MIDAS is followed. The lagged inflows for this model are positive and significant at the 1 percent level up to the second lag, the third and fourth lag are negative and statistically significant at the 10 percent level. The Middle Income Country GDP is positive and significant at the 5

percent level; the rest of the quarterly variables are statistically insignificant. Further, monthly panel analysis for the ECB yield curve shows results that are not statistically significant.

For both the models shown in Tables 4.4 and 4.5, it can be seen that the models can explain up to 36 and 45 percent of the variation in capital inflows to MICs respectively. This implies that these M-MIDAS-AR models are a fairly good fit to the data. The results for the extended models of the QE effects from both developed economies on MICs are presented in Table 4.6 and 4.7. The first lag of the growth differential between the US and MIC is statistically significant at 10% level. However, the second lag of the differential is negative, but still significant even at 5% level of significance.

When the QE periods are broken down into their respective phases as per the U.S. QE program (see Table 4.6), QE01 is found to be positive and statistically significant at the 5 percent level. The QE01 indicator enters with a statistically and economically significant coefficient. It suggests that the QE01 period saw an increase in net capital inflows to Middle Income Countries of 2.82/(1-0.4) ≈ 4.7 percent beyond any effects that QE may have had on observable channels such as the flattening of the yield curve, as global investors would have been rebalancing their portfolios. Lagged inflows remain statistically significant up to the third lag, but the rest of the quarterly variables are found not to be significant. The polynomial distributed lags of both the USA yield curve (which represented the portfolio balance channel) and lagged money supply (liquidity channel) are found to be statistically significant. Their overall effect of the yield curve on capital inflows is positive but declining in the lags, and although the overall effect of lagged money supply is also positive, the coefficient is significant and is much less than that of the yield curve.

The results also show that the interest rate differential between the U.S. and MICs is not statistically significant at all. This could also potentially be due to the fact that two out of the ten countries' interest rate data was not available. The results for the ECB QE program effects on MICs in Table 4.7 are not statistically significant for any of the variables in the quarterly panel except for lagged inflows which have already been established to be so in the parsimonious model.

Table 4.5: Parsimonious ECB Quantitative Easing program effects on MICs

The regression model represented in the table has been constructed using the stationary data, meaning that some variables have been differenced as per their original integration order, and are all I(0). Lagged inflows are the quarterly lag of net capital inflows and are a combination of FDI, portfolio net inflows and bank loans. The model was run using an PDL/Almon MIDAS regression with 3 polynomial degrees and the sample used was 2005Q1 – 2015Q4, and there are 440 observations after adjustments. The capital inflows are in log form and the rest of the variables at level form (except where the variable was differenced for stationarity). The equation for this model is: Net Capital Inflows = Lagged Capital Inflows + ECB 3M T-bill + ECB Yield curve + VIX + GDP + QE + ε_t. The model estimated up to 4 lags of the monthly variable (yield curve).

Definitions: VIX = Volatility Index; MIC GDP = Middle Income Country GDP; PDL = Polynomial Distributed Lag; 3M T-bill = 3-month Treasury bill rate; ECB = European Central Bank.[4]

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.9209	1.2513	4.7319	0.0000
Lagged inflows(-1)	0.4967	0.0500	9.9306	0.0000
Lagged inflows(-2)	0.3896	0.0566	6.8819	0.0000
Lagged inflows(-3)	-0.1115	0.0568	-1.9640	0.0502
Lagged inflows(-4)	-0.0901	0.0490	-1.8363	0.0670
ECB 3M T-bill	-0.9585	1.0338	-0.9271	0.3544
VIX	-0.0273	0.0453	-0.6027	0.5470
MIC GDP	0.1185	0.0572	2.0714	0.0389
QE period	0.6052	0.5532	1.0940	0.2746
ECB Yield Curve (Monthly panel)				
PDL01	2.8886	3.4015	0.8492	0.3962
PDL02	-1.4410	2.8462	-0.5063	0.6129
PDL03	0.1720	0.5441	0.3161	0.7521
Regression model performance				
R-squared	0.4451			
Adjusted R-squared	0.4348			
Durbin-Watson stat	1.9806			

[4] The same definitions apply for the tables reporting the extended model results, some definitions have not been repeated as some have been already given – the same abbreviations and their meaning remain the same for the rest of the study.

Table 4.6: Extended USA QE program effects on MICs

The regression is an extension of the parsimonious model in Table 4.4. The QE period has been broken down into QE01 – QE03 through the use of dummy variables (1 representing a QE period for each dummy variable). The model was also run using an PDL/Almon MIDAS regression with 3 polynomial degrees and the sample used was 2001Q1 – 2015Q4. There are 480 observations after adjustments The equation for this model is: Net Capital Inflows = Lagged Capital Inflows + USA 3M T-bill + Lagged Money Supply + USA Yield curve + Interest differential + VIX + GDP + NAMPMI + Lagged Growth Differential + Real effective exchange rate + QE01 +QE02 + QE03 + ε_t. The Growth differential is between the U.S. and the MICs on a quarterly basis and these are at level form in the data.

Definitions: QE = Quantitative Easing episode(s); MIC = Middle Income Country; VIX = Volatility Index.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.8632	7.4196	-0.5207	0.6028
Lagged inflows(-1)	0.4010	0.0466	8.5987	0.0000
Lagged inflows(-2)	0.3592	0.0477	7.5239	0.0000
Lagged inflows(-3)	-0.1499	0.0478	-3.1345	0.0018
USA 3M T-bill	0.3283	0.2241	1.4647	0.1437
VIX	-0.0025	0.0605	-0.0420	0.9666
MIC GDP	0.0928	0.1440	0.6446	0.5195
NAM PMI	0.1547	0.1215	1.2734	0.2035
Lagged Growth differential(-1)	0.2516	0.1412	1.7815	0.0755
Lagged Growth differential(-2)	-0.2153	0.0978	-2.2029	0.0281
Real effective Exchange Rate	0.0001	0.0002	0.5263	0.5989
QE01	2.8153	1.2214	2.3050	0.0216
QE02	-1.8052	1.5199	-1.1877	0.2356
QE03	0.7079	1.3805	0.5128	0.6083
Lagged USA M2 Money Supply (Monthly panel)				
PDL01	0.1032	0.0487	2.1188	0.0346
PDL02	-0.1056	0.0545	-1.9384	0.0532
PDL03	0.0259	0.0138	1.8817	0.0605
USA Yield Curve (Monthly panel)				
PDL01	2.6000	1.0579	2.4577	0.0144
PDL02	-1.1522	0.3652	-3.1546	0.0017
PDL03	0.0947	0.0267	3.5395	0.0004
MIC/USA Interest Differential (Monthly panel)				
PDL01	0.6361	0.6741	0.9435	0.3459
PDL02	-0.5403	0.6237	-0.8664	0.3867
PDL03	0.0980	0.1196	0.8193	0.4130
R-squared	0.3962			
Adjusted R-squared	0.2238			

The study finds the ECB yield curve overall effect to be positive and statistical significant but there is a decrease in the lags as the number of lags increase. The dummy variables that have been used to represent the periods of ECB QE periods (which include QE03 and recent extensions) are found not to be significant. The primary indicator for the liquidity channel for the parsimonious and extended models was found to be not statistically significant for both QE programs, however the secondary indicator (lagged money supply) in the case of the U. S. program was found to be significant at the 5 percent significance level. For the portfolio balance channel, the yield curve was found to be significant with the exception of the parsimonious model of the ECB QE program effects. The confidence channel was not significant for any of the models that were specified, suggesting that there is no evidence of improved or reduced confidence.

Table 4.7: Extended ECB QE program effects on MICs

The regression is an extension of the parsimonious model in Table 4.5. The ECB QE period represented here is a combination of QE03 and the recent extension of the ECB program that covers the rest of 2015. The model was also run using an PDL/Almon MIDAS regression with 3 polynomial degrees and the sample used was 2005Q3 – 2015Q4. There are 336 observations after adjustments. The MIDAS method used selects different lag lengths for the higher frequencies and therefore influence the number of observations through adjustments. The equation for this model is: Net Capital Inflows = Lagged Capital Inflows + ECB 3M T-bill + Lagged Money Supply + ECB Yield curve + Interest differential + VIX + GDP + NAMPMI + Lagged Growth Differential + Real effective exchange rate + ECBB QE +QE03 + ε_t. The Growth differential is between the Euro Area quarterly growth and the MICs' quarterly growth and these are at level form in the data.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.5831	5.1064	1.8767	0.0615
Lagged inflows(-1)	0.4803	0.0532	9.0346	0.0000
Lagged inflows(-2)	0.4154	0.0604	6.8818	0.0000
Lagged inflows(-3)	-0.1114	0.0609	-1.8305	0.0681
Lagged inflows(-4)	-0.1316	0.0565	-2.3280	0.0205
ECB 3M T-bill	-0.4605	1.3554	-0.3398	0.7342
VIX	-0.0675	0.0549	-1.2301	0.2196
MIC GDP	0.1218	0.1372	0.8881	0.3752
NAM PMI	-0.0473	0.0860	-0.5497	0.5829
Lagged Growth differential(-1)	0.0394	0.1387	0.2842	0.7764
Real effective Exchange Rate	0.0001	0.0002	0.2413	0.8095
ECB QE period	-0.8950	1.0372	-0.8629	0.3888
QE03	0.8721	1.3857	0.6294	0.5296
Lagged ECB M2 Money Supply (Monthly panel)				
PDL01	0.0000	0.0000	0.5534	0.5804
PDL02	0.0000	0.0000	-1.1253	0.2613
PDL03	0.0000	0.0000	1.2450	0.2140
ECB Yield Curve (Monthly panel)				
PDL01	3.5245	1.6392	2.1502	0.0323
PDL02	-1.8232	0.5769	-3.1605	0.0017
PDL03	0.1441	0.0427	3.3781	0.0008
MIC/EU Interest Differential (Monthly panel)				
PDL01	0.6444	0.5708	1.1290	0.2598
PDL02	-0.4048	0.3746	-1.0806	0.2807
PDL03	0.0492	0.0470	1.0459	0.2964
R-squared	0.5110			
Adjusted R-squared	0.3656			

5. Conclusion

Through recent literature, it has been established that QE programs of developed economies affect Emerging Market Economies through financial flows. This study thus sought to examine financial inflows into Middle Income Countries to establish whether QE policy programs in developed economies have an impact on MICs through financial flows.

In this study, an Autoregressive Multifactor MIDAS model was used to ascertain the effects of QE in developed economies on MICs' financial markets through the various transmission channels. Due to the nature of the QE programs, where Central Banks were conducting QE policy through monthly purchases of assets, it was befitting to use the highest frequency data available to establish whether there are any observable and latent QE effects on MICs. The results suggest the QE programs in the developed economies had an impact through the portfolio balance channel for both the U.S. and European QE programs. The U.S. QE program was also found to have effects on MICs through the liquidity channel via its secondary indicator which is lagged money supply.

The study finds that the lagged dependent variable is statistically highly significant in all the regressions, implying a certain amount of partial adjustment, which is not a surprise considering the use of quarterly data for capital inflows. From the baseline results, the study finds evidence of transmission of QE to net capital inflows to Middle Income Countries along the portfolio rebalancing channel. Over and above this, a distinct increase in inflows is found during the QE01 period, when the QE periods are broken down, that may be attributed to the flattening of the yield curve.

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Appendix A

Table A.1: Baseline sample of Middle Income Economies

The classification of countries by geographical region and income group as per the International Monetary Fund.

Country	Income classification	Region
Angola	Upper middle income	Sub-Saharan Africa
Bolivia	Lower middle income	Latin America & Caribbean
Botswana	Upper middle income	Sub-Saharan Africa
Bosnia and Herzegovina	Upper middle income	Europe & Central Asia
Cambodia	Lower middle income	East Asia & Pacific
Kyrgyz Republic	Lower middle income	Europe & Central Asia
Sudan	Lower middle income	Sub-Saharan Africa
Swaziland	Lower middle income	Sub-Saharan Africa
Tunisia	Lower middle income	Middle East & North Africa
Vanuatu	Lower middle income	East Asia & Pacific

Table A.2: Interest rate differential – USA

The table is constructed using monthly country deposit rate of the MICs and their difference with the target rate of the Federal Reserve. The difference is calculated by subtracting the federal target rate form the MIC rate and all reported figures are in level form between the period 2000M01 and 2015M12. The reported figures have also been divided into QE and non-QE periods to see the difference in the interest rate differential (these country deposit rates are used for the interest rate differential in the study).

Deposit rate difference (Interest rate differential) between USA and Middle Income Countries									
		QE periods							
Obs.	Angola	Bolivia	Botswana	Cambodia	Kyrgyz Republic	Swaziland	Tunisia	Vanuatu	All
Mean	7.17	6.77	4.86	1.25	5.94	3.31	4.30	1.26	4.36
Max	15.14	6.86	8.70	1.76	14.25	7.85	4.71	1.88	15.14
Min.	2.79	6.62	1.95	1.04	0.69	1.92	3.92	0.87	0.69
Std. Dev.	3.90	0.05	1.91	0.20	3.91	1.47	0.26	0.25	3.01
N	49	49	49	49	49	49	49	49	392
		non - Periods							
Mean	15.91	4.77	5.46	-0.05	6.49	2.88	2.63	-1.10	4.62
Max	63.84	6.90	9.60	1.85	43.63	7.92	5.03	1.43	63.84
Min.	-1.85	-0.36	2.37	-3.44	-2.09	-1.05	-0.66	-5.29	-5.29
Std. Dev.	17.30	2.19	2.39	1.61	8.35	2.37	1.83	2.06	8.56
N	143	143	143	143	143	143	143	143	1144

Table A.3: Interest rate differential – EU

The table is constructed using monthly country deposit rate of the MICs and their difference with the ECB's deposit rate. The difference is calculated by subtracting the ECB deposit rate form the MIC rate and all reported figures are in level form between the period 2000M01 and 2015M12. The reported figures have also been divided into QE and non-QE periods to see the difference in the interest rate differential (these country deposit rates are used for the interest rate differential in the study).

Deposit rate difference (Interest rate differential) between Euro area and Middle Income Countries									
		QE periods							
Obs.	Angola	Bolivia	Botswana	Cambodia	Kyrgyz Republic	Swaziland	Tunisia	Vanuatu	All
Mean	6.95	6.54	4.63	1.03	5.71	3.09	4.08	1.04	4.13
Max	14.99	7.06	7.88	1.62	12.59	6.37	4.92	2.20	14.99
Min.	2.82	5.16	2.21	0.10	0.50	1.73	2.89	-0.56	-0.56
Std. Dev.	3.77	0.40	1.58	0.38	3.79	1.20	0.51	0.52	2.95
N	49	49	49	49	49	49	49	49	392
		non - Periods							
Mean	15.92	4.78	5.46	-0.04	6.50	2.89	2.63	-1.09	4.63
Max	62.30	6.91	8.20	4.26	45.38	6.60	4.94	1.17	62.30
Min.	0.03	1.44	2.22	-2.39	-0.44	1.26	0.90	-3.81	-3.81
Std. Dev.	16.99	1.64	1.79	1.39	8.59	1.32	1.10	1.56	8.42
N	143	143	143	143	143	143	143	143	1144

Appendix B

Table B.1: Best model fit and lag length selection for the USA QE program variables, parsimonious baseline model.

This construct of this table and the method used is identical to Table 4.4 and this model was run to allow the PDL/Almon MIDAS to select the appropriate lag lengths for the model. Whilst the equation is identical, there is a slight variation in the period, the sample used by this model between 2001Q1 and 2015Q1 due the 12 lags used for the higher frequency variable, and resulted in 600 observations being included.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.3015	1.2775	4.1498	0.0000
Net Inflows(-1)	0.4193	0.0419	10.0079	0.0000
Net Inflows(-2)	0.3364	0.0456	7.3789	0.0000
Net Inflows(-3)	-0.1684	0.0458	-3.6750	0.0003
Net Inflows(-4)	0.0495	0.0432	1.1455	0.2525
USA 3M T-bill	0.2220	0.2304	0.9633	0.3358
VIX	0.0066	0.0339	0.1936	0.8466
MIC GDP	0.1610	0.0609	2.6426	0.0084
QE period	0.7060	0.6034	1.1701	0.2424
Crisis	0.0812	0.9815	0.0827	0.9341
Post Crisis	0.8521	0.7952	1.0715	0.2844
USA Yield Curve (Monthly panel)				
PDL01	1.2601	0.7733	1.6295	0.1038
PDL02	-0.6721	0.2749	-2.4448	0.0148
PDL03	0.0603	0.0203	2.9695	0.0031

R-squared	0.3669	Mean dependent var.	19.5272
Adjusted R-squared	0.3561	S.D. dependent var.	6.3847
S.E. of regression	5.1231	Akaike info criterion	6.1336
Sum squared resid.	15459.2200	Schwarz criterion	6.2362
Log likelihood	-1826.0720	Hannan-Quinn criter.	6.1735
Durbin-Watson stat	1.9978		

Table B.2: Best model fit and lag length selection for the ECB QE program variables, parsimonious baseline model.

This construct of this table and the method used is identical to Table 4.5 and this model was run to allow the PDL/Almon MIDAS to select the appropriate lag lengths for the model. Whilst the equation is identical, there is a slight variation in the period, the sample used by this model between 2005Q3 and 2015Q4 due the 8 lags used for the higher frequency variable, and resulted in 420 observations being included.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.7802	1.3373	3.5746	0.0004
Net Inflows(-1)	0.4947	0.0508	9.7388	0.0000
Net Inflows(-2)	0.4313	0.0576	7.4834	0.0000
Net Inflows(-3)	-0.1122	0.0618	-1.8146	0.0703
Net Inflows(-4)	-0.1814	0.0603	-3.0068	0.0028
Net Inflows(-5)	-0.0114	0.0590	-0.1936	0.8466
Net Inflows(-6)	0.0629	0.0551	1.1405	0.2547
Net Inflows(-7)	0.1652	0.0531	3.1111	0.0020
Net Inflows(-8)	-0.0754	0.0462	-1.6318	0.1035
Net Inflows(-9)	-0.0493	0.0433	-1.1366	0.2564
Euro 3M T-bill	-0.5908	1.0141	-0.5825	0.5605
VIX	-0.0239	0.0443	-0.5401	0.5894
MIC GDP	0.1460	0.0576	2.5328	0.0117
QE period	0.5536	0.5547	0.9980	0.3189
	Euro Area Yield Curve (Monthly Panel)			
PDL01	3.424638	1.742838	1.964978	0.0501
PDL02	-1.790398	0.851289	-2.10316	0.0361
PDL03	0.153773	0.088641	1.73478	0.0835

R-squared	0.4865	Mean dependent var.	19.9547
Adjusted R-squared	0.4701	S.D. dependent var.	5.9147
S.E. of regression	4.3057	Akaike info criterion	5.8048
Sum squared resid.	7526.7940	Schwarz criterion	5.9683
Log likelihood	-1202.0080	Hannan-Quinn criter.	5.8694
Durbin-Watson stat	1.8128		

Table B.3: Best model fit and lag length selection for the USA QE program variables, extended baseline model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.0539	7.5227	-0.4060	0.6850
Net Inflows(-1)	0.4066	0.0473	8.6009	0.0000
Net Inflows(-2)	0.3462	0.0512	6.7643	0.0000
Net Inflows(-3)	-0.1675	0.0513	-3.2636	0.0012
Net Inflows(-4)	0.0360	0.0487	0.7383	0.4607
USA 3M T-bill	0.3239	0.2265	1.4300	0.1534
VIX	-0.0077	0.0609	-0.1262	0.8997
MIC GDP	0.1013	0.1462	0.6925	0.4890
NAM PMI	0.1387	0.1232	1.1252	0.2611
Growth differential(-1)	0.2400	0.1459	1.6447	0.1007
Growth differential(-2)	-0.2348	0.1169	-2.0096	0.0451
Growth differential(-3)	-0.0193	0.1113	-0.1733	0.8625
Growth differential(-4)	0.0618	0.0958	0.6446	0.5195
Real Effective Exchange rate	0.0001	0.0002	0.4287	0.6684
QE01	2.5822	1.2800	2.0174	0.0442
QE02	-1.5980	1.5525	-1.0293	0.3039
QE03	0.9274	1.4078	0.6588	0.5104
USA M2 Money Supply (Monthly panel)				
PDL01	0.1012	0.0490	2.0663	0.0394
PDL02	-0.1056	0.0547	-1.9321	0.0540
PDL03	0.0262	0.0138	1.8967	0.0585
USA Yield curve (Monthly panel)				
PDL01	2.4507	1.0910	2.2464	0.0252
PDL02	-1.0995	0.3765	-2.9201	0.0037
PDL03	0.0911	0.0275	3.3089	0.0010
MIC/USA Interest Differential (Monthly panel)				
PDL01	0.6307	0.6784	0.9296	0.3531
PDL02	-0.5334	0.6270	-0.8507	0.3954
PDL03	0.0964	0.1202	0.8021	0.4229

R-squared	0.3976	Mean dependent var.	19.5272
Adjusted R-squared	0.2207	S.D. dependent var.	6.3847
S.E. of regression	5.6365	Akaike info criterion	6.3687
Sum squared resid	14709.3200	Schwarz criterion	6.5947
Log likelihood	-1502.4790	Hannan-Quinn criter.	6.4575

Table B.4: Best model fit and lag length selection for the ECB QE program variables, extended baseline model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.5855	5.2416	2.0195	0.0443
Net Inflows(-1)	0.4864	0.0560	8.6865	0.0000
Net Inflows(-2)	0.4187	0.0636	6.5817	0.0000
Net Inflows(-3)	-0.1312	0.0667	-1.9665	0.0501
Net Inflows(-4)	-0.1671	0.0638	-2.6178	0.0093
Net Inflows(-5)	0.0672	0.0550	1.2210	0.2230
Net Inflows(-6)	0.0668	0.0500	1.3366	0.1823
Euro Area 3M T-bill	0.1334	1.3870	0.0962	0.9234
VIX	-0.0564	0.0576	-0.9802	0.3277
MIC GDP	-0.3799	0.1762	-2.1560	0.0319
NAM PMI	-0.0898	0.0885	-1.0147	0.3111
Growth differential(-1)	1.3460	1.3718	0.9812	0.3272
Growth differential(-2)	-0.8377	3.4231	-0.2447	0.8068
Growth differential(-3)	-0.2559	3.3814	-0.0757	0.9397
Growth differential(-4)	0.2560	1.2738	0.2010	0.8409
Real Effective Exchange rate	0.0001	0.0002	0.2181	0.8275
ECB QE period	-0.8677	0.8408	-1.0320	0.3029
	ECB M2 Money Supply (Monthly panel)			
PDL01	-3.54E-11	1.28E-11	-2.7587	0.0061
PDL02	3.54E-11	1.26E-11	2.8017	0.0054
PDL03	-3.57E-12	1.26E-12	-2.8311	0.0049
	Euro Area Yield curve (Monthly panel)			
PDL01	0.2825	3.6360	0.0777	0.9381
PDL02	2.9769	2.6825	1.1098	0.2680
PDL03	-0.7542	0.4173	-1.8072	0.0717
	MIC/EU Interest Differential (Monthly panel)			
PDL01	0.641887	0.582834	1.101321	0.2716
PDL02	-0.385494	0.380991	-1.011819	0.3124
PDL03	0.045382	0.047681	0.951789	0.3419

R-squared	0.5066	Mean dependent var	19.9547
Adjusted R-squared	0.3519	S.D. dependent var	5.9147
S.E. of regression	4.7617	Akaike info criterion	6.0619
Sum squared resid.	7232.8880	Schwarz criterion	6.3573
Log likelihood	-992.4028	Hannan-Quinn criter.	6.1797