Global Liquidity: Measurement, Determinants, Spillovers and Implications for Developing Countries

By

Israr Ahmad Shah Hashmi

137-SE/PhD/F14

Supervised by

Dr. Arshad Ali Bhatti

(Assistant Professor, IIIE, IIUI)

A Dissertation Submitted to the School of Economics, International Institute of Islamic Economics in Partial Fulfillment for the Award of Doctor of Philosophy Degree in Economics of the International Islamic University, Islamabad.

Liquidity (Economics)

Economic development

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

DEDICATION

To the ones who are no more yet never gone,

for they live in my heart,

my memories:

my parents

who

happily sacrificed what they had

to realize what we dreamt for.

APPROVAL SHEET

Global Liquidity: Measurement, Determinants, Spillovers and Implications for Developing Countries

By

ISRAR AHMAD SHAH HASHMI
Reg. No. 137-SE/Ph.D/F14

Accepted by International Institute of Islamic Economics, International Islamic University, Islamabad, as partial fulfillment of the requirements for the award of Ph.D degree in Economics.

Supervisor:

Dr. Arshad Ali Bhatti
Assistant Professor, IIIE
International Islamic University, Islamabad

Internal Examiner:

Dr. Abdul Jabbar
Assistant Professor, IIIE
International Islamic University, Islamabad

External Examiner I:

Dr. Muhammad Arshad Khan
Associate Professor,
Department of Management Sciences
COMSATS, Islamabad

External Examiner II:

Dr. Karim Khan,
Associate Professor,
PIDE, Islamabad

Head,
School of Economics,
International Islamic University, Islamabad

Director General,
International Institute of Islamic Economics
International Islamic University, Islamabad

Date of Viva Voce: 09-02-2021

DECLARATION

I, **Israr Ahmad Shah Hashmi** S/O **Kamir Shah Hashmi,** Registration No. 137/SE/ PHD/ F14, student of Ph. D. Economics at the School of Economics, International Institute of Islamic Economics, International Islamic University, Islamabad, do hereby solemnly declare that the thesis entitled: ***"Global Liquidity: Measurement, Determinants, Spillovers and Implications for Developing Countries",*** submitted by me in partial fulfillment for the award of Ph. D. degree in Economics, is my original work, except where otherwise acknowledged in the text, and has not been submitted or published earlier and shall not, in future, be submitted by me for obtaining any degree from this or any other university or institution.

Signature: ____________

Dated: February 09, 2021

Israr Ahmad Shah Hashmi

Copy Rights

ABSTRACT

This study constructs five monetary measures of global liquidity, appraises their performance, explores the short and long run drivers of global liquidity and examines spillover effects of global liquidity on developing economies. We construct and examine the dynamics of theoretical and atheoretical measures of global liquidity and regional monetary aggregates, using monthly data on the components of broad money over the period 2001M12-2017M12 for 21 high-income countries. The atheoretical measures exploited by this study comprise of the simple-sum, GDP-weighted growth rates and PCA based aggregation methods; whereas theoretical measures include the currency equivalent and Divisia index techniques of monetary aggregation. We employ a graphical approach to investigate the trends and dynamics of the aggregates over time. It reveals that theoretical measures outperform atheoretical ones in the effective delineation of financial and liquidity conditions and policy stance.

Further, we evaluate the relative performance of the global liquidity measures on the basis of their out-of-sample forecasting ability and the strength of association between the lags of their cyclical components and the cyclical components of global real economic activity, global consumer goods, global commodity and equity prices. For the forecasting purpose, we estimate VARs using data for the period of 2001M12 to 2015M6 and generate forecasts for the remaining period of 30 months. We evaluate the ability of each global liquidity measure to forecast each global variable on the criteria of root mean squared error and mean absolute error, and through visual inspection. The results of this analysis establish the supremacy of currency equivalent measure over other measures in efficiently forecasting all the four global variables. Further, the correlation analysis demonstrates that the lags of cyclical components of currency equivalent measure have a relatively sturdiest association with the cyclical components of global real economic activity and that of Divisia measure with the cyclical components of global consumer goods and equity prices. Overall, the findings of both approaches endorse the superiority of theoretical measures over the atheoretical ones.

Besides, we also explore the short and long-run determinants of global liquidity by utilizing the ARDL bounds testing approach. The findings of this part of the exploration substantiate that global real economic activity, bank leverage, cross border bank flows, risk sentiment, inflation, interest rate and interest rate differential significantly influence short-run dynamics of global liquidity. However, the nature and time of effects of these short-run determinants vary across global liquidity measures. Further, it is also observed that these factors drive global liquidity conditions in the long run too. Though the nature and magnitude of their effects vary across global liquidity measures, yet, taking together, global real economic activity, cross border bank flows, inflation and interest rate differential foster whilst global bank leverage, risk sentiment and interest rate hamper global liquidity conditions in the long run.

Additionally, we also investigate the spillover effects of global liquidity on developing economies. For the purpose, we utilize the data of 40 developing countries for the same period and employ the SVAR technique. The findings of this analysis corroborate the existence of significant spillover effects of global liquidity on the developing countries' variables. However, the time and magnitude of the impulse responses of the developing countries variables vary across global liquidity measures. But, overall real economic activity, consumer price index, monetary aggregate and policy rate of developing countries respond significantly and positively while the real effective exchange rate of developing countries first exacerbates and then ameliorates over time in response to one time one standard deviation positive innovation in global liquidity.

ACKNOWLEDGEMENT

I offer my first and foremost gratitude to Allah Almighty, "who taught man that what he knew not", for granting me courage and perseverance to accomplish the daunting tasks of Ph. D. course and research works.

Secondly, I am highly grateful to my supervisor, Dr. Arshad Ali Bhatti, Assistant Professor, IIIE, without whose support, motivation and guidance, this work would not have seen the light of day. His erudite manner of guidance and stress relieving style impressed me a lot and always appeared as light whenever I felt myself in dark. I always found him helping and encouraging whenever I sought his help throughout this long journey.

Besides, I also stand in gratitude to my teachers who taught me during the course work of Ph. D. programme, especially to Dr. Abdul Jabbar, Dr. Hafiz Muhammad Yasin, Dr. Attiq-Ur-Rehman and Dr. Babar Hussain for their insightful mentoring during the course work. I am also thankful to the academic and administrative staff of IIIE, especially to Syed Niaz Ali Shah, Zaheer Ahmed and Arif Khan for their support and assistance during this voyage of academic exploration. In addition to this, I also acknowledge the support and motivation extended by all my Ph. D. fellows, especially by Dr. Ghulam Moeen-Ud-Din, Tauqir Ahmed and Rashid Rauf who kept his office door opened for us for group-study during the course work.

Moreover, I am highly indebted to my family and friends for their encouragement and social and moral supports during this long journey, extended over some years. I am deeply grateful to Dr. Husnain Abbas Naqvi who encouraged and pushed me to get enrolled in Ph. D programme. Further, I am also indebted to the person who lives in my memories now, Touqeer Raza Shah (late). I offer my special thanks to my elder brother, Dr. Zawar Hashmi, for his love, support and motivation during all this way. I am also thankful to Muhammad Fahad Awan for his support and assistance.

Last but not least, I am grateful to my wife and kids for their support and sacrifice. Sacrifice in a sense that I could not give them their due time and could not meet their demands and wishes for being unable to spare enough time for them from this hefty work.

Israr Ahmad Shah Hashmi

January, 2021

CONTENT LIST

CHAPTER 8 CONCLUSION AND RECOMMENDATIONS

List of Tables

List of Figures

List of Abbreviations/Acronyms

ADF: Augmented Dickey Fuller

AIC: Akaike Information Criterion

ARDL: Autoregressive Distributive Lag

BIS: Bank for International Settlements

BRIC: Brazil, Russia, India and China

CANSIM: Canadian Socio-Economic Information Management System

CDS: Credit Default Swap

CE: Currency Equivalent

CFS: Centre for Financial Stability

CFTC: Commodity Future Trading Commission

CGFS: Committee on Global Financial System

CP: Commercial Papers

CPI: Consumer Price Index

CPID: Consumer Price Index of Developing Countries

CRB: Commodity Research Bureau

CUSUM: Cumulative Sum

CUSUMSQ: Cumulative Sum of Square

CVAR: Cointegrated Vector Autoregression

DF: Dickey Fuller

DLCEISR: Log difference of currency equivalent measure for Israel

DLCENEAP: Log difference of currency equivalent measure for East Asia and Pacific

DLCENEUCA: Log difference of currency equivalent measure for Europe and Central Asia

DLCENLAC: Log difference of currency equivalent measure for Latin America and Caribbean

DLCENNA: Log difference of currency equivalent measure for North America

DLDIVEAP: Log difference of Divisia index for East Asia and Pacific

DLDIVEUCA: Log difference of currency Divisia index for Europe and Central Asia

DLDIVISR: Log difference of Divisia index for Israel

DLDIVLAC: Log difference of Divisia index for Latin America and Caribbean

DLDIVNA: Log difference of Divisia index for North America
DLGDPWEAP: Log difference of GDP-weighted measure for East Asia and Pacific
DLGDPWEUCA: Log difference of GDP-weighted measure for Europe and Central Asia
DLGDPWLAC: Log difference of GDP-weighted measure for Latin America and Caribbean
DLGDPWNA: Log difference of GDP-weighted measure for North America
DLGLCEN: Log difference of currency equivalent measure of global liquidity
DLGLDIV: Log difference of Divisia index of global liquidity
DLGLGDPW: Log difference of GDP-weighted measure of global liquidity
DLGLPCA: Log difference of PCA-based measure of global liquidity
DLGLSUM: Log difference of simple-sum measure of global liquidity
DLPCAEAP: Log difference of PCA-based measure for East Asia and Pacific
DLPCAEUCA: Log difference of PCA-based measure for Europe and Central Asia
DLPCALAC: Log difference of PCA-based measure for Latin America and Caribbean
DLPCANA: Log difference of PCA-based for North America
DLSUMEAP: Log difference of simple-sum measure for East Asia and Pacific
DLSUMEUCA: Log difference of currency equivalent measure for Europe and Central Asia
DLSUMISR: Log difference of simple-sum measure for Israel
DLSUMLAC: Log difference of simple-sum measure for Latin America and Caribbean
DLSUMNA: Log difference of simple-sum for North America
EME: Emerging Market Economy
EU: the European Union
FA: Factor Analysis
FAVEC: Factor-Augmented Vector Error Correction
FFR: Federal Fund Rate
FPEC: Final Prediction Error Criterion
FRED: Federal Reserve Economic Data
GBL: Global Bank Leverage
GCBBF: Global Cross Border Bank Flows

GCMIFCE: Global commodity price index forecasted through currency equivalent measure of global liquidity
GCMIFDIV: Global commodity price index forecasted through Divisia measure of global liquidity
GCMIFGDPW: Global commodity price index forecasted through GDP-weighted growth rates measure of global liquidity
GCMIFPCA: Global commodity price index forecasted through PCA-based measure of global liquidity
GCMIFSUM: Global commodity price index forecasted through simple-sum measure of global liquidity
GCMPI: Global Commodity Price Index
GCMPISECE: Forecast standard error of global commodity price index generated through currency equivalent measure of global liquidity
GCMPISEDIV: Forecast standard error of global commodity price index generated through Divisia measure of global liquidity
GCMPISEGDPW: Forecast standard error of global commodity price index generated through GDP-weighted growth rates measure of global liquidity
GCMPISEPCA: Forecast standard error of global commodity price index generated through PCA-based measure of global liquidity
GCMPISESUM: Forecast standard error of global commodity price index generated through simple-sum measure of global liquidity
GCPI: Global Consumer Price Index
GCPIFCE: Global consumer price index forecasted through currency equivalent measure of global liquidity
GCPIFDIV: Global consumer price index forecasted through Divisia measure of global liquidity
GCPIFGDPW: Global consumer price index forecasted through GDP-weighted growth rates measure of global liquidity
GCPIFPCA: Global consumer price index forecasted through PCA-based measure of global liquidity
GCPIFSUM: Global consumer price index forecasted through simple-sum measure of global liquidity
GCPISECE: Forecast standard error of global consumer price index generated through currency equivalent measure of global liquidity

GCPISEDIV: Forecast standard error of global consumer price index generated through Divisia measure of global liquidity

GCPISEGDPW: Forecast standard error of global consumer price index generated through GDP-weighted growth rates measure of global liquidity

GCPISEPCA: Forecast standard error of global consumer price index generated through PCA-based measure of global liquidity

GCPISESUM: Forecast standard error of global consumer price index generated through simple-sum measure of global liquidity

GDP: Gross Domestic Product

GFC: Global Financial Crisis

GINF: Global Inflation

GINT: Global Interest Rate

GINTD: Global Interest Rate Differential

GIPI: Global Industrial Production Index

GIPIFCE: Global industrial production index forecasted through currency equivalent measure of global liquidity

GIPIFDIV: Global industrial production index forecasted through Divisia measure of global liquidity

GIPIFGDPW: Global industrial production index forecasted through GDP-weighted growth rates measure of global liquidity

GIPIFPCA: Global industrial production index forecasted through PCA-based measure of global liquidity

GIPIFSUM: Global industrial production index forecasted through simple-sum measure of global liquidity

GIPISECE: Forecast standard error of global industrial production index generated through currency equivalent measure of global liquidity

GIPISEDIV: Forecast standard error of global industrial production index generated through Divisia measure of global liquidity

GIPISEGDPW: Forecast standard error of global industrial production index generated through GDP-weighted growth rates measure of global liquidity

GIPISEPCA: Forecast standard error of global industrial production index generated through PCA-based measure of global liquidity

GIPISESUM: Forecast standard error of global industrial production index generated through simple-sum measure of global liquidity

GLCE: Currency equivalent measure of global liquidity
GLDIV: Divisia measure of global liquidity
GLGDPW: GDP-weighted growth rates measure of global liquidity
GLPCA: PCA-based measure of global liquidity
GLSUM: Simple-sum measure of global liquidity
GRINT: Global Real Interest Rate
GVAR: Global Vector Autoregression
HP: Hodrick-Prescott
HQC: Hannan-Quinn Criterion
IFS: International Financial Statistics
IMF: International Monetary Fund
INTD: Interest Rate of Developing Countries
IPID: Industrial Production Index of Developing Countries
KPSS: Kwaitkowski, Phillips, Schmidt and Shin
LIBOR: London Interbank Offer Rate
LM: Lagrange multiplier
MAE: Mean Absolute Error
MD: Monetary Aggregate of Develping Countries
MOVE: Merrill Lynch Options Volatility Estimate
MSCI: Morgan Stanley Capital International
MSCIFCE: Morgan Stanley Capital International's world index forecasted through currency equivalent measure of global liquidity
MSCIFDIV: Morgan Stanley Capital International's world index forecasted through Divisia measure of global liquidity
MSCIFGDPW: Morgan Stanley Capital International's world index forecasted through GDP-weighted growth rates measure of global liquidity
MSCIFPCA: Morgan Stanley Capital International's world index forecasted through PCA-based measure of global liquidity
MSCIFSUM: Morgan Stanley Capital International's world index forecasted through simple-sum measure of global liquidity
MSCISECE: Forecast standard error of Morgan Stanley Capital International's world index generated through currency equivalent measure of global liquidity
MSCISEDIV: Forecast standard error of Morgan Stanley Capital International's world index generated through Divisia measure of global liquidity

MSCISEGDPW: Forecast standard error of Morgan Stanley Capital International's world index generated through GDP-weighted measure of global liquidity

MSCISEPCA: Forecast standard error of Morgan Stanley Capital International's world index generated through PCA-based measure of global liquidity

MSCISESUM: Forecast standard error of Morgan Stanley Capital International's world index generated through simple-sum measure of global liquidity

OECD: Organization for Economic Cooperation and Development

OIS: Overnight Indexed Swap

PCA: Principal Component Analysis

PP: Phillips and Perron

PPP: Purchasing Power Parity

PVAR: Panel Vector Autoregression

REER: Real Effective Exchange Rate

REERD: Real Effective Exchange Rate of Developing Countries

RESET: Regression Specification Error Test

RMSE: Root Mean Squared Error

SDR: Special Drawing Right

SIC: Schwartz Information Criterion

SVAR: Structural Vector Autoregression

TBR: Treasury Bill Rate

TED: is an acronym constructed from T-bill and ED, and is a ticker symbol for the Eurodollar future contracts.

UK: United Kingdom

US: United States

VAR: Vector Autoregression

VECM: Vector Error Correction Model

VIX: Volatility Index of Chicago Board options Exchange

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The interdependence of economic activities across the world is increasing in this era of globalization. Rather, increasing degree of economic and financial integration is the defining feature of global economic system in recent years. The financial interdependence among economies has increased due to increasing financial integration and international lending (Takáts and Temesvary, 2020; Schnabl, 2012; Cetorelli and Goldberg, 2012; Lane and Milesi-Ferretti, 2007). Researchers and policymakers have delved into the integrating nature of global economic system to the extent that the phrase "the world is growing increasingly connected" has now become a cliché (Bruno and Shin, 2014). So, in this prevailing situation of global interdependence, the impact of economic conditions in a country spills over the borders to a greater or a smaller degree and the cross-border transmission of financial crises bears out the same (Sahoo et al., 2020; Gamba-Santamaria et al., 2017; Ait-Sahalia et al., 2012).

An appropriate monetary policy, in increasingly integrated financial markets, is one of the most challenging tasks faced by the central banks of the world (Diamond et al., 2020; Bussière et al., 2020; Belke and Rees, 2014; De Santis et al., 2014). In global perspectives, liquidity allocations influence financial and macroeconomic developments in a way that these developments are not controllable by national policymakers (He and McCauley, 2013; Chen et al., 2012; Matsumoto and Schindler, 2006). Further, Rey (2015) maintain that international macroeconomics postulates "trilemma" - independent monetary policies are viable, even with free capital mobility, if and only if floating exchange rate regimes are adopted. But the existence of global financial cycle has reduced the trilemma into a "dilemma" which posits that independent monetary policies are workable only if capital accounts are managed. Nonetheless, in the state of free mobility of capital, global financial cycles subdue national monetary policy irrespective of exchange rate regimes.

Why at Global Scale?

The existing evidence related to both global liquidity and global inflation dynamics supports that global perspectives are far more important than national ones, when the monetary transmission mechanism is to be explored and examined (Inekwe, 2020; Belke et al., 2014; Ciccarelli and Mojon, 2010; D'Agostino and Surico, 2009). Additionally, modeling the inflation at global level is more adequate than at national level in investigating the fact whether and to what extent global factors are responsible for the developments in global liquidity (Borio and Filardo, 2007). Lending empirical support to this viewpoint, Ciccarelli and Mojon (2010) argue that national inflation has a tendency to adjust to global inflation level as any deviation of national inflation from global inflation level disappears or is corrected over the time. Thus, the explorations and investigations on global liquidity and global inflation suggest that it is more important to investigate these issues at global level than at national level when monetary transmission mechanism is aimed to be investigated and interpreted (Belke and Volz, 2019; Belke et al., 2010a, b). Nonetheless, Canova et al. (2007) confirm the existence of global business cycle.

The erratic developments in financial markets further pose serious challenges to monetary authorities of the world to tackle with. For instance, non-fundamental surges in asset prices can potentially trigger inflationary pressures and can lead to inefficient allocation of resources, not only within the country but also across the countries. Nonetheless, they are liable to cause overconsumption pattern due to wealth effect (Dreger and Wolters, 2011). Consequently, the episodes of financial booms and busts have revived the researchers' attention on global factors that derive worldwide financial conditions (Bruno and Shin, 2014).

A number of studies limelight the importance of variables aggregated at global level for investigations and explorations (Belke and Keil, 2016; Belke et al 2014; Giese and Tuxen, 2007). Moreover, in today's state of interlinked financial markets, a shift in money supply of one country can be absorbed by the demand of any other country; however, simultaneous shifts in major economies are most likely to affect global asset and goods prices (Giese and Tuxen, 2007). In this direction, the empirical endeavour, investigating the commonality in monetary aggregates of various currency areas, substantiates that around 50% of narrow money aggregate variance can be attributed to one common global factor – the expansionary monetary policy of the Bank of Japan (Rüffer and Stracca, 2006). Further, Brockman et al. (2009) also document commonality in liquidity across the countries.

Global Liquidity in Current Economic Scenario

Owing to the tilt of evidence in favour of global factors instead of domestic factors as presented in the preceding passages, in general, and the global financial crisis (henceforth GFC) of 2007-2008, in particular, global liquidity has remained central to the debate on international monetary system. There prevails a perception that global liquidity is a powerful driver of cross-border capital flows, global inflation, global asset prices and financial stability (Cohen et al., 2017). The monetary aggregates view recognizes its role as one of the chief determinants of aggregate demand, goods price inflation and cross-border macroeconomic spillovers (Chen et al., 2012; Rüffer and Stracca, 2006; Baks and Kramer, 1999). Another stance supported by empirical findings views that an abnormal increase in private credit coupled with rise in asset prices may lead to financial distress (Drehmann et al., 2011).

Another argument, grounded on empirical analyses, imputes booms in assets prices to liquidity spillovers to some asset markets (Bose and Chattopadhyay, 2019; Adalid and Detken, 2007). Moreover, financial integration may dampen local liquidity shocks because it helps banks in smoothing regional (local) liquidity shocks by making lending and borrowing very easy in interbank market. Since financial integration makes the availability of short-term funds possible, banks can easily overcome liquidity shortages. However, easy and quick access to liquid assets may change banks' lending and portfolio decisions. Banks may pursue less liquid and risky investment strategies that, in turn, lead to financial instability (Schnabl, 2012; Cetorelli and Goldberg, 2012). Further, global liquidity adds to the build-up of financial system vulnerabilities due to global imbalances and mismatches across countries, maturities and currencies (Djigbenou-Kre and Park, 2016; Borio, 2008). However, Mayordomo et al. (2014) argue that shortages of global liquidity emanate serious implications for economic growth, as witnessed in 2008-09. Further, the measures (like accumulation of precautionary reserves) taken to address these shortages impact financial markets and patterns of capital flows to a great extent.

Realizing the importance of global liquidity, researchers and policymakers have endeavoured to understand the concept better, and this has led to mushrooming literature in this field. In this scenario, the Bank for International Settlements (henceforth BIS) constituted a committee to delve deeper into the concept and aspects of global liquidity. The committee has presented a number of detailed reports on the subject covering theoretical issues related to the conceptual framework, drivers and dynamics of global liquidity.

Nonetheless, global liquidity has been undergoing a persistent increase since 2001 (Belke et al., 2010a, b). It has witnessed a surge in the mid-nineties, accelerated in early 2000 in face of easing of monetary policies of industrialized countries and then in 2008-09 during the GFC (Brana et al., 2012; Berger and Harjes, 2009). During this period, low interest rates especially in the three major economies – the US, the Euro Area and Japan – along with financial globalization, speedy financial innovations and high market participation rate have led to plentiful global liquidity. The accommodative policy stance in major economies characterized by low (long-term) interest rate can be imputed to global savings-investment imbalances accumulated in the preceding years (Belke and Verheyen, 2014; Berger and Harjes, 2009).

In view of all this, global liquidity merits a detailed and rigorous analysis. Moreover, economists and policy analysts have attempted to attract the attention of researchers to this matter. Belke et al. (2014) plead that global liquidity deserves same or even more attention of researchers for worldwide analyses as global interest rate has received as a potential factor of global financial stability in the wake of the GFC. In the same vein, Everett (2016) asserts that better understanding of the idea of global liquidity, its determinants and its spillover effects concerning global financial conditions, is important for researchers and policymakers, provided that it gives important insight in identifying rising future imbalances and transmission of financial shocks.

Theoretical Discussion

The roots of global liquidity can be traced back to the umbrella of demand for money theories, where the distinguished one is "liquidity preference theory". Over time, as the literature evolved, there emerged a stream of literature that uncovered the existence of significant linkage between money growth and real and nominal stock prices and interest rates (Marshall, 1992; Friedman 1988, 1968). Moreover, the conclusion derived by Friedman (1968) that an increase in money growth leads to temporary decline in nominal and real interest rate is known in the literature as "liquidity effect". These findings served as a foundation stone in the development of dynamic general equilibrium models that elaborate the linkages of money growth with asset prices, term structure of interest rate and inflation (Marshall, 1992; Lee, 1992; Stulz, 1986; Day, 1984).

Later on, there emerges a branch of literature that discusses these relationships in the global context (Chen et al., 2012; Rüffer and Stracca, 2006; Baks and Kramer, 1999). Now this sort of literature is further growing into various directions. The prominent directions of the growth of this sort of literature are as follows. First, a strand of literature discusses the role of global liquidity in the determination of global consumer goods, commodity and asset prices (Bose and Chattopadhyay, 2019; Belke et al., 2014; Chen et al., 2012; Baks and Kramer, 1999). Second, some authors focus on the role of global liquidity in the global financial stability and cross-border bank activities (Osina, 2020; Cohen et al., 2017; Djigbenou-Kre and Park, 2016; Schnabl, 2012). Third, another sort of literature sheds light on the drivers of global liquidity (Avdjiev et al., 2020; Cerutti et al., 2017; Miranda-Agrippino and Rey, 2015). Lastly, some exploratory attempts investigate the spillover effects of global liquidity (Inekwe, 2020; Bonizzi et al., 2019; Darius and Radde, 2010; Baks and Kramer, 1999). A detailed discussion on the theoretical foundations of models employed in this study is given in chapter 3, under the headings of theoretical framework.

1.2 The Concept and Measurement Issues of Global Liquidity

Despite being a focal point of recent research endeavours on international financial stability, global liquidity still lacks agreed definition and measure (Cohen et al., 2017; Domanski et al., 2011). It has been used in a variety of ways. It refers to monetary policy stance of advanced economies or currency areas when it is recognized as a key driver of goods price inflation. In another context, where its financial stability implications are taken into account, it refers to the recognition that availability of plentiful low cost funding in global financial markets can potentially add to global financial vulnerabilities through leverage and huge currency and maturity mismatches (Domanski et al., 2011; Landau, 2011). It appears to be a multifaceted concept with only "ease of financing" being the common element. Nevertheless, the variant nature of the concept of global liquidity can potentially lead to tenuous and destabilizing policy initiatives (the Committee on the Global Financial System (henceforth CGFS), 2011).

Simply, global liquidity measures global monetary policy stance and refers to supply of cash – the most liquid assets (CGFS, 2011). But, generally, global liquidity is considered to be an "ease of financing in global financial centres", though it is a challenging task to measure. Therefore, global liquidity remains an elusive concept (Cohen et al. 2017; Domanski et al. 2011). Further, the concept of global liquidity can best be explained by shedding light on its foundations. Liquidity, in general, refers to the degree of ease and speed with which an asset can be converted into another asset (purchasing power). Keeping in view this notion of 'liquidity' and in the context of current financial system, two concepts of global liquidity are the most important: market liquidity and funding liquidity (CGFS, 2011). Market liquidity refers to the situation where immediate or short notice sale of an asset has least impact on its price. A lesser impact on asset price is associated with more market liquidity. Similarly, funding liquidity involves raising cash by borrowing with least impact on borrowing cost. Less of an impact on borrowing cost indicates greater funding liquidity (Cohen et al. 2017; CGFS, 2011).

The "ease of financing" concept of global liquidity entails some implications. First, liquidity, when it is aggregated at global level, depends on the interactions of market and funding liquidity. For an illustration, in the run-up of the GFC, securitizations especially mortgage-backed securities were found to be highly liquid. This resulted in ample funding liquidity by encouraging banks and other financial institutions to exploit these securities as collateral in carrying out repo transactions and other similar activities. Second, the overall "ease of financing" depends on the actions of financial institution, private investors and public sector. Securitization describes the creation of liquidity through the interactions of private market participants. Additionally, central banks provide the fundamental means of payment (in the form of base money). The conditions on which they supply base money, in turn, influence funding and market liquidity (Domanski et al., 2011).

Thus, a wide range of measures of different aspects of global liquidity are suggested in the literature[1]. The selection of measures depends primarily on the aspect of global liquidity being focused on. Keeping in view earlier works and the views of the CGFS (2011), the multifaceted concept of global liquidity is related to "ease of financing". This can be accessed through both monetary view and funding and market view. The former view refers generally to the contribution to official component of global liquidity by monetary authorities. The latter view relates to private component of global liquidity. Hence, constructing the measure of global liquidity, one must be mindful of the fact that global liquidity is mainly determined by the interactions of financial institutions and private investors. Financial institutions fetch market liquidity to the securities market through their trading activities (buying securities) and funding liquidity to the borrowers through their lending activities (CGFS, 2011).

But the question arises: Which measure or aspect of global liquidity is relatively better to explain financial and macroeconomic conditions? To answer this question, some researchers are of the view that various concepts of liquidity are closely related (Howell, 2020; Cohen et al. 2017; Baks and Kramer 1999). For instance, monetary liquidity can be an important source of funding in the securities market. Increased market liquidity lowers the funding cost (interest rate) and hence supports market making activities. The net supply of securities might tend to increase in the periods of ample market liquidity because monetary markets are generally receptive to new issues. On the other hand, money demand, willingness of financial institutions and investors to take risk, willingness of corporations to take on debt and global liquidity may increase simultaneously during periods of improved economic prospects. Clearly, relationships among different types of liquidity assign a key role to central banks and hence to monetary liquidity (Baks and Kramer 1999).

Monetary and credit measures are therefore the best options to proxy the quantity or volume of global liquidity. Moreover, other aspects of global liquidity are also primarily determined by money and credit supply in global financial centres. The ability of financial and non-financial institutions to advance credit is further determined by the availability of monetary services in the market. Thus, credit can

[1] See Committee on Global Financial System (CGFS) report (2011) for detailed description of the measures of global liquidity.

also be proxied by monetary assets (Chung et al., 2014). Inspired by this stance, this study also investigates monetary measures of global liquidity.

In this section, this investigation constructs and examines the dynamics of five different monetary measures of global liquidity: simple sum (henceforth GLSUM), GDP-weighted growth rates (henceforth GLSUM), currency equivalent (henceforth GLCE), Divisia index (henceforth GLDIV), and Principal Component Analysis (hereafter PCA) based (henceforth GLPCA) measures. We firstly construct and investigate the dynamics of aggregates at a regional level and then at a global level. For this, sampled countries are grouped into five regional blocks, as categorized by the World Bank. The regional blocks are: (i) East Asia and Pacific (ii) Europe and Central Asia (iii) Latin America and Caribbean (iv) Middle East and North Africa, and (v) North America.

1.3 Relative Performance of the Measures of Global Liquidity

The notion of "super-neutrality of money" has invited the researchers to extend their investigations. There exists a view that the reasons of such results that support the super-neutrality characteristic of money may be due to the neglect of global liquidity and one common (worldwide) rate of interest and inflation (Giese and Tuxen, 2007; Juselius, 2007; Hendry, 2001). In this direction, an empirical stance appears that corroborates that global liquidity is one of the chief drivers of asset and consumer price inflation (Bose and Chattopadhyay, 2019; Sousa and Zaghini, 2008; Rüffer and Stracca, 2006; Baks and Kramer, 1999).

The explorations, with investigations extended at global scale, contend that global liquidity deeply impacts not only financial but also real economic variables. Clear evidence in this regard is the impact of financial crises on real economic activity, as it was witnessed that real economic activities of many economies were hit severely during the GFC. An empirical evidence of the impact of global liquidity on macroeconomic variables is presented by many researchers like Bussière et al (2020), Belke and Keil (2016), Belke et al. (2010a, b) and Giese and Tuxen (2007). Additionally, its profound impact on global real economic activity is also well documented in the literature (Belke and Keil, 2016; Rüffer and Stracca, 2006).

Moreover, there exists rich literature on the performance of global liquidity as an indicator of the developments in global commodity, consumer goods and asset prices (Belke et al., 2014, 2010a, b; Darius and Radde, 2010). Further, Alessi and Detken (2011) substantiate that global liquidity is an important early warning indicator of assets price booms and busts. However, the role of global liquidity in the volatility of commodity prices and the build-up of speculative pressure remains controversial (Beckmann et al., 2014). On the other hand, there exists an empirical evidence that large swings in assets, commodity and house prices emanate serious implications for real economic activities and financial stability. Historically, a period of large fluctuations in asset prices has been a period of financial instability (Drehmann et al., 2011; Detken et al., 2010).

To unfold the enigma of economic recessions and financial turmoil caused by asset and commodity price booms and busts, researchers and policymakers have endeavoured to discover the true association of asset prices and global liquidity. A number of studies attempt to investigate this association (Bose and Chattopadhyay, 2019; Kang et al., 2016b; Brana and Prat, 2016; Beckmann et al., 2014; Belke et al., 2010a, b). But the investigators have utilized only few measures of global liquidity – mostly atheoretical monetary measures - for their explorations. However, there exists country and monetary union level evidence that theoretical monetary measures outperform atheoretical ones in forecasting real economic activities and inflation, and also on the basis of some other criteria (Darvas, 2015; Huang and Xia, 2015; Schunk, 2001; Barnett et al., 1984). Further, Hashmi and Bhatti (2019) support the same stance by presenting regional and global level evidence.

It indicates that an important issue still lacks researchers' attention: whether theoretical or atheoretical measures have more predictive power of global real and nominal economic activities. Thus, it invites further exploration aimed to gauge the performance of theoretical as well as atheoretical measures so that the measures which accurately signal the developments in economic and financial conditions can be distinguished. This study attempts to bridge this gap in this section by evaluating performance of two theoretical (GLCE and GLDIV) and three atheoretical (GLSUM GLPCA and GLGDPW) measures of global liquidity in forecasting global real and nominal economic conditions, and also by their association with these conditions. Following Schunk (2001) and Belongia and Ireland (2017), we compare out-of-sample forecasting ability of these monetary measures and the strength of association between the lags of their cyclical components and the cyclical components of global real economic activity and global consumer, commodity and asset price indices.

1.4 Determinants of Global Liquidity

The rigor with which global liquidity is being recently focused reflects a view that global liquidity and its determinants are of paramount importance for global financial stability (Osina, 2020; Cohen et al., 2017; CGFS, 2011). Further, the identification and elaboration of the main determinants of global liquidity conditions are desperately required (Osina, 2019; Cerutti et al., 2017, 2014; Bruno and Shin, 2014; Rey, 2015). Hence, in addition to the investigation of the dynamics of global liquidity, the exploration of the determinants of global liquidity is of high significance for global financial and economic stability.

But the empirical literature on the determinants of global liquidity is very scant, even in spite of its increasing recognition in the literature on global financial conditions. To the best of our knowledge, there is no empirical study which explicitly and rigorously investigates its determinants. However, some studies attempt to underline the drivers of the elements of global liquidity like cross-border capital flows, bank loans and debt instruments flows (Avdjiev et al., 2020; Cerutti et al., 2017; Miranda-Agrippino and Rey, 2015; Forbes and Warnock, 2012). Only few studies investigate the determinants of global liquidity, using cross-border bank flows as its proxy (Osina, 2019; Cerutti et al., 2017; Renata, 2015). However, the theoretical literature proposes a number of potential drivers of global liquidity conditions, which can be classified into three major categories: macroeconomic, other public sector policies and financial factors (Domanski, 2011; CGFS, 2011).

Keeping in view the importance of the exploration of the determinants of global liquidity as realized by some authors coupled with the limitation of the literature, this study contributes to the literature by exploring its determinants in this section. We endeavour to dig out its short and long run determinants, using its five aforementioned measures. The identification of determinants can potentially be handy in preventing or at least controlling detrimental developments in global liquidity through timely maneuvering of its determinants.

1.5 Global Liquidity Spillovers

Financial liberalization and deregulation have promoted globalization of investment and financial activities, increasing the magnitude of booms and busts in credit and asset markets. The trends and behavior of financial assets in one county influence the behavior of financial assets in another country. Hence, shocks in one asset market affect other financial markets. This phenomenon indicates the association among financial instruments of different markets and financial contagion. A number of empirical investigations suggest the existence of cross-border financial spillovers and financial contagions (Guerello and Tronzano, 2020; Belke and Volz, 2019; Kyle and Xiong, 2001; King and Wadhwani, 1990).

In the similar fashion of the international effects of financial instruments, liquidity in one financial center can influence financial conditions in other centres. Further, the existence of international financial institutions facilitates cross-border transmission of shocks (Takáts and Temesvary, 2020; Schnabl, 2012; Cetorelli and Goldberg, 2012; Sbracia and Zaghini, 2003). Even in the absence of international financial institutions, portfolio diversification facilitates transmission of monetary shock across the borders (Devereux and Sutherland, 2011). Moreover, monetary trends have shown many similarities in the major industrialized countries (Sousa and Zaghini, 2007).

Moreover, monetary conditions in advanced economies drive global financial and monetary conditions (Brana et al., 2012). The monetary policy shocks and domestic monetary decisions of major economies of the world emanate cross-border implications (Sahoo et al., 2020; Tule et al., 2019). This might be owing to the fact that currencies of major economies function as 'vehicle' currency and most of international transactions are carried out in these currencies. Hence, monetary shocks in major economies spillover to other economies, affecting domestic monetary decisions of other economies. Supporting this viewpoint, Kang et al. (2016b) argue that the increase in Chinese liquidity has significant effect on the US economy. Analogously, a number of investigations validate the existence of cross-border spillover effects of monetary developments in advanced economies (Diamond et al., 2020; Chen et al., 2016; Laeven and Tong, 2012; Ammer et al., 2010). All this contends that monetary measures taken in an economy, especially in the advanced one, can have across the borders implications.

In the face of growing financial integration, global monetary conditions have deep impact on domestic economic conditions of an individual country (CGFS, 2011). Recent research endeavours and policymakers, focusing on the notion of global liquidity, hold that permissive credit conditions are transmitted across borders to other regions or parts of the world (Diamond et al., 2020; Clark et al., 2020;

Mirandra-Agripinno and Rey, 2015). Further, Kokeyne et al. (2010) maintain that the ample global liquidity generated in advanced economies has flowed to emerging economies. Global liquidity is considered to be an integral concept in international monetary transmission (Choi et al., 2017). The empirical evidence in this regard is also well documented by Sousa and Zaghini (2008). It endorses the existence of spillovers of global liquidity to the Euro Area.

But the existing literature has overlooked the investigation of spillover effects of global liquidity on developing countries. Based on these facts, this study attempts to complement the literature on global liquidity spillovers by exploring and inspecting spillover effects of global liquidity on developing countries in this section. For the purpose, we construct and investigate aggregated variables of developing countries and the measures of global liquidity constructed in this study. Further, following the existing empirical endeavours in this direction, such as Kang et al.(2016b), Maćkowiak (2007) and Sousa and Zaghini(2008), we also exploit structural vector autoregression (hereafter SVAR) technique for the analyses.

1.6 Objectives of the Study

The main objectives of the study are to:

a) Measure global liquidity through the lens of monetary aggregates.

b) Examine dynamics of regional and global monetary aggregates over the time.

c) Gauge the relative performance of theoretical and atheoretical monetary measures of global liquidity.

d) Explore the short and long run determinants of global liquidity using its different measures.

e) Investigate spillover effects of global liquidity on the developing countries.

1.7 Research Questions

The major research questions of the study are as follows.

a) How can global liquidity be assessed in monetary perspectives?

b) What are the dynamics of global monetary aggregates over time?

c) What are the dynamics of regional monetary aggregates over time?

f) What are the relatively more effective monetary measures of global liquidity?

d) What are the major determinants of global liquidity?

e) What is the nature and magnitude of the spillover effects of global liquidity on developing countries?

1.8 Significance of the Study

The existing theoretical literature proposes a wide range of price- and quantity-based measures[2] of global liquidity, but the empirical literature has utilized only few of them, mostly atheoretcal monetary measures (Belke and Volz, 2019; Belke and Keil, 2016; Beckmann et al., 2014; Belke et al., 2013, 2010a, b). Only one empirical study, Baks and Kramer (1999) exploits theoretical measure, GLDIV, but it does not carry out monetary aggregation over the countries in line with the recommendations of Barnett (2007). This study complements this sort of literature by introducing two theoretical measures[3] of global liquidity constructed on the data of relatively broader sample of countries. Besides, this attempt may also help the monetary authorities in effectively pursuing intermediate targets by utilizing the theoretical monetary aggregates proposed by this study.

Moreover, only few empirical investigations employ two or three monetary measures for the corroboration of their findings (Beckman et al., 2014; Belke et al., 2013; Darius and Radde, 2010; Baks and Kramer, 1999). But there exists a convincing argument in the literature that advocates cross-validation of the findings by using more than one measures of global liquidity (Beckman et al., 2014). This endeavour contributes to the literature by investigating five global liquidity measures and presenting the findings corroborated by them. Hence, it may guide policymakers to take policy actions on the basis of relatively authentic conclusions.

It is much pronounced in the literature that global liquidity is one of the chief drivers of global economic and financial conditions. Its role in the developments of global real economic activity and global consumer goods, commodity and asset prices is well acknowledged (Bose and Chattopadhyay, 2019; Ratti and Vespignani,

[2] Price-based measures include business and mortgage loan rates, long-term government bond yields, and policy and money market interest rates; quantity-based measures include cross-border bank credit, base money, broad money aggregates, central bank assets and foreign exchange reserves.

[3] Currency-equivalent measure and Divisia index

2015; Belke et al. 2014; Beckmann et al., 2014; Darius and Radde, 2010; Baks and Kramer, 1999). Even Alessi and Detken (2011) impute global asset price booms and busts to it. On the other hand, many authors document poor performance of global liquidity in signaling dynamics of global equity prices (Brana et al., 2012; Belke et al., 2010b; Darius and Radde, 2010). This exploration attempts to unveil this enigma, investigating that whether poor performance of global liquidity is due to the use of its inefficient measure. Through this attempt, it may equip the decision-makers with the information that which measures of global liquidity are relatively more trustworthy in different contexts.

Besides, some authors stress on the need of the exploration of the determinants of global liquidity (Avdjiev et al., 2020; Osina, 2019; Cerutti et al., 2017; Bruno and Shin, 2015). Though some endeavours are made in this direction, but they use cross-border capital and credit flows and bank lending as its proxies (Osina, 2019; McCauley et al., 2015; Burger et al., 2015; Cerutti, 2015). Yet the existing literature lacks any rigorous attempt that exploits its widely accredited indicators – monetary measures, in this regard. This effort attempts to bridge this gap. By dint of this toil, it may help the stakeholders to prevent or at least lessen the severity of any economic or financial debacle triggered by irregularities in global liquidity by effectively maneuvering its drivers. Moreover, the policymakers may be able to guess future dynamics of global liquidity on the basis of the behavior of its drivers.

Additionally, a burgeoning empirical literature investigates international spillovers of monetary developments in major advanced economies (Guerello and Tronzano, 2020; Tule et al., 2019; Fratzscher et al., 2017). Likewise, some investigations examine spillover effects of global liquidity on advanced and emerging economies (Inekwe, 2020; Bonizzi et al., 2019; Darius and Radde, 2010; Baks and Kramer, 1999). However, their investigations mainly explore these effects in the context of individual country. Nonetheless, Chandrasekhar (2008) visualizes potential implications of cross-border capital flows to developing countries. But the existing literature lacks rigorous empirical endeavors that probe into the spillover effects of global liquidity on developing economies. This study attempts to contribute in this field too. Further, this endeavour also may provide insight to the authorities in developing countries in devising and executing policy measures in the face of different monetary developments in the advanced economies, in the current state of increasingly integrated world.

Contributions of the Study

The major contributions of the study are as follows.

a) It devises and introduces two new theoretical monetary measures of global liquidity: currency equivalent and Divisia index of monetary aggregation.

b) It evaluates the performance of three atheoretical (utilized in the existing literature) and two theoretical (developed by this study) monetary measures of global liquidity.

c) It explores the short and long run drivers of global liquidity, using its most widely acknowledged and used measures – the monetary measures.

d) It examines spillover effects of global liquidity on developing countries.

e) It utilizes five measures of global liquidity for all analyses.

1.9 Organization of the Study

The study is organized as follows: chapter 2 reviews the existing theoretical as well as empirical literature on the measures and indicators of global liquidity, determinants of global liquidity, international monetary spillovers and the linkages between global liquidity and macroeconomic variables. Chapter 3 expounds the underlying procedures involved in the construction and aggregation of global liquidity measures and other variables, and the methods and econometric techniques employed by the study to achieve the set objectives, and it also describes the data and its sources. Further, chapter 4 examines the dynamics of regional and global monetary aggregates. Chapter 5 evaluates the relative performance of global liquidity measures on the basis of results obtained. Chapter 6 discusses the results obtained from the analyses executed to dig out the short and long run determinants of global liquidity. Chapter 7 sheds light on the findings derived from the analyses carried out to investigate the spillover effects of global liquidity and consequent implications for developing countries. Lastly, chapter 8 presents the conclusions derived and policy recommendations made in light of the findings of the study.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

International economic analyses are bifurcated into real-side international economics and financial-side international economics: this division may also be referred to as dichotomy of interest. Real-side international economic analyses deal with the effects of cross-border transactions on trade patterns, production structures and factor markets of economies. Financial-side international economic analyses investigate the impacts of cross-border transactions on exchange rates, interest rates and financial markets. Typically, these two concerns are independent of each other because it is thought that financial variables have no significantly persistent impact on the real variables. But, it is held that financial variables have profound impact on financial (monetary) variables within and across the borders (Arndt and Richardson, 1987).

In the milieu of current state of globalized world, it is generally perceived that the potency of domestic monetary policy is attenuated by exogenous foreign monetary developments. The reason is that the state of increasing cross-border capital flows can potentially fetch liquidity to the areas where monetary authorities deliberately attempt to dry-up liquidity to achieve certain objectives. Consequently, the endeavors made by domestic monetary authority badly fail unless they are provided with a closed-border environment. Nonetheless, this phenomenon was first envisaged in the Mundell-Fleming framework, by Mundell (1960) and Fleming (1962), a long ago. Altogether, this situation necessitates that the policymakers should make arrangements compatible with global developments in pursuit of imperative goals so that better results can be obtained.

Notably, the global financial crisis (henceforth GFC) prompted the debate over the active use of monetary and other regulatory policies to ward off financial turmoil resulting from assets and commodity price bubbles. In the backdrop of the GFC, there emerges a stance that lays more emphasis on global liquidity than national monetary aggregates owing to the fact that the latter neglect key cross-border dynamics (Beckman et al., 2014). Motivated by this stance, a shift in exploration from national level to international has taken place. Researchers have realized the importance of the issues of global nature, and have strived to address them.

Resultantly, a bourgeoning literature, investigating the developments and dynamics of global variables, emerged. In this field, numerous authors investigate the linkages of variables aggregated at global scale, international monetary spillovers and stability of global financial and economic conditions. For simplicity and maintaining conformity with the analyses of this investigation, the existing literature is reviewed under four subsections: (i) measures of global liquidity (ii) linkages between global liquidity and other macroeconomic and financial variables, and the performance of monetary aggregates (iii) determinants of global liquidity (iv) spillovers of global liquidity.

2.2 Measures of Global Liquidity

The measurement of global liquidity has been and is still a challenging task for researchers. Despite being a focal point of recent research, global liquidity lacks a standard definition and a precise measure. However, a wide array of theoretical measures is suggested for different aspects of global liquidity in the literature. Owing to the fact, the selection of measures depends primarily on the aspect of global liquidity being focused on (the Committee on the Global Financial System (hereafter CGFS), (2011). But researchers have utilized only few of them in empirical explorations. Anyhow, both theoretical as well as empirical branches of the literature are persistently growing in the field of global liquidity.

2.2.1 Measures Suggested in the Theoretical Literature

In a broader sense, global liquidity measures can be classified into two major categories. The first category includes quantity-based measures which generally employ domestic and cross-border bank credit, year-on-year growth rate of international bank claims and credit to GDP ratios as measures of credit aspect of global liquidity. The measures of monetary liquidity include base money and broader money aggregates, central bank assets, foreign exchange reserves and official foreign exchange reserves as percentage of GDP. The indicators for funding liquidity include debt and bank lending (net international debt securities issuance), bond and equity flows and banking sector loan to deposit and non-core liabilities ratios, bank liquidity ratios, maturity mismatch measures and commercial papers (hereafter CP) market volumes. Further, the proxies suggested for global excess liquidity and market liquidity are positive deviations of global credit to GDP ratios from their long-term trend over an extended period (credit-to-GDP gaps) and transaction volumes, respectively (Howell, 2020; CGFS, 2011; Domanski et al., 2011; Landau, 2011).

The second category is the price-based measures which include policy and money market interest rates and monetary conditions indices as indicators of monetary liquidity. The funding liquidity can be proxied by major policy rates including interbank money, wholesale funding markets and long-term capital markets rates. The business and mortgage loan rates represent the financial conditions faced by borrowers; and long-term government bond yields and money market rates depict the liquidity and funding conditions of banks. Further, volatility of stock market is, sometimes, used as a proxy for investor risk appetite and willingness to provide funding. In addition, the indicators for short-term and cross-currency funding conditions are bank credit default swap[4] (hereafter CDS) premia (five-year), Libor-OIS spread[5] (three-month) and cross-currency basis swaps (versus US dollar and euro). The indicators for risk appetite and market positioning include VIX[6] and MOVE indices[7], net inflows into hedge funds, carry-to-risk ratios and Commodity Futures Trading Commission (hereafter CFTC) non-commercial net position (Howell, 2020; McGuire and Sushko, 2015; Miranda-Agrippino and Rey, 2012; Domanski et al., 2011; Landau, 2011).

In addition to the above, the CGFS (2011), in its attempt to elaborate the notion of global liquidity, distinguishes between two major constituents of global

[4] CDS is a financial swap agreement which requires the seller of CDS to compensate its buyer in case of loan default or any other undesirable event.
[5] Libor-OIS spread refers to the difference between two interest rates, London Interbank Offered Rate (LIBOR) and the Overnight Indexed Swap (OIS) rate.
[6] VIX is the ticker symbol for theCBOE Volatility Index and is a measure of the implied volatility of S&P 500 index options. It is calculated by Chicago Board Options Exchange (CBOE).
[7] MOVE index is the Merrill Lynch Options Volatility Estimate (MOVE) index. It is the weighted (yield curve weighted) index of normalized implied volatility of one-month Treasury options.

liquidity - official and private liquidity. The official liquidity refers to the unconditionally available funding which monetary authorities use to settle their claims. It can mainly be accessed through volume of foreign exchange reserves, central banks' swap lines, IMF programmes and SDRs. Since the use of SDRs is, to some extent, subject to the discretion of central banks and can be utilized only in a limited quantity, SDRs and IMF arrangements cannot function as a tool for the creation of official liquidity but can only serve as a vehicle to mobilize it. Thus, mere central banks can generate official liquidity through their regular operations and as an emergency liquidity support during the periods of stress (Landau, 2013; CGFS, 2011).

On the other hand, in the face of currently prevailing situation characterized by increased international capital mobility and integrated global financial centres, private liquidity has become a vital component of global liquidity. Private liquidity is largely created through cross-border operations of banks and other financial intermediaries. Financial institutions fetch market liquidity to securities markets through market-making activities and funding liquidity through interbank lending. Hence, private liquidity is closely associated with funding conditions and monetary liquidity, and is better reflected in monetary and credit aggregates. Further, global private liquidity cannot accurately be reckoned by just taking into account the constituents of domestic liquidity. In this context, international component potentially matters by deeply influencing macroeconomic and market outcomes of recipient countries. Hence, both the concepts, though are fundamentally different, yet have one common aspect - the ease of financing (Landau, 2013; CGFS, 2011).

2.2.2 Measures Employed in the Empirical Literature

The empirical literature also exploits a variety of global liquidity measures due to the fact that the choice of the measures fundamentally depends upon the nature of analyses. However, there exists a viewpoint that global liquidity can better be appraised through the combinations of both price and quantity indicators. Price indicators subtly reflect the conditions of the provision of liquidity while quantity measures capture the extent to which these conditions contribute to the build-up of global risk (Domanski et al., 2011 and Landau, 2011). But a very few empirical studies have utilized price or combinations of both quantity and price measures.

In this line, some authors make use of the price measure of the monetary conditions of advanced economies (Choi and Lee, 2010; Kim, 2001). Bonizzi et al. (2019) use prices measures of global liquidity to investigate its implications for Sub-Saharan Africa. Chen et al. (2012) retrieve supply and demand shocks from quantity and price measures of global liquidity and then assess their impacts on receiving countries GDP growth. Kang et al., (2016a) also follow the same approach to devise price measures. In the same fashion, another study employs factor model to construct a measure of global liquidity based on common factors of its quantity- and price-based indicators which include monetary aggregates, domestic and cross-border credit aggregates, retail lending rates, government bond yields, money market rates and stock market volatility (Eickmeier et al., 2014).

In addition to the above viewpoint, there emerges another stance that global liquidity can effectively be assessed through credit aggregates (CGFS, 2011) and that cross-border bank loans and bond flows are the major components of global liquidity. Contributing to this aspect of the field, a strand of recent empirical literature utilizes credit aggregates and cross-border loans as indicators of global liquidity (Osina, 2020, 2019). Further, Chung et al. (2014) exploit credit aggregates – the counterparts of monetary aggregates - of a broader set of developed and emerging economies as a measure of global liquidity.

Besides, Avdjiev et al. (2020) use components of global liquidity as its measures. They use cross border bank and non-bank loans, flows of international debt securities reported by the Bank for International Settlements (henceforth BIS) over the period of 2000Q1 to 2015Q4. Bruno and Shin (2014) utilize aggregate cross-border banks' credit. They exploit panel data for 46 developed and emerging economies. Osina (2019) uses cross-border bank flows for 149 sampled countries over the period 2000 to 2016. However, Cesa-Bianchi et al. (2015) utilizes cross-border bank-to-bank lending deflated by CPI of the US as a measure of global liquidity, using data for the period of 1990 to 2012. Furthermore, Chandrasekhar (2008) uses international exposure of the banks of BIS reporting countries. However, Fornari and Levy (2000) use changes in international or external exposure of banks of reporting countries as an indicator of the trends in global liquidity.

But after the GFC, a shift in cross-border credit (form cross-border bank loans to cross-border debt securities) has been witnessed. This shift in cross-border loans along with dollarization (dominance of the US dollar credit) of international debt securities is known as the "second phase" of global liquidity in the literature (Shin, 2014). Consequently, international debt securities have appeared as an additional measure of global liquidity. Some authors, such as Aldasoro and Ehlers (2018) and Avdjiev et al. (2020), use them as a measure of global liquidity for their analyses. Furthermore, the BIS has also incorporated them in the list of the indicators of global liquidity and provides insight about global liquidity conditions by analyzing their dynamics. Nonetheless, this section of literature that exploits cross-border bank loans or capital flows as measures of global liquidity mostly explore the determinants of global liquidity.

The use of international capital, debt securities or bank flows as measures of global liquidity has many pitfalls. First, these flows can be components of global liquidity or its drivers but not global liquidity itself (Avdjiev et al., 2020). Second, the flows can depict the shift of liquidity from one financial center to another but cannot reflect the quantity of global liquidity. Anyhow, it is argued that the ability of financial and non-financial institutions to advance credit is further determined by the availability of monetary services in the market. Thus, credit can also be proxied by monetary assets (Chung et al., 2014).

However, the largest portion of empirical literature has utilized monetary measures of global liquidity. The oldest and traditional monetary aggregates have been constructed by simple-sum aggregation. This procedure of construction involves sum of monetary aggregates, especially broad money (M_2, M_3 or whichever is available for each economy) (Beckmann et al., 2014; Belke et al., 2013; Sousa and Zaghini, 2007 and Baks and Kramer, 1999). Further, a number of empirical investigations employ simple sum of monetary aggregates of major economies, converted into a common currency, as an indicator of global liquidity. The pioneer work in this direction and on the global liquidity is attributed to Baks and Kramer (1999). In this perspective, they construct two measures of global liquidity through simple-sum method: narrow and broad money aggregates. For the purpose they use quarterly data for the period of 1971Q4 to 1998Q4 on narrow and broad money, converted into US dollar through respective countries exchange rate, for G7 countries.

In the same vein, some authors construct aggregates of global liquidity by exploiting the data of developed and emerging economies. For instance, Sousa and Zaghini (2007) construct global monetary aggregate through simple-sum technique by using broad money data for G5 countries: Canada, the Euro Area, Japan, the UK and the US. Likewise, Ratti and Vespignani (2015) also use simple-sum method to construct global liquidity, using monthly data ranging from 1999M1 to 2012M12 for G3 (Japan, EU and the US) and BRIC[8] countries. Here, EU includes the Euro Area and the UK. They construct separate measures of global liquidity for G3 and BRIC countries. Additionally, Sousa and Zaghini (2008) use simple-sum of monetary aggregates of reference countries converted into common currency on the basis of euro-based purchasing power parity (henceforth PPP).

Another chunk of empirical literature uses sum of monetary assets across the world as an indicator of global liquidity. A group of this sort of studies exploits sum of base money of the US and the world foreign exchange reserves (Belke et al., 2013; Darius and Radde, 2010). In addition to this, Belke et al. (2013) also use just total foreign exchange reserves of the world excluding gold. Besides, Belke et al. (2014) utilize the ratio of total nominal money of the world to the world's nominal GDP as a proxy of global liquidity. However, Brana et al. (2012) use it as a measure of global excess liquidity. But Berger and Harjes (2009) proxy global excess liquidity by excess liquidity of the US and Japan individually. They define excess liquidity as the level of M_2 that exceeds demand for money - adjusted to developments in long-term interest rate and output.

The procedure of simple sum aggregation simply involves the addition of dollar values (converted into a single currency) of all financial assets intended to be included in monetary aggregates. Hence, this technique assigns equal weights to all financial assets regardless of their varying degrees of "moneyness". It is based on a strong assumption that all components of monetary aggregates are perfect substitutes (Barnett and Su, 2017; Darvas, 2015; Alkhareif and Barnett, 2012; Barnett, 2003, 1980). It gains theoretical support from the notion of classical economists that the essential function of money is to serve as a medium of exchange – to facilitate transactions only. To the classical economists, anything which might function as a medium of exchange is money. Thus, based on this definition of money, monetary aggregates comprise of only two components: currency and demand deposits (Barnett, 1984).

[8] Group of countries that includes Brazil, Russia, India and China.

Researchers have further underlined the limitations of simple-sum method of monetary aggregation and advocate the use of GDP-weighted growth rates index. They establish the superiority of GDP-weighted index on the following grounds. First, GDP-weighted index offsets the dollar-bias to great extent as in simple-sum measures monetary aggregates of different countries are converted into common currency through their respective currency exchange rate while it is not required in GDP-weighted growth rates index. Second, since the definitions of monetary aggregates vary across countries, simple-sum measure over-represents (under-represents) the monetary aggregates of the country with broader (narrower) definition of monetary aggregates in global aggregate. However, GDP-weighted growth rates measure reduces this bias by taking into account the growth rates of country-specific monetary aggregates instead of considering their levels (Belke et al., 2014, 2013).

Therefore, a substantial portion of empirical literature constructs indicators of global liquidity through weighted growth rates of monetary aggregates. The case in point is D'Agostino and Surico (2009), who use simple mean of the growth rates of G7 broad money as a measure of global liquidity. Another strand of literature utilizes GDP-weighted sum of monetary aggregates as a measure of global liquidity. For instance, Kang et al. (2016a) use GDP-weighted sum of monetary aggregates for the US, Eurozone and Japan. Analogously, Baks and Kramer (1999) utilize weighted sum of growth rates of monetary aggregates for G_7 countries.

Some other studies, following the groundbreaking work of Beyer et al. (2001), construct and utilize a monetary index of global liquidity by assigning weights to the growth rates of a country' monetary aggregate (like, M2, M3). The weights are assigned equal to the GDP share of respective country in the group of sampled countries (Belke and Volz, 2019; Belke and Keil, 2016; Belke et al., 2010a, b; Giese and Tuxen, 2007). These studies employ different samples of countries. For example, Giese and Tuxen (2007) construct the measure using quarterly data over the period 1982Q4-2006Q4 on broad money for six industrialized countries – France, Germany, Italy, Japan, the UK and the US. Belke et al. (2010a, b) use the data for 11 high income countries: Australia, Canada, Denmark, the Euro Area, South Korea, Japan, Norway, Sweden, Switzerland, the UK and the US. However, Beckman et al. (2014) utilize the data for OECD countries for this purpose.

Another strand of literature utilizes Principal Component Analysis (henceforth PCA) or factor analysis (henceforth FA) technique for monetary aggregation across the countries. For an illustration, Choi et al. (2017) utilize FA approach to construct the measure, using financial data for G_5 countries – France, Germany, Japan, the UK and the US. They use nine financial variables of advanced economies to derive global liquidity through PCA. They further distinguish three momenta of global liquidity: policy-driven, market-driven liquidity and risk averseness. Beckmann et al. (2014) distinguish between idiosyncratic and common factors of countries and use common components of monetary aggregates of individual countries, following the procedure suggested by Bai and Ng (2004), and utilize the data for the OECD countries.

On the other hand, there exists evidence of the use of various transformations of monetary and financial variables as indicators of global liquidity. In this direction, Bierut (2013) uses two measures of global liquidity: traditional measure founded on G5 data and broad measure constructed on the data of 26 countries or currency areas. The author further exploits different transformations of financial variables representing both quantity and price measures. Transformations of quantity measures include their annual growth rates, excess of their growth rates to nominal GDP growth rates, deviations of their ratios to GDP to their trends, deviations of their levels from their trends, deviations of their annual growth rates from their trends, and deviations of excess of their growth rates from their trends. Transformations of price measures include levels of short-term and long-term interest rates, excess of interest rates to annual nominal GDP growth rates, deviations of their levels from their trends, deviations of their excess from their trends, their term spreads and deviations of their term spreads from their trends.

But the GDP-weighted measures and different transformations of monetary aggregates, like summation measures, lack a theoretical foundation. They do not assign weights to monetary assets on the basis of their moneyness, rather they assign weights in accordance with the level of economic activity (GDP) of the country concerned. Hence, the indices constructed through the procedures not supported by monetary theory fail to measure liquidness of assets accurately. These indices ignore the importance of liquidness of components of monetary aggregates by allocating equal weights to all of them, while aggregation is carried out within a country. They, like simple sum methods, consider the components of monetary aggregates as perfect substitutes of one another. Further, any weighting scheme, without theory, is questionable (Serletis and Molik, 2000).

In view of the aforementioned limitations of simple sum, GDP-weighted and other atheoretical aggregation procedures, researchers have attempted to measure moneyness of assets to somewhat better degree. In this direction, Barnett (1980) and Rotemberg et al. (1995) have made valuable contributions by introducing the indices having theoretical foundations, Divisia and currency equivalent procedures (henceforth CE) of monetary aggregation, respectively. Both the procedures assign weights to monetary assets according to their characteristic of moneyness. However, Divisia and CE measures differ from each other to a considerable extent. Divisia index functions as a flow measure while CE index as a stock measure (Huang and Xia, 2015).

After the seminal work of Barnett (1980), researchers devoted their efforts to the construction and investigation of the properties of Divisia monetary aggregates. The Centre for Financial Stability (henceforth CFS)[9] maintains a directory of the studies that construct Divisia monetary indices for different countries. Though, the exploration of most of the studies covers only single country (Schunk, 2001; Drake et al., 2000; Thornton and Yue, 1992; Barnett et al., 1984). However, some studies endeavour to construct Divisia monetary aggregation across the countries, but they have only been conducted on the Euro Area (Barnett and Gaekwad, 2018; Darvas, 2015; Binner et al., 2009; Stracca, 2004 and Barnett, 2003). Another study of this sort is conducted only on the member countries of the Gulf Cooperation Council (Alkhareif and Barnett, 2012).

Moreover, most of the investigations reveal that the Divisia monetary index outperforms other atheoretical monetary measures in forecasting real activities and inflation, and also on the basis of some other criteria (Hashmi and Bhatti, 2019; Darvas, 2015; Alkhareif and Barnett, 2012; Schunk, 2001; Barnett et al., 1984). Further, Hjertstrand et al. (2018) investigate superlative, non-superlative and atheoretical indexes to identify which measures better fit the data and contain the information and properties of weak separability as obtained from revealed preference tests. Relying on the results of various tests executed, they conclude that superlative

[9] The CFS is a think tank focused on financial markets, located in New York, America.

indexes perform far better than other indexes. Additionally, the atheoretical measures present the poorest performance.

But Huang and Xia (2015) argue that the CE measure surpasses Divisa and simple-sum monetary aggregates on the theoretical as well as empirical footings. They compare theoretical foundations and gauge the performances of both Divisia and CE monetary aggregates of the US and China through cointegration analysis in the setting of demand for money equation. Moreover, they contend that the CE measure allows over time change in the liquidity of monetary assets what the Divisia index does not. The CE measure has no theoretical error but the Divsia index is not free of theoretical errors. The CE measure has no measurement error because it involves absolute weighted average aggregation procedure, while Divisia index is the approximate of the weighted growth rates, hence is likely to involve measurement errors. However, the investigation of the studies, using CE technique, also covers single country (Huang and Xia, 2015; Serletis and Molik, 2000).

2.3 Global Liquidity and Other Economic Variables

The interrelationships of global liquidity and macroeconomic variables have remained an area of interest for researchers even before the GFC of 2007-2008. However, this era could not draw a great deal of researchers' attention to this subject matter: only few investigative attempts were made in this field before 2007. But the GFC infused a new thrust in the exploratory attempts when a shift in the viewpoint took place, which envisaged that global developments attenuate the impact of domestic policy measures. This standpoint ascribed an important role to global liquidity in real and financial developments over the world. Consequently, experts have delved into association of global liquidity with global macroeconomic and financial variables and ability of different monetary aggregates to accurately signal developments in macroeconomic and financial variables.

2.3.1Global Liquidity, Macroeconomic and Financial Variables

The GFC prompted the debate over the active use of monetary and other regulatory policies to stave off financial turmoil resulting from assets and commodity price bubbles. In the backdrop of the GFC, there emerges a stance that lays more emphasis on global liquidity than national monetary aggregates owing to the fact that the latter neglect key cross-border dynamics. However, the role of global liquidity in the volatility of commodity prices and the build-up of speculative pressure remains controversial (Beckmann et al., 2014). To unfold the enigmas pertaining to economic recessions and financial turmoil caused by asset and commodity price booms and busts, researchers and policymakers have endeavoured to discover the true association of asset prices and global liquidity. A number of studies attempt to investigate this association (Bose and Chattopadhyay, 2019; Kang et al., 2016a; Brana and Prat, 2016; Beckmann et al., 2014; Belke et al., 2010a, b).

Additionally, it is also held that the substantial amount of capital flows driven by global excess liquidity to emerging countries poses a serious challenge for their financial stability. The explorations about this kind of effects of global liquidity point out that global liquidity creates serious implications for financial stability by impacting investors' risk appetite and amplifying volatility in cross-border capital flows (Belke and Volz, 2019; European Central Bank, 2011). Moreover, the high volatility in cross-border capital flows, particularly in portfolio investments flows, raises concerns about sudden-stop episode and capital outflows which are likely to threaten financial stability in a number of ways. For example, capital inflows cast upward pressure on asset and real estate prices, and appreciate real exchange rate up to undesired level, causing loss in capital gains. The capital inflows involving low funding costs provide an opportunity to both financial and non-financial sectors to increase their debt leverage which often leads to balance sheet mismatches (Forbes and Warnock, 2012; Kokeyne et al., 2010).

Moreover, the role of global liquidity in achieving and maintaining financial stability has been a question of debate. Researchers have made its profound analyses but failed to develop consensus. For an illustration, Borio (2008) argues that abundance of global liquidity has been a key factor in the buildup of financial imbalances prior to global financial crisis. Likewise, Goldstein (1998) considers prior loose conditions of global liquidity as one of the chief causes of the Asian financial crisis. Contrary to this standpoint, Mayordomo et al. (2014) maintain that the financial crisis of 2007-2012 was caused by serious liquidity shortages in financial markets. It might be due this reason that some researchers point out that there happened to be a "liquidity paradox" as there was a shortage of liquidity at financial centers even in the time of excess of global liquidity during the GFC (Chandrasekhar and Ghosh, 2009).

Furthermore, many countries have experienced booms in their asset and real estate markets since 2001. Some researchers attribute these sequences of soaring asset prices to spillover effects of liquidity on certain asset markets (Belke and Volz, 2019; Adalid and Detken, 2007; Greiber and Setzer, 2007). Lending support to this stand, Taylor (2007) argues that lax US monetary policy has resulted in asset market boom by lowering real interest rate artificially. Relying on this view, Bianchi et al. (2016) extend the investigation further by incorporating news about global liquidity regime and future income into Fisherian model of financial crisis and macro-prudential policy. The calibrated results based on the data of Argentina show that good news and low interest rate lead to credit boom which in turn results in financial crisis, if the good shocks are not perceived and there is a sudden change in global liquidity regime. However, agents save less with the increase in the precision of good news which is most likely to cause, though less frequent but very severe, financial crises.

On the other hand, during the last decade a number of studies limelight the importance of variables aggregated at global level for investigations and explorations due to multiple reasons. First, in today's state of interlinked financial markets, a shift in money supply of one country can be absorbed by the demand of any other country; however, simultaneous shifts in major economies are most likely to affect global asset and good prices (Giese and Tuxen, 2007). Second, it is also argued that modeling of inflation at global level is more adequate than that of national level in investigating the fact whether and to what extent global factors are responsible for the developments in global liquidity (Borio and Filardo, 2007). Lending empirical support to this viewpoint, Ciccarelli and Mojon (2010) argue that national inflation has a tendency to adjust to global inflation level as any deviation of national inflation from global inflation level disappears or is corrected over time. Thus, the explorations and investigations on global liquidity and global inflation suggest that it is more important to investigate these issues at global level than at national level when monetary transmission mechanism is aimed to be examined (Belke et al., 2010a, b).

Motivated by the preceding standpoint, a strand of empirical literature explores the nexus among global liquidity and global macroeconomic variables. Global liquidity casts favourable impact on economic activities, production and real GDP (Belke and Keil, 2016; Brana et al., 2012; Sousa and Zaghini, 2007). However, Rüffer and Stracca (2006) too document same findings in case of Euro zone and Japan but they present no evidence of these effects in the case of the US.

Further, a substantial portion of literature investigates the linkage of global liquidity and assets prices. In this direction the pioneer attempt was made by Baks and Kramer (1999) which, relying on contemporaneous correlation analysis, reported positive correlation of global liquidity with stock returns and negative with interest rates. Further, they also observe that volatility of money growth in the US and Japan affects volatility of asset returns in G7 countries. Adding to this sort of literature, several investigators attempt to probe into the nexus of global liquidity and equity prices through some sophisticated econometric techniques. However, they find asset and stock prices nonresponsive (or very weak response) to global liquidity shocks (Brana et al., 2012; Dreger and Wolters, 2011; Belke et al., 2010b; Darius and Radde, 2010; Giese and Tuxen, 2007). Furthermore, Belke et al. (2010b) attribute the non-responsiveness of asset prices to the global liquidity shocks to the dominance of substitution effect prevailing among this asset class.

In the like manner, a number of explorations investigate the impact of global liquidity on consumer goods prices. They are of the view that global liquidity leads to surge in consumer price index (inflation) (Belke et al., 2010a; Adalid and Detken, 2007). But Roffia and Zaghini (2007) argue that monetary growth causes inflation only if monetary growth is synchronized with asset price inflation. However, a group of authors document significant impact of global liquidity on inflation (Brana et al., 2012; Belke et al., 2010a; Sousa and Zaghini, 2007). Nonetheless, Sousa and Zaghini (2007) further identify its positive impact on aggregate prices with lag. Supporting the same stance, D'Agostino and Surico (2009) argue that global liquidity has a substantial power to predict the US inflation rates. Additionally, global liquidity has positive effect on broad money and gold prices (Belke et al., 2010b; Rüffer and Stracca, 2006) but it has negative effect on real interest rate (Türkay, 2018; Sousa and Zaghini, 2007).

Another section of literature examines and distinguishes the effect of global liquidity on goods and commodity prices. Commodity prices adjust more quickly than the prices of consumer goods to money supply shocks. Prices of consumer goods adjust in the long run while commodity prices play a key role in clearing markets in the short run (Beckmann et al., 2014; Belke et al., 2010a; Browne and Cronin, 2010; Frankel, 1986). Moreover, Beckmann et al. (2014) further argue that the long run relationship between global liquidity and commodity prices exists only if monetary policy is modeled in terms of common factors, but it may not in case of the use of its indicator constructed through aggregation of individual time series. Further, global liquidity is the key determinant of the long-run homogeneity of commodity and goods price movements (Ratti and Vespignani, 2015; Belke et al. 2014, 2013, 2010a). Nonetheless, liquidity granger causes commodity prices (Ratti and Vespignani, 2015).

Additionally, another empirical endeavour decomposes the commodity prices into narrower groups to examine the impact of global liquidity. The case in point in this line is Belke et al. (2013). They document the existence of well-established positive long-term relationship between global liquidity and food prices. Further, food prices significantly adjust to the cointegrated relationship in cointegrated vector autoregression (henceforth CVAR) framework. However, the global liquidity itself does not adjust, but it drives the adjustment process. They further argue that global commodity and food price inflation is primarily driven by monetary expansions, especially in advanced economies. Nevertheless, their results support the stance of "financialization of commodities".

Complementing the ongoing literature, Belke et al. (2014) investigate the linkages between global liquidity, global interest rate and global consumer goods and commodity prices through CVAR model. They use two commodity indices: the Commodity Research Bureau (henceforth CRB) price index and the CRB raw industrial index to examine the interactions among goods and commodity prices, interest rate and money aggregated at a global scale. They find positive relationship between global interest rate and global inflation supporting Taylor-rule-type conjecture, but negative relationship between global interest rate and global commodity price as noted by Frankel and Hardouvelis (1985). However, interest rate does not adjust in the long-run to account for global output growth and inflation rate.

Furthermore, the nexus between global liquidity and house prices is also well documented in the literature. Subscribing to this sort of matter, Cesa-Bianchi et al. (2015) explores the linkages of global liquidity and house prices and other macroeconomic variables using panel VAR approach. The findings of the study reflect that house prices are more volatile and associated to capital flows in emerging economies than that in advanced economies. Moreover, consumption and house prices in emerging market economies (hereafter EMEs) respond more than that in advanced economies to positive shock of global liquidity. Similarly, Belke et al. (2010b) also document leading role of global liquidity in the development of house prices. They further document the existence of house price spillover effects on goods price inflation. Nonetheless, some other empirical explorations also ascertain significant impact of global liquidity on house prices (Darius and Radde, 2010; Giese and Tuxen, 2007).

Although majority of the studies employ linear models to explore the nexus among global liquidity and global macroeconomic aggregates but Beckmann et al. (2014) argue that the models based on linear adjustment may not be able to take into account some important features of global monetary transmission. So, some researchers have attempted to investigate the dynamics of the nexus. To this end, Beckmann et al. (2014) utilize Markov-switching vector error correction model and reveal that the relationship between global liquidity and prices is regime-dependent which implies that the impact of global liquidity measure on prices is time-dependent. In the same fashion, Brana and Prat (2016) confirm that nonlinear relationship between global excess liquidity and equity prices exists for the 11 emerging economies of Latin America.

There is a newly emerging trend in literature that examines the relationships among liquidity, financial integration and macroeconomic variables on global scale. The prior literature reveals that the researchers have attempted to explore the nexus among global macroeconomic aggregates and global liquidity or global financial integration. They incorporate global liquidity and global financial integration in their investigation models separately. Hence, the literature that investigates these two aggregates together in one model is very scarce, rather Belke and Keil (2016) claims to be the first study of this kind that uses these two variables together. Anyhow, they explore linear relationships among global financial integration, global liquidity and global macroeconomic variables in a unified framework, using CVAR model for major industrialized countries.

As far as econometric tools are concerned, the literature aimed to explore the relationships among global liquidity and the variables aggregated on global scale has utilized a variety of econometric techniques and models. Many studies that examine linear relationships among the variables employ CVAR model (Belke et al., 2014, 2010a; Giese and Tuxen, 2007), global vector autoregression (hereafter GVAR) model (Belke et al., 2013; Giese and Tuxen, 2008). Moreover, the studies that have attempted to explore regime-switching nature of the relationships apply Markov-switching vector error correction model (Beckmann et al., 2014). Furthermore, the explorations which attempt to assess non-linear relationships utilize panel threshold model (Brana and Prat, 2016).

2.3.2 Performance of Monetary Aggregates

The evidence presented in the literature that global liquidity plays critical role in the developments and deeply influences global financial and economic conditions, coupled with the realization that bursting bubbles entail financial distress which ultimately retards real economic activity and growth process (Dreger and Wolters, 2011; Helbling and Terrones, 2003), has altogether provided a potential insight for further explorations. Consequently, a sizable portion of literature examines the ability of global liquidity to forecast global real and nominal economic activities, particularly developments in asset and commodity prices. Further, in this field many authors strive to compare the efficacy of different indicators of global liquidity and financial conditions. The work in this area can offer guidance in the selection and execution of preemptive measures to prevent assets and commodity price booms and busts that ultimately lead to financial and economic distress.

Contributing to this sort of literature, Alessi and Detken (2011) utilize broad money and credit (ratio of nominal money or credit to GDP) measures of global liquidity, using data over the period of 1970 to 2007 for 18 OECD countries. They endeavour to discover good indicators of high cost assets booms and busts. For the purpose, they compare the performance through signalling approach, using loss functions to rank the indicators. For the purpose, they use five real and 13 financial variables with up to their six transformations. They find that global liquidity outperforms all other indicators in accurately signalling the booms in asset prices.

Similarly, Ratti and Vespignani (2015) appraise the efficiency of global liquidity measures constructed over the data ranging from 1999M1 to 2012M12 for G3 and BRIC countries separately. They strive to disentangle the influence of liquidity of major developed and major developing economies on global and disaggregated commodity prices through structural factor-augmented vector error correction (henceforth FAVECM) technique. They find that a positive innovation in BRIC liquidity has greater impact than that of G3. The positive shock in BRIC liquidity is linked with increased global industrial production and tightening global monetary policy as indicated by increased policy rate. But the impact of G3 liquidity remains insignificant.

Additionally, Darius and Radde (2010) assess the performance of different measures of global liquidity by evaluating their role in assets and commodity price developments over the time: during the period of Great Moderation (early 1980s to early 2000s) and the total sampled period (1971Q1 to 2009Q3) including the GFC period. To this end, they employ impulse response functions and variance decomposition techniques. They document time-varying nature of the impact of global liquidity: very fragile impact during the period of Great Moderation, and the inclusion of the GFC period (2008-09) results in the complete loss of predictive power of global liquidity. They further maintain that during the GFC period global liquidity and asset prices moved in opposite direction. Likewise, Kang et al. (2016a) evaluate the relative performance of quantity- and price-based measures of global liquidity on the basis of their power to explain the dynamics of global commodity price.

On the other hand, several authors evaluate the performance of different monetary aggregates of a country on different criteria. For example, Schunk (2001) discerns the ability of simple-sum and Divisia monetary aggregates of the US in out-of-sample forecasting real GDP and GDP deflator through VAR approach. The findings of the study assert that Divisia monetary aggregate outperforms the simple-sum monetary aggregate in out of sample forecasting real GDP and GDP deflator on the basis of root mean square error and mean absolute error, and also through visual inspection. Moreover, narrow money aggregate (M1) performs relatively better than broad money aggregate in predicting GDP deflator. Additionally, Belongia and Ireland (2017) examine the effectiveness of monetary policy rules to meet long run targets through correlations between cyclical components of GDP and price level and lags of cyclical components of different monetary aggregates and other monetary policy indicators.

Overall, it is evident from the existing literature that global liquidity has sturdy association with macroeconomic and financial variables, particularly with global real economic activity and global goods, commodity and asset prices. Moreover, it has power to signal future developments in real economic activity and asset prices.

Hence, gaining insight from this and from Schunk (2001) and Belongia and Ireland (2017), it is justified that the performance of different monetary measures of global liquidity can better be appraised by following two ways: first, gauging their abilities to forecast global real economic activity and global goods, commodity and asset prices. Second, the strength of correlations of the cyclical components of global real economic activity and global consumer goods, commodity and asset prices with lags of the cyclical components of the global liquidity measures can potentially indicate the performance of the monetary measures of global liquidity.

2.4 Determinants of Global Liquidity

Despite the fact that global liquidity has been focal point of recent research, the empirical literature on its determinants is very scarce. However, theoretical literature underpins and elaborates the interactions of its drivers to some extent. This sort of literature also provides theoretical foundations for the linkages and channels through which macroeconomic and other variables can potentially determine global liquidity conditions. But there are very few attempts which explore its determinants empirically. Further, the empirical investigations in this direction have merely used cross-border capital and bank flows as its measures. Thus, this section proceeds as follows: its first subsection delves into theoretical literature and the second subsection presents overview of empirical literature on the determinants of global liquidity.

2.4.1 Theoretical Literature

The eminent endeavours that theoretically encompass the drivers of global liquidity and their interaction have been made in this decade after the eruption of the GFC. The chief contributors to this field of the area include Cohen et al. (2017) and the CGFS (2011). They classify the determinants of global liquidity into three major categories: macroeconomic, other public sector polices, and financial factors. Macroeconomic factors impact global liquidity through return expectations, funding costs and market participants' risk perception. On the same grounds, macroeconomic factors along with some other private sector factors can influence global liquidity from both demand and supply sides.

In the same vein, monetary policy stance sets domestic short-term interest rate which, in turn, affects risk free (nominal) yield curve by changing expectations about future policy rates. This risk free rate serves as a benchmark on which interbank rates and returns on other financial assets are determined. Further, the risk premia added to the returns on financial assets reflect counterparty risk, risk appetite and market-specific liquidity conditions. On the other side, level of interest rate potentially affects private credit, and funding and liquidity conditions on the whole. Low level of interest rate leads to a surge in global liquidity through increased private credit and also through stimulating search for yield behavior, incentivizing carry trades and cross-currency investment. Simultaneously, monetary policy stance is adjusted in accordance with real activity growth and inflation which further substantially influence risk-taking behavior.

Apart from the above, other public sector policies mainly include central bank liquidity policy and financial regulations. Central bank's collateral policy deeply influences liquidity and its allocation. For instance, if central bank stops accepting the assets as collateral, which it has been accepting before, this act will lead to a substantial reduction of credit to that particular sector. Contrary to this, it is maintained that extraordinary domestic liquidity facilities have mitigated the effects of the GFC when global capital market became almost illiquid. Apart from this, financial regulations affect global liquidity through influencing the movements of capital flows. For an illustration, banks and other financial intermediaries deploy their funds internationally through portfolio allocation decisions that seek out most profitable use of funds. Thus, differences in regulations across markets and jurisdictions can significantly impact global liquidity conditions.

Additionally, financial factors incorporate financial integration, financial innovation and risk appetite. Financial integration stimulates cross-border capital flows by providing access to new financial products. That is why financial integration has strong bearings on global liquidity due to the fact that it can potentially promote capital flows and amplify monetary spillover effects. Moreover, financial innovations often lead to sophisticated modes of payments and cause expansions in market or funding liquidity. Liquidity promoting effects of financial innovations work through various channels. First, liquidity increases via the process of securitization which involves transformation of illiquid assets into relatively more liquid ones. Second, the widespread use of the instruments of collateralized funding also enhances liquidity. For example, repo contracts are viewed as a prospect source of liquidity creation. Third, the financial derivatives, particularly the standardized ones, can also affect market liquidity.

On the other hand, market participants' willingness to provide liquidity depends primarily on their risk-taking behavior and the way they perceive and assess risk. The well known characteristic of risk appetite is its cyclical nature. Owing to this reason, sudden variations in risk appetite and liquidity preferences are likely to amplify liquidity cycles and build up liquidity surges and shortages. Periods of intensified risk appetite are, more generally, associated with swelling balance sheets and rising leverage, especially in banking sector. For example, a market participant confronting the situation of vanishing risk appetite, increased counterparty risk and drying-up market liquidity struggles to reduce leverage. Hence, shortages of liquidity have tendency to correlate with surges in the volatility of financial market. However, in general, banks and other agents add to global liquidity in good times and cut it down in bad times.

Nonetheless, it is observed that private liquidity quantitatively dominates official liquidity. Further, private liquidity portrays increasing tendency and cyclical components. The increasing trend in private component of global liquidity is due to financial innovations and rising global financial integration. But the cyclical nature of private constituent of global liquidity can be ascribed to divergence in the growth rates, monetary policy stances and risk appetites across the countries. Hence, for the financial stability perspective understanding and examining the determinants of private liquidity are of more importance. Moreover, the destruction and creation of private component of global liquidity is closely associated to deleveraging and leveraging by private financial institutions. Consequently, global private liquidity is strongly linked to cross-border bank flows. This international component of global liquidity can be a powerful source of global financial instability because of its strong ability to amplify cyclicality of domestic financial conditions and to intensify domestic imbalances.

Adding to the same kind of theoretical literature, Chandrasekhar (2008) identifies the determinants of global liquidity inspecting the developments in variables over the time, without relying on any rigorous econometric technique. The investigation uses international banks exposure of the BIS reporting countries as a measure of global liquidity. The author is of the view that a sudden build-up of global liquidity can be attributed to sudden accumulation of foreign exchange with a very few firms and countries due to rise in oil prices. Further, the contemporary global system inherits long term rising tendency in global liquidity. Additionally, low income people subscribe to the funds in saving centers to insure their future, financial firms borrow these funds at very low cost along with the aim to invest in assets with high risk and high return. This altogether leads to expansion of global liquidity. Furthermore, recent surges in global liquidity can be imputed to the expansionary monetary policies pursued by the central banks of advanced economies.

2.4.2 Empirical literature

The empirical literature, with its focus on the exploration of the determinants of global liquidity, mainly employs the elements of global liquidity like cross-border capital flows, bank loans and debt instruments flows as its indicators. Moreover, the studies that examine the determinants of these components of global liquidity, considering their origin and destination, classify their drivers into two major categories: "pull" (domestic) and "push" (global) factors. In this regards, Calvo et al. (1993) is considered to be among the pioneer works that distinguish between push and pull factors of capital flows and limelight the importance of common global (push) factors. Further, the pull factors of these flows include recipient country's GDP (output) growth, credit risk and the degree of openness of capital account. On the other hand, the push factors consist of monetary policies of advanced economies, global output growth and global risk aversion (Belke and Volz, 2019; Cerutti et al., 2017; Miranda-Agrippino and Rey, 2015; Forbes and Warnock, 2012).

In addition, some authors identify improved macroeconomic conditions as pull factor and advantageous global conditions as push factors of the surges in capital flows to the EMEs and advanced economies (Chuhan et al., 1998; Taylor and Sarno, 1997; Ghosh and Ostry, 1994). Further, Fratzscher (2012) investigates the extent to which capital flows triggering factors are connected to push and pull factors. The author further notes diverse influences of global factors across countries during the GFC. Adding to the same sort of literature, Bruno and Shin (2013, 2015) establish the supremacy of push (global) factors over the pull (domestic) factors in determining the intensity of cross-border capital flows.

Another string of literature investigates the drivers of different episodes of capital flows. For instance, Forbes and Warnock (2012) stress on the role of global factors, especially global risk aversion sentiment, in driving four extreme episodes of global cross-border capital flows: surge, flight, stop and retrenchment. In the same line, some other studies, investigating the drivers of gross international flows, impute retrenchment of cross-border bank flows subsequent to the GFC to de-globalization, risk aversion and deleveraging (Cerutti et al., 2017; Forbes et al., 2015; Rose and Wieladek, 2011).

Besides, a number of studies substantiate that global risk conditions are important drivers of cross-border capital and bank flows. For example, Bruno and Shin (2015) envisage that risk appetite of market participants is one of the key determinants of global liquidity conditions. Further, the periods of serenity in financial markets, where global investors present less risk-averse attitude, are associated with high bank leverage and a surge in cross-border bank flows. Opposite to this, several authors document retrenchment or reduction in capital flows by global investors during the "risk-off" periods (McCauley, 2012; Forbes and Warnock, 2012).

Further, Rey (2015) asserts that VIX index is one of the key drivers of global liquidity. Nonetheless, he observes that monetary conditions of major financial centers are highly associated with VIX index and deeply influence the common global financial cycle of international capital flows. Further, Reinhardt and Riddiough (2015) utilize panel data of 25 advanced and emerging economies to analyze the reactions of intra-bank and interbank cross-border flows to variations in global risk. They endorse that interbank cross-border flows shrink during the periods of high global risk volatility while intra-bank cross-border flows remain stable or even increase.

Another strand of literature documents that global bank leverage and bank leverage cycles are important determinants of global liquidity and financial conditions. To investigate this stance, Bruno and Shin (2013) use panel data for 46 developed and emerging economies and endorse that the important driver of banking sector capital flows is global banks leverage cycle. Further, global liquidity, in turn, determines the credit growth in recipient country by following global banks leverage cycle. However, Bruno and Shin (2014) argue that global liquidity is determined by global banks leverage before 2008. Moreover, they are of the view that the magnitude of gross capital flows among countries mainly determines their financial conditions. Besides, Everett (2016) utilizes the determinants of global liquidity as its proxy to examine their impact on cross-border bank flows. For the purpose, the study exploits the US broker dealers' equity scaled by assets as a proxy of global bank leverage and VIX index as an indicator of global risk, considering them the determinants of global liquidity.

Some other empirical studies discover a number of macroeconomic and financial factors as drivers of international capital and bank flows, using panel data analyses. They investigate and pinpoint broker-dealers' leverage, short-term real interest rates, term spread (slope of yield curve), TED spread[10], VIX index, growth rate of M_2, real GDP growth, inflation, interest rate differentials, index of financial globalization and stock market turnover ratio as determinants of global liquidity (Osina, 2019; Cerutti et al., 2017; Renata, 2015). On the other hand, Cerutti et al. (2014) envisage that the determinants of cross-border bank flows drive global liquidity. Moreover, they substantiate that global financial cycle is largely influenced by the banking conditions in the Euro Area and the UK, and monetary policy stance of the US.

Overall, the studies, investigating the relationships between global liquidity and its determinants, find that cross-border bank flows increase with the increase in the US broker-dealers' leverage and short-term real interest rates, and decrease with the increase in the US VIX index, TED spread, term spread and appreciation of the US dollar (in terms of real effective exchange rate (henceforth REER)) (Cerutti et al., 2017; McCauley et al., 2015; Burger et al., 2015; Cerutti, 2015; Rey, 2015). Moreover, Cerutti et al. (2017) document similar results in case of the European Union and the UK. They further note that monetary policy factors (short-term real interest rates, term spread and REER) of the US are more significant determinants of global financial conditions than that of the European Union. Contrary to this, they find that the factors pertaining to bank conditions (broker-dealers' leverage and TED spread) of the European Union are more important determinants of global financial conditions than that of the US. In addition, Renata (2015) documents negative association between financial market drivers and banks' lending and maintains that

[10] TED is an acronym constructed from T-bill and ED, and is a ticker symbol for the Eurodollar future contracts. TED spread is the difference between the interest rate on the short-term US government debt (T-bill) and interest rate charged on inter-bank loans.

global level drivers play important role in explaining global liquidity conditions in emerging countries.

Some recent empirical endeavours investigate the determinants of momenta and shifts in global liquidity. In this regards, Choi et al. (2017) identify three momenta: policy-driven, market-driven liquidity and risk averseness. They are of the view that policy-driven liquidity is influenced by discretionary decisions of monetary authorities, market-driven is created by market developments and financial innovations especially in advanced economies and risk averseness aspect of global liquidity demonstrates collective behaviour of market participants to plunge into financial risks.

In the field of shift drivers of global liquidity, Avdjiev et al. (2020) attempt to explore them by using data for 64 countries on the borrowing side and 44 countries on lending side. They further examine global and domestic elements of sampled countries. Their global factors include Federal Fund Rate (henceforth FFR), VIX index and global GDP, and their country-specific factors include sovereign credit ratings, Chinn-Ito index as an indicator of financial openness devised by Chinn and Ito (2008) and GDP. They divide the time period into different sample periods, after 2013Q1 they add quarter one by one for investigation. They conclude that FFR is an important driver of global liquidity but VIX loses its significance over the time. Furthermore, they conclude that the factors of advanced economies are more important than that of the emerging economies.

2.5 Global Liquidity Spillovers

In this state of increasingly globalized world, it has become a matter of fact that economic and financial developments in one country, especially in a major economy, entail cross-border implications to a greater or lesser extent. Moreover, the epidemic nature of the effects of financial crises, which the last two decades have witnessed, has lent much strength to this notion. This issue has received much attention of researchers. Numerous investigators have delved into the issue. They investigate international spillovers of global economic developments and economic and policy developments in major economies to other countries and regions, and authenticate the existence of these effects (Guerello and Tronzano, 2020; Sahoo et al., 2020; Choi et al., 2017; Fratzscher et al., 2017; Kang et al., 2016b; Baks and Kramer, 1999).

This section proceeds in two steps: in the first step, it discusses theoretical foundations of international spillovers, and in the second step it outlines empirical endeavours made in this area.

2.5.1 Theoretical Foundation of International spillovers

One of the most pioneer attempts that expound the foundations of cross-border transmission of monetary shocks and monetary spillovers is the Mundell-Fleming framework, owed to the seminal works of Mundell (1960) and Fleming (1962). The Mundell-Fleming framework envisages that an expansionary shock to domestic money supply decreases domestic interest rate, which results in capital outflow and subsequent depreciation of domestic currency. In this way, domestic goods become relatively cheaper than foreign goods due to which foreign spending shifts to the domestic goods. Consequently, domestic output increases while foreign output declines. Thus, the impact of expansionary shock to domestic money supply in this framework is considered as "beggar-thy-neighbour" type. Owing to this fact, it remains possible that foreign monetary authorities react by increasing foreign money supply. By such an action of foreign monetary authorities a positive correlation between domestic and foreign money supply may be created. This is one of the ways through which domestic monetary shocks transmit across the borders.

Contrary to the Mundell-Fleming framework, new open economy models such as Obstfeld and Rogoff (1995) and Kollmann (2001) take into account nominal rigidities and imperfect asset substitution across countries, and consequently argue that an expansionary monetary shock may increase output both at home and abroad. So, in their view the effect of expansionary domestic monetary shock can be of "prosper-thy-neighbor" type. As in the Mundell-Fleming model, monetary expansion depreciates domestic currency which results in the shift in demand from foreign goods to domestic goods. However, this intra-temporal effect may be overturned by the inter-temporal effect as initially sticky prices are expected to increase in the following periods, thereby reducing the real rate of interest on foreign assets. Hence, current period goods become relatively cheaper than future goods. So, demand for both foreign and domestic goods, at the same time, shifts towards the present (inter-temporal switching effect). If this inter-temporal aspect, which is completely absent in the Mundell-Fleming framework, prevails, a domestic monetary expansion raises foreign output.

Besides, there exists a stance that foreign monetary spillovers can be traced even in standard macroeconomic frameworks but the advancement in this direction is hindered by the practices that heavily rely on the unreasonably stringent assumptions. Moreover, the monetary interactions are overlooked in the standard New Keynesian model in favour of rationalized cashless model which focuses on the role of interest rate only (Woodford, 2011, 2008). But Andrés et al. (2009) argue that money must be modeled in such contexts, if real balance effects and adjustment costs of money stock are important. The quantity theorists maintain that global money plays important role, even in a cashless economy, in transmission mechanism, particularly when asset prices have effective role in the transmission of monetary stance (Nelson, 2003; Svensson, 2000).

Contributing to the same stance, Berger and Harjes (2009) rest the theoretical paradigm of their analyses on the channels explained in the New Keynesian dynamic general equilibrium model with the assumption of sticky-prices to discover spillover effects of global liquidity on the Euro Area macroeconomic variables, particularly inflation. They are of the view that there are various channels through which global liquidity can influence the Euro Area inflation. First, expansionary foreign monetary developments appreciate the Euro Area's currency and temporarily increase foreign demand for its goods. If the prices of the Euro Area imports are sticky enough to limit the effect of excess global liquidity on its import prices, its inflation will be triggered. Second, the European Central Bank may react to surge in foreign money supply by lowering domestic interest rate to sustain with foreign competitiveness. Third, the spillover effect of expansionary global liquidity may disseminate through the channel of liquidity arbitrage: the plentiful global liquidity is expected to have direct impact on regional financial conditions through search for yield and carry-trade practices. Last, the excess global liquidity may impact the Euro Area inflation through interest rate channel as envisaged by quantity theory of money.

Further, the CGFS (2011) views exchange rate regimes as one of the strongest stimuli of monetary transmission across currency areas. It suggests free adjustment of exchange rate to moderate transmission of policy stance and to decrease capital flows stimulated by currency misalignment and other macroeconomic factors. An economy pursuing pegged exchange rate policy implicitly adopts the monetary policy stance of the country with whose currency it pegs its currency, in the face of fully liberalized capital movements. However, flexible exchange rate policy cannot completely insulate an economy from the spillover impacts of foreign macroeconomic conditions, as witnessed during the GFC where many advanced economies with fully flexible exchange rate failed to ward off its effects.

2.5.2Empirical Evidence

A number of empirical studies explore the existence of cross-border short-term and long-term relationships among the financial derivatives, cross-border transmission of economic shocks, and the impact of cross-border financial flows on the economic performance of respective countries. But an emerging stream of literature in this field investigates the relationships among variables aggregated on global level. The Mundell-Fleming framework serves as a workhorse to analyze the monetary spillovers and cross-border transmission of monetary shocks. But the analyses are not so simple now: researchers have further explained the complex nexuses among the financial instruments of different countries by probing into the trends and associations among them and using most advanced and sophisticated econometric techniques and methods.

Few recent studies investigate cross-border commonalities in the liquidity conditions. For an illustration, Brockman et al. (2009) document commonality in liquidity utilizing intraday spread and depth data for 47 stock markets across the world. Bai and Qin (2015) endorse the existence of liquidity commonalities in 18 emerging markets. Further, the liquidity co-movements are positively associated with co-movements in volatility and risk and negatively associated with the level of financial market development. Similarly, Mayordomo et al. (2014) put forward evidence of the existence of liquidity commonalities in corporate Credit Default Swap market of 24 countries. However, they are of the view that the liquidity commonalities are time-dependent but are independent of firms' characteristics, and vary across regions. Further, liquidity commonalities get stronger with the increase in the risk. Additionally, some researchers highlight the importance of macroeconomic factors in explaining global liquidity commonality and conclude that there is no single factor that can explain global liquidity commonality in financial dynamics across countries, which macroeconomic factors cannot explain (Eickmeier et al., 2014).

Apart from this, another strand of literature investigates the existence and nature of international financial spillovers. For instance, some researchers present the evidence of the spillover effects of both returns and conditional volatility of the US equity markets to the UK and Japan's equity markets (King et al., 1994; Lin et al., 1994; Hamao et al., 1990). In the similar manner, another group of investigators documents significant spillovers in foreign exchange markets (Andersen and Bollerslev, 1998; Engle et al., 1990). Further, it is also substantiated that there exist some spillovers from the US bond market to euro area bond markets (Ehrmann and Fratzscher, 2005; Goldberg and Leonard, 2003). Nonetheless, Beirne et al. (2013) examine the volatility spillovers from mature markets to emerging markets and put forward the evidence of volatility spillovers from mature markets to emerging markets. Yet, Smimou and Khallouli (2016) find a persistent liquidity co-movements and the existence of positive pair-wise unconditional correlations and a liquidity spillover from small markets to large markets.

Besides, there exists another strand of literature that explores spillover effects during financial crises and contagions. Researchers have investigated spillovers of various financial crises to different regions and countries (Ait-Sahalia et al., 2012). Some researchers investigate spillovers of the GFC to the US, Asian and Latin American stock markets (Apostolakis, 2016; Yiu et al., 2010). Similarly, Cheung et al. (2007) examine spillovers to the US and Asian emerging markets during the Asian financial crisis of 1997. Likewise, Caramazza et al. (2004) investigate the nature of spillovers in 41 EMEs during the Mexican (1994), Asian (1997) and the Russian (1998) financial crises. In like manner, Darvas and Szapáry (2000) investigate the spillovers of the Russian financial crisis to Central and Eastern European countries. Contributing to this sort of literature, Cho et al. (2015) examine the integration and co-movement of portfolios sorted on the basis of firm characteristics with regional and global factors during the periods of five major crises.

Adding to the literature on international spillovers of liquidity, interest rates and portfolios, some authors explore spillovers effects of these variables on monetary and financial developments of other countries (Diamond et al., 2020). In this context, Smimou and Khallouli (2016) present empirical evidence of liquidity spillovers from small markets to large markets during the GFC of 2007-2008. Similarly, Ehrmann et al. (2011) argue that the Euro Area bond and equity markets are highly responsive to the shocks to the US short-term interest rates, and the shocks to euro area short-term interest rates have also significant impact on the US bond and equity markets. Further, Ehrmann and Fratzscher (2009) document that on average stock returns, in 50 equity markets, fall in response to tightening monetary policy of the US, along with heterogeneity across countries. Analogously, Conover et al. (1999) examine responses of equity markets of 16 industrialized countries to the US monetary environment, determined by changes in discount rate. They conclude that higher stock returns are associated with expansive monetary environment.

On the other hand, there exists a burgeoning literature that explores the channels through which international spillovers dissipate. It is observed that the most widely discussed channels in the literature are four: wealth effect, cross market hedging, liquidity and correlated information channels (Kodres and Pritsker, 2002; Masson, 1999; King and Wadhwani, 1990). Furthermore, Pritsker (2001) investigates and highlights the importance of these four channels in analyzing the episode of the Asian financial crisis. Likewise, Smimou and Khallouli (2016) investigate liquidity channels in transmitting external shocks among the Euro zone countries in relation to the global financial crisis of 2007-2008. However, there exists another standpoint that maintains that international trade and financial linkages play more important role than the country-specific factors in explaining international spillovers associated with equity and bond markets (Forbes and Chinn, 2004).

Complementing the same sort of literature, some authors testify that the transmission or contagion effects of different crises take place through international bank lending, especially through common bank lenders (Sbracia and Zaghini, 2003; Kaminsky and Reinhart, 2000; Salgado et al., 2000). Further, in this direction, Rijckeghem and Weder (2003), using exchange market pressure index as a measure of contagion, endorse the strong role of common bank lender effect in transmission of various crises, such as Thai, Mexican and Russian crises. But they, when exploiting flow data of bank lending, note varying potential of common bank lending effect in transmitting these crises. They find its strong effect during Thai, smaller effect during Mexican and the insignificant effect during Russian crisis.

In the same manner, few authors discover various channels of the cross-border dissemination of liquidity effects. In this context, there exists a viewpoint that "risk-taking channel" transmits monetary policy stances of major economies across borders through international bank activities (Albrizio et al., 2020; Takáts and Temesvary, 2020). Further, it is maintained that monetary policy stance can potentially influence not only short-term interest rates and consequent domestic credit growth but also long-term interest rates and yield curves by modifying market participants' future expectations (Borio and Zhu, 2012; Borio, 2010). Borio and Zhu (2012) further corroborate that risk–taking channel works through adjustments in asset prices, search for yield activities and valuation effects. Nonetheless, the connection between liquidity and bank risk taking has multiplier effect on the transmission of monetary spillovers (Borio and Zhu, 2012; Borio, 2010).

Moreover, some investigators identify some other channels of liquidity transmission. In this line, Bruno and Shin (2014) view that cross-border transmission of global liquidity is carried out through global and local banks interactions. For instance, when global banks provide wholesale funds to local banks on lenient conditions, local banks pass on lenient conditions to their borrowers, which eventually results in increased credit supply. Supporting the stance that cross-border transmission propagates through international bank activities, Buch and Goldberg (2015) hold that liquidity risk is transmitted through cross-border banks lending. They further observe that responses of banks to international lending are primarily determined by their balance sheet characteristics. Further, Kim (2001), using VAR technique on aggregates of G6 countries, argues that expansionary monetary policy of the US causes booms in the rest of the world through world's real interest rate channel. Further, Ehrmann and Fratzscher (2009) argue that the US monetary policy transmits to equity markets through interest rate and exchange rate channels.

Additionally, He and McCauley (2013) hold that global liquidity is transmitted to the Asian economies through multiple channels, including both quantity and price channels. They recommend that policymakers in the Asian countries, while setting domestic policy rates, should keenly observe the interest rate settings in major advanced economies. The policymakers must be mindful of the risk of currency appreciation and foreign currency credit flux that may be the result of low policy rates in advanced economies. The authors further argue that the unconventional monetary policy measures of major central banks, particularly which involve large purchases of bonds, push down bond yield in global market. They also maintain that currencies ultimately tend to appreciate, despite lower interest rates and bond yields, and mounting exchange market pressure via foreign reserve accumulation.

Another string of literature explores the determinants of international spillovers. In this regard, some authors argue that bilateral trade plays an important role in the transmission of cross-border spillovers (Forbes and Chinn, 2004; Glick and Rose, 1999; Krzak, 1998; Wyplosz, 1996). Contrary to this viewpoint, Ehrmann and Fratzscher (2009) contend that global integration matters more than bilateral integration. Besides, another group of researchers signify the role of banks especially the foreign-owned banks in the transmission of international financial spillovers (Guerello and Tronzano, 2020; Kolasa et al., 2015; Kollmann, 2013; Kamber and Thoenissen, 2013). Nonetheless, a recent attempt by Georgiadis (2016) lists a range of determinants of the US monetary policy spillovers: specifically trade and financial integration, financial openness, financial market development, exchange rate regime, industry structure, labour market rigidities and the extent of participation in global value chain.

Apart from the above, there exists another stream of literature that investigates monetary spillovers of one country to another. In this context, a couple of empirical investigations suggest that liquidity shocks in advanced economies spillover the borders and substantially impact macroeconomic and financial conditions of other countries. For an illustration, an increase in the Chinese liquidity increases world oil and commodity prices and inflation rate in the US, depreciates the US dollar in terms of its real trade-weighted value and decreases terms of trade of the US (Kang et al., 2016b). Analogously, Dekle and Hamada (2015) maintain that expansionary monetary policy of Japan engenders healthy consequences for the US economy. They further argue that the Japanese currency appreciation owing to expansionary monetary policy is beneficial while Japanese currency depreciation is detrimental to the US economy. Moreover, Choi and Lee (2010) maintain that expansionary monetary policies in advanced economies lead to persistent surge in output and inflation of the Asian emerging economies.

Further, a number of studies investigate the spillovers of the US monetary stance to other economies (Sahoo et al., 2020; Tule et al., 2019; Avdjiev and Hale, 2019). In this regards, Laeven and Tong (2012) argue that global stock prices increase in response to unexpected monetary loosening and decrease in response to unexpected monetary tightening of the US monetary policy. These responses are very strong in case of firms dependent on external financing and for the countries with more aligned domestic monetary policy with that of the US. Further, Fratzscher et al. (2017) investigate the spillovers of different episodes of the US quantity easing. They establish the evidence of significant spillover effect on capital flows to other countries but with varying magnitude of the effects across episodes. Lending empirical support to this stance, a number of other explorations confirm the spillover effects of the US monetary policy on other economies (Georgiadis, 2016; Bowman et al., 2015; Bauer and Neely, 2014; Maćkowiak, 2007; Canova, 2005). Further, Baks and Kramer (1999) substantiate that the US and Japan money growth has positive impact on the money growth of other G7 countries. They also note that volatility of money growth in the US and Japan affects volatility of asset returns in G7 countries.

Another chunk of literature investigates the spillovers of global liquidity to advanced economies. For illustration, Sousa and Zaghini (2008) investigate spillover effects of global liquidity on the Euro Area. They document persistent positive impacts of extra-Euro liquidity on monetary aggregate (M_3) and price level in the Euro Area. Further, Rüffer and Stracca (2006) examine global liquidity spillovers to the Euro Area, Japan and the US. They find significant spillovers to these economies. They further document that spillover effects are stronger in the Euro Area than in Japan. However, for the US the spillover effects of global excess liquidity are very weak and are opposite to that in the Euro Area and Japan. Analogously, Darius and Radde (2010) maintain that spillover effects vary across countries – the US and Japan. They further observe that domestic factors (monetary policy) matter more than the foreign factors in the determination of house price.

Contributing to this kind of literature, some authors examine the spillover effects of global liquidity on EME, and developing economies (Diamond et al., 2020; Inekwe, 2020; Choi et al., 2017). Further, Choi et al. (2017) investigate the spillover effects of global liquidity on 10 EMEs, using quarterly data spanning 1995Q1 to 2014Q3. They note that the EMEs reduce their policy rates and increase foreign reserves in response to positive innovation in global liquidity. In this way, the EMEs attempt to ward off the impact of increased global liquidity on external fronts instead of from their real activities. They further document different effects on inflation-targeting and non-inflation-targeting economies. In case of heightened risk averseness EMEs offset the effect of increased capital flows through depleting foreign exchange reserves. Overall, there is positive impact of global liquidity on output and equity prices; however, in the presence of elevated risk averseness, there may be opposite effect. They further observe that the financial variables of inflation-targeting regimes are less volatile than that of non-inflation-targeting regimes.

Further, He and McCauley (2013) investigate channels and the nature of impact of global liquidity, indexed in terms of foreign currency credit, on three Asian economies: China, Hong Kong and Korea. They maintain that growth of foreign currency credit is not dependent on capital outflows from source countries; rather they can be funded through offshore deposits. They document rapid growth of dollar credit to the firms located in mainland China and Hong Kong, but very modest growth of that to the firms located in Korea. Further, notwithstanding the retreat from dollar intermediation by the European banks, the foreign currency borrowings in China and Hong Kong kept on increasing. Nonetheless, foreign currency credit is associated with domestic interest rate, especially in China. Besides, the Korean macroprudential policy considerably restrains interbank flows to Korea.

As far as econometric technique to investigate spillovers is concerned, researchers have employed a variety of techniques. For instance, Baks and Kramer (1999) utilize granger causality to establish spillover effects. Rijckeghem and Weder (2003) rest their findings on panel data analysis. But most of the studies utilize the family of VAR models for the purpose. For instance, Choi et al. (2017) employ a panel factor augmented VAR (henceforth PFAVAR) technique. Dekle and Hamada (2015) use GVAR model. Some authors exploit impulse responses generated from VAR framework (He and McCauley, 2013; Darius and Radde, 2010; Kim, 2001). Some other studies exploit structural VAR (henceforth SVAR) technique to examine the monetary spillovers in order to rest their findings on theoretical foundations (Kang et al., 2016b; Sousa and Zaghini, 2008).

However, there exists evidence that developing countries have been a destination of huge international capital flows. Further, it is also argued that the surge in capital flows to developing countries is mainly supply-driven. Nonetheless, this surge in capital flows can potentially result in the overwhelming role of international firms in the financial decisions of these countries, increase in financial vulnerability of these countries and coerced macroeconomic adjustments, reducing fiscal and monetary autonomy of these countries (Chandrasekhar, 2008). But, despite the recognition of these developments and their perspective consequences, the empirical literature still lacks rigorous analyses of spillover effects of global liquidity on the developing countries.

2.6 Summary and Research Gaps

From the review of existing literature, it is obvious that there exists a wide range of price- and quantity-based measures of global liquidity in the theoretical literature (Howell, 2020; CGFS, 2011; Domanski et al., 2011). But empirical literature exploits only few of them for the analyses. Further, a very small fragment of empirical literature utilizes price indicators (Bonizzi et al., 2019; Choi and Lee, 2010; Kim, 2001). Moreover, it is argued in the literature that price measures indicate the conditions at which liquidity is available instead of quantity of liquidity (Domanski et al., 2011; Landau, 2011). Therefore, huge proportion of empirical literature utilizes quantity measures with dominance of credit and monetary aggregates. In this part of literature, only few studies utilize credit aggregates as indicators of global liquidity. Further, the studies utilizing credit aggregates mainly proxy global liquidity by cross-border bank lending (Osina, 2020, 2019; Cesa-Bianchi et al., 2015; Bruno and Shin, 2014).

Nonetheless, there exists a stance that credit aggregates can be captured by their counterparts - monetary assets (Chung et al., 2014). Moreover, the largest strand of empirical literature employs monetary aggregates, mostly atheoretical monetary measures of global liquidity (Belke and Volz, 2019; Belke and Keil, 2016; Beckmann et al., 2014; Belke et al., 2013, 2010a, b). But numerous authors put forward evidence that establishes the supremacy of theoretical monetary aggregates over atheoretical ones (Hashmi and Bhatti, 2019; Hjertstrand et al., 2018; Huang and Xia, 2015; Schunk, 2001; Barnett et al., 1984). However, the empirical literature on global liquidity overlooks its theoretical monetary measures.

Further, the existing literature corroborates the existence of linkages between global liquidity and macroeconomic and financial variables aggregated at global scale. This sort of literature investigates the interactions of global liquidity, global real economic activity, and global goods, commodity and asset prices (Ratti and Vespignani, 2015; Belke et al. 2014, 2013, 2010a, b; Beckmann et al., 2014). There is a consensus on the fact that global liquidity a plays key role in the developments of global real economic activity and global goods and commodity prices, but its role in the developments of asset prices is a matter of debate. Many authors document poor performance of global liquidity in signaling the dynamics of global equity prices (Brana et al., 2012; Belke et al., 2010b; Darius and Radde, 2010; Giese and Tuxen, 2007).

Thus, these findings raise doubt: whether the inefficiency of global liquidity to predict global equity prices is due to the use of inappropriate measures of global liquidity. Moreover, only few studies in this field use two or three different measures of global liquidity for the cross-validation of their findings (Beckman et al., 2014; Belke et al., 2013; Darius and Radde, 2010; Baks and Kramer, 1999). This prompts further exploration aiming to examine the performance of theoretical as well atheoretical measures of global liquidity in forecasting these global macroeconomic and financial variables, which the existing literature lacks.

Moreover, theoretical literature focuses on the drivers of global liquidity and envisages their interactions (Cohen et al., 2017; CGFS, 2011). However, some authors stress on the need for the explorations of the determinants of global liquidity (Cerutti et al., 2017, 2014; Bruno and Shin, 2015; Rey, 2015). But the empirical literature on the determinants of global liquidity is very scant. Nonetheless, only few endeavours attempt to explore its determinants (Avdjiev et al., 2020; Cerutti et al., 2017; McCauley et al., 2015; Burger et al., 2015). Moreover, these studies mainly use elements of global liquidity like cross-border capital and credit flows and bank lending as its proxies. Further, some other explorations investigate the determinants of the component of global liquidity such as international debt securities (Avdjiev et al., 2020; Osina, 2019; Aldasoro and Ehlers, 2018). Nonetheless, the empirical literature totally overlooks the determinants of global liquidity measured through its most widely acknowledged and used measures - monetary aggregates.

Additionally, a substantial chunk of theoretical as well as empirical literature devotes its attention to the investigation of spillover effects of global liquidity. In the theoretical considerations of the subject, the Mundell-Fleming and the New Keynesian Dynamic Equilibrium models lend theoretical foundations for the cross-border monetary spillovers (CGFS, 2011; Berger and Harjes, 2009). Similarly, a burgeoning empirical literature investigates international spillovers of monetary developments in major advanced economies (Guerello and Tronzano, 2020; Inekwe, 2020; Fratzscher et al., 2017; Kang et al., 2016b). Likewise, some investigations examine spillover effects of global liquidity on advanced economies (Darius and Radde, 2010; Sousa and Zaghini, 2008; Rüffer and Stracca, 2006; Baks and Kramer, 1999). However, their investigations mainly explore these effects in the context of individual country.

Analogously, some other authors inspect implications of cross-border bank flows to the EMEs, with special look on the Asian EMEs (Belke and Volz, 2019; Choi et al., 2017; He and McCauley, 2013). However, in the currently globalized state of the world, global monetary developments can potentially impact economic and financial conditions of developing countries. Further, Chandrasekhar (2008) visualizes potential implications of cross-border capital flows to developing countries. But the existing literature lacks rigorous empirical endeavors that probe into the spillover effects of global liquidity on developing economies.

This study attempts to bridge the gaps identified above. For the purpose, it constructs two theoretical and three atheoretical monetary measures of global liquidity. Our theoretical measures are grounded on Divisia and CE techniques of monetary aggregation and atheoretical measures include simple-sum, GDP-weighted growth rates and PCA based monetary aggregates. Further, this study appraises the performance of these measures by investigating their ability to forecast global real economic activity, global CPI and global commodity and equity prices, and by analyzing the strength of association of the lags of their cyclical components with the cyclical components of these global variables. Moreover, it also explores short and long run determinants of global liquidity, assessed through these measures. Furthermore, it also investigates the spillover effects of global liquidity on developing countries by utilizing SVAR framework and employing different theoretical restrictions suggested in the literature and also through Cholesky decomposition.

CHAPTER 3

METHODOLOGY AND DATA

3.1 Introduction

This chapter elaborates the procedures involved in the construction of the measures of global liquidity, econometric techniques employed for the analyses and theoretical underpinning and construction of other variables investigated in different analyses, and issues related to the availability and streamlining processes of data and its sources. Since this study constructs theoretical and atheoretical monetary aggregates at regional and global levels, appraises the relative performance of monetary measures of global liquidity, explores the short and long run determinants of global liquidity and investigates spillover effects of global liquidity on developing countries, it undertakes four partially independent analyses. Each analysis requires somewhat different techniques due to which various data aggregation and estimation techniques are dealt with in detail in different sections of this chapter.

In compliance with the aforementioned course of actions, this chapter proceeds as follows: its second section discusses aggregation techniques employed to construct monetary aggregates over the countries at regional and global levels. The third section expounds the procedures involved in the construction of variables and their cyclical components and the econometric techniques employed to appraise the relative performance of the global liquidity measures devised in this study. The fourth section elucidates the procedures involved in the construction of global variables and econometric tools exploited to discover the short and long run determinants of global liquidity. The fifth section explains aggregation procedures involved in the construction of variables for the developing countries and econometric techniques utilized to examine spillover effects of global liquidity on the developing countries. The sixth section contains descriptive statistics of variables; and the last section takes a glance on the issues related to the data, the steps taken during data smoothing process and data sources.

3.2 Construction of Regional and Global Monetary Aggregates

The high income countries are at the core of the world economy hence can deeply influence global economic developments. Moreover, it is contended that global monetary conditions are strongly driven by the monetary developments in advanced economies of the world (Belke et al., 2018). Nonetheless, it is also apparent from the existing literature that researchers utilize monetary aggregates of major advanced economies to devise the measures of global liquidity (Belke and Volz, 2019; Beckman et al., 2014; Belke et al., 2013; Baks and Kramer, 1999). Acquiring insight from this stance, this study also utilizes monetary aggregates of high income countries for the construction of five different monetary measures of global liquidity: simple sum (henceforth GLSUM), GDP-weighted growth rates (henceforth GLGDPW), currency equivalent (henceforth GLCE), Divisia index (henceforth GLDIV), and Principal Component Analysis (hereafter PCA) based (henceforth GLPCA) measures.

Further, we construct monetary aggregates at a regional level and then at a global level. For this, the sampled high income countries are grouped into five regional blocks, as categorized by the World Bank. The regional blocks are: (i) East Asia and Pacific (ii) Europe and Central Asia (iii) Latin America and Caribbean (iv) Middle East and North Africa, and (v) North America. This section sheds light on the construction of each monetary aggregate on by one.

3.2.1 The Simple-Sum Method

This procedure involves the conversion of seasonally adjusted broad money of all countries into a common currency, which can be obtained by dividing the broad money by the respective country's exchange rate, and then summing the converted series up. It can be described as:

$$SUM_{kt} = \sum_{i=1}^{N} \frac{bm_{it}}{e_{it}} \qquad ; i \in k \qquad \dots \qquad (3.1)$$

Where, SUM_{kt} is the regional aggregate of region k in time t, bm_{it} is the broad money of country i in time t and e_{it} is the exchange rate of country i in time t. Exchange rate implies the value of a US dollar in terms of domestic currency.

Furthermore, the range of N varies from region to region. Its range for East Asia and Pacific is six ($N = 1,2, \ldots ,6$), ten for Europe and Central Asia ($N = 1,2, \ldots ,10$), two for Latin America and Caribbean ($N = 1,2$), one for the Middle East and North Africa ($N = 1$), two again for North America ($N = 1,2$), and 21 at a global level ($N = 1,2, \ldots ,21$). Hereafter, its range will remain the same in all analyses in this section[11].

3.2.2 GDP-Weighted Growth Rates Method

In this section, we follow Belke and Keil (2016), Giese and Tuxen (2007) and Beyer et al. (2001) to construct monetary aggregates at regional and global levels. This procedure of aggregation involves the conversion of nominal GDP of all countries into a common currency using purchasing power parity (PPP) exchange rates. Then each country's GDP share in the total group GDP is calculated. The GDP share of the country is used as a weight for that country. Hence country- specific weight of country i in time t is:

$$w_{it} = \frac{GDP_{it}/e_{it}^{PPP}}{\sum_{i=1}^{N}\left(GDP_{it}/e_{it}^{PPP}\right)} \quad ; i \in k \quad \ldots \quad (3.2)$$

Where, w_{it} is the weight, GDP_{it} is the nominal GDP and e_{it}^{PPP} is the purchasing power parity exchange rate of country i in time t.

The growth rates of monetary aggregates constructed across the countries can be obtained by allotting the weights calculated above to the growth rate of broad money (in domestic currency) of the respective country.

$$G_t = \sum_{i=1}^{N} w_{it} g_{it} \quad ; i \in k \quad \ldots \quad (3.3)$$

Here, g_{it} is the growth rate of broad money of country i in time t and G_t is the aggregate growth rate in time t. Some studies use year specific weights at this stage of aggregation because the data on GDP is generally available in annual frequency

[11] Section 3.2 and in its all forthcoming sub-sections.

(Belke and Keil, 2016; Belke et al., 2014; Baks and Kramer, 1999). We also use year specific weights at this step of aggregation.

The aggregate monetary index across the countries M^{GDP} can be constructed by using an initial level, 100, and multiplying it by aggregate weights computed above.

$$M_{kT}^{GDP} = \prod_{t=2}^{T}(1 + G_t).100 \qquad \dots \qquad (3.4)$$

3.2.3 PCA-based Aggregation

The prime objective of PCA is to explain the variance of observed data by utilizing a few linear combinations of original data (Joint Research Centre-European Commission, 2008). The PCA-based aggregation procedure can be described as follows: suppose we construct a monetary aggregate across the countries, utilizing the data on broad money for N countries. Here, we use broad money of each country converted into a common currency based on the respective country's exchange rate. A small number of variables (principal components) can capture a large proportion of the variation of the original N variables. Further, the P number of principal components can retain a high amount of the variability of the original variables even when $P < N$. However, the maximum number of principal components can be N.

$$Z_1 = a_{11}M_1 + a_{22}M_2 + \cdots + a_{1N}M_N$$
$$Z_2 = a_{21}M_1 + a_{22}M_2 + \cdots + a_{2N}M_N$$

.

.

.

$$Z_N = a_{N1}M_1 + a_{N2}M_2 + \cdots + a_{NN}M_N \qquad \dots \qquad (3.5)$$

Where, M_i is the broad money of country i, Z_i is the i^{th} principal component and a_{ij} is a weight assigned to the broad money of country j in principal component i. a_{ij} is also termed as component or factor loading and is chosen in such a way that the principal components satisfy the following conditions.

a. The principal components are uncorrelated (orthogonal).

b. The first principal component explains the maximum proportion of the variance of variables. The second principal component explains the maximum of the remaining variance and so on. All the remaining variances are accounted for by the last component. Further,

$$a_{i1}^2 + a_{i2}^2 + \cdots + a_{iN}^2 = 1 \qquad \text{and } i = 1,2,\ldots,N$$

PCA involves tracing the eigenvalues which requires a covariance matrix. So, the sample covariance matrix, CM can be expressed as:

$$CM = \begin{bmatrix} cm_{11} & \cdots & cm_{1N} \\ \vdots & \ddots & \vdots \\ cm_{N1} & \cdots & cm_{NN} \end{bmatrix} \qquad \ldots \qquad (3.6)$$

Where, cm_{ii} is the variance of the monetary aggregate (broad money) of country i and cm_{ij} is the covariance of monetary aggregates of country i and j, when $i \neq j$. The eigenvalues of the matrix CM show variances of the principal components and can be obtained by solving the characteristic equation. The characteristic equation can be obtained from:

$$|CM - \lambda I| = 0 \qquad \ldots \qquad (3.7)$$

Where, I is the identity matrix of the same order as that of CM and λ is the vector of eigenvalues. Anyhow, the results of PCA analysis are given in Appendix (Tables A4.1 through A4.5)

3.2.4 Currency Equivalent Method

The roots of this method of monetary aggregation can be traced back to the rigorous works of Hutt and Keynes (1963), and Rotemberg et al. (1995). In this method, we first construct the currency equivalent of the broad money of each country and then derive their weighted sum after converting them into a common currency. The aggregation within countries can be sketched as:

$$cebm_{it} = \sum_{j=1}^{J}\left(\frac{R_{it} - r_{ijt}}{R_{it}}\right)m_{ijt} \qquad \ldots \qquad (3.8)$$

For aggregation across the countries, Chung et al. (2014) use the simple sum method. But, at this stage of aggregation we follow Barnett (2007) where he suggests the aggregation procedure of Divisia index across the countries. We follow him so that the aggregation procedure may be based on theory even at this stage of aggregation across the countries. Through the heterogenous-countries approach this procedure can be described as:

$$CE_{kt} = \sum_{i=1}^{N} W_{it} \left(\frac{cebm_{it}}{e_{it}}\right) \qquad ;i \in k \qquad \ldots \qquad (3.9)$$

$$\text{where, } W_{it} = \frac{ce_{it}^{*} \Pi_{it} p_{it}^{*} H_{it} / e_{it}}{\sum_{i=1}^{N} \left[ce_{it}^{*} \Pi_{it} p_{it}^{*} H_{it} / e_{it} \right]} = \frac{ce_{it} \Pi_{it} H_{it} / e_{it}}{\sum_{i=1}^{N} \left[ce_{it} \Pi_{it} H_{it} / e_{it} \right]} \qquad \ldots \qquad (3.10)$$

and, $cebm_{it}$ is the currency equivalent measure of the broad money of country i in time t, R_{it} is the benchmark rate of return of country i in time t, r_{ijt} is the rate of return of component j in country i at time t, m_{ijt} is the value of component j of the broad money of country i in time t, CE_{kt} is the regional currency equivalent aggregate of region k in time t, e_{it} is currency exchange rate of country i in time t, H_{it} is the population of country i in time t and Π_{it} is the user cost price aggregate of country i in time t.

The Fisher's factor reversal test claims the existence of a user-cost-aggregate price dual to the quantity aggregate in a way that their product is equal to the total expenditures on all components. Hence;

$$\Pi_{it} M_{it} = \sum_{j=1}^{J} \pi_{ijt} m_{ijt} \qquad \ldots \qquad (3.11a)$$

$$\text{So,} \quad \Pi_{it} = \frac{\sum_{j=1}^{J} \pi_{ijt} m_{ijt}}{M_{it}} \qquad \ldots \qquad (3.11b)$$

Where, Π_{it} is the user-cost-aggregate price for country i at time t and M_{it} is the quantity aggregate (broad money) of country i at time t. We use this method to calculate country specific user-cost-aggregate price.

We use three to four components of broad money for each country as stated in section 3. So, J ranges from one to four ($J = 1,2, \ldots\ldots, 4$) and the currency in circulation or M1 bears no interest. Deposit rate is imputed to transferable deposits included in broad money. The treasury bill rate (hereafter TBR) or money market rate (if TBR is not available) is assigned to other deposits or the constituents of M2 but not of M1. Short-term or medium term (if short-term is not available) government bond yield is allocated to deposits other than securities included in broad money or the assets included in M3 but not in M1. However, for the US, we assign TBR to the components incorporated in M1 other than currency in circulation, and short-term bond yield to the components included in M2 but not in M1.

Benchmark Rate of Return

The benchmark rate of return (R_t), as defined by Barnett (1987), is the return obtained on an investment asset, purely held for accumulating wealth, and which does not perform any other service such as liquidity. Researchers use different proxies for it. Usually, the investigators follow the envelope approach: the highest rate of interest is used as a proxy (Alkhareif and Barnett, 2012; Serletis and Molik, 2000). Some other researchers construct its proxy by adding liquidity premia to the selected rate of interest (Stracca, 2004)[12]. This study also follows the envelope approach in most of the cases but only in a very few cases, we have constructed a benchmark rate of return by adding liquidity premia[13]. In most of the sampled countries, the highest rate of interest is the lending rate, so, we use that as the benchmark rate of interest.

3.2.5 The Divisia Index

The Divisia index meets the standards of the class of superlative index numbers as defined by Diewert (1976). Its footing primarily rests on the seminal works of Törnqvist (1936) and Theil (1967), that is why it is also known as Törnqvist-Theil Divisia index in the literature. But the rigorous contributions of Diewert (1976, 1978) and Barnett (1978, 1980) developed it further in the monetary

[12] For the detailed discussion on the construction of proxies for benchmark rate of return, please see Barnett (2003).

[13] We have constructed benchmark rate of return by adding liquidity premia for Denmark, Hungary, Korea Republic, Norway, Poland, Sweden and the UK.

context. However, Barnett (1980) succeeded in constructing Divisia monetary aggregates consistent with the microeconomic theory. Therefore, the Divisia monetary index is attributed to the groundbreaking work of Barnett (1980). It entertains three functions of money (medium of exchange, store of value and unit of account) and dismisses investment motives, hence measures other monetary services related to liquidity (Hancock, 2005). This method involves the construction of Divisia indices within countries and then aggregation of the indices across the countries.

Aggregation within Countries

Let m_{ijt} be the per capita value of asset type j (component of broad money) in country i at time t and J be the total number of asset types in country i. Also, let the rate of return of asset j in country i at time t be r_{ijt}, and the true cost of living in country i at time t be p_{it}^{*}.Then, the discrete-time approximation to continuous-time Divisia monetary index can then be expressed as:

$$M_{it} = \prod_{j=1}^{J}\left(\frac{m_{ijt}}{m_{ij,t-1}}\right)^{w_{ijt}} . M_{i,t-1} \qquad \ldots \qquad (3.12)$$

$$\text{where, } w_{ijt} = \frac{1}{2}(s_{ijt} + s_{ij,t-1}) \qquad \ldots \qquad (3.13)$$

$$\text{and, } s_{ijt} = \frac{(R_{it} - r_{ijt})m_{ijt}}{\sum_{j=1}^{J}(R_{it} - r_{ijt})m_{ijt}} = \frac{\pi_{ijt}\, m_{ijt}}{\sum_{j=1}^{J}\pi_{ijt}\, m_{ijt}} \qquad \ldots \qquad (3.14)$$

Where, M_{it} is the Divisia monetary index of the broad money of country i in time t, w_{ijt} is the weight allotted to component j of the broad money of country i in time t, s_{ijt} is the expenditure share of component j of the broad money of country i in time t, R_{it} is the benchmark rate of return of country i in time t and π_{ijt} is the user cost of component j of broad money of country i in time t. The user cost is the return given up due to holding a monetary asset instead of holding an asset with higher return (Barnett, 1978). In other words, user cost is the opportunity cost of an asset and is a representative index of its price. It can be calculated as:

$$\pi_{ijt} = \frac{(R_{it} - r_{ijt})}{1 + R_{it}} \quad \ldots \quad (3.15)$$

The logarithmic transformation of the Divisia index can be expressed as:

$$logM_{it} - logM_{i,t-1} = \sum_{j=1}^{J} w_{ijt}\,(logm_{ijt} - \log m_{ij,t-1}) \quad \ldots \quad (3.16)$$

Aggregation Across the Countries

We follow the heterogenous countries approach of Barnett (2007) to construct Divisia index across the sampled countries. Let N be the total number of countries in the group. The population of country i at time t is H_{it}. The discrete-time approximation to continuous-time Divisia monetary index, aggregated across the countries, can be expressed as:

$$DIV_{kt} = \prod_{i=1}^{N} \left({h_{it} M_{it}}/{e_{it}} \right)^{W_{it}^{*}} . DIV_{k,t-1} \qquad \text{and } i \in k \quad \ldots \quad (3.17)$$

where, $h_{it} = \frac{H_{it}}{\sum_{i=1}^{N} H_{it}}$ ... (3.18)

$$\text{and, } W_{it} = \frac{M_{it}^{*} \Pi_{it}^{*} p_{it}^{*} H_{it} / e_{it}}{\sum_{i=1}^{N} \left[M_{it}^{*} \Pi_{it}^{*} p_{it}^{*} H_{it} / e_{it} \right]} = \frac{M_{it} \Pi_{it}^{*} H_{it} / e_{it}}{\sum_{i=1}^{N} \left[M_{it} \Pi_{it}^{*} H_{it} / e_{it} \right]} \quad \ldots \quad (3.19)$$

where $W_{it}^{*} = \frac{1}{2}\left(W_{it} + W_{i,t-1}\right)$ ... (3.20)

From the above expression it is apparent that $0 \leq W_i \leq 1$ for all i, and $\sum_{i=1}^{N} W_i = 1$. Thereby, we may consider $\{W_1, \ldots \ldots \ldots, W_N\}$ as a probability distribution in constructing Divisia means across the countries. DIV_{kt} is the Divisia monetary index for region k at time t. The remaining notations are the same as those in the previous section of CE measure.

The logarithmic transformation of Divisia indices can be expressed as:

$$logDIV_{kt} - logDIV_{k,t-1} = \sum_{i=1}^{N} W_{it}\left[log\left(\frac{h_{it}M_{it}}{e_{it}}\right) - log\left(\frac{h_{i,t-1}M_{i,t-1}}{e_{i,t-1}}\right)\right] \quad \ldots \quad (3.21)$$

Through Fisher's factor reversal property of user cost aggregates and monetary quantity the user cost aggregate across the countries can be obtained as:

$$\Pi_t = \frac{\sum_{i=1}^{N}\left(M_{it}s_{it}\Pi_{it}/e_{it}\right)}{M_t} \quad \ldots \quad (3.22)$$

3.3 Relative Performance of Global Liquidity Measures

The linkages among global liquidity, global real economic activity (henceforth GIPI), global consumer price index (henceforth GCPI), global commodity price index (henceforth GCMPI) and global asset prices (henceforth MSCI) are well established in the literature (Belke et al., 2014, 2013, 2010a, b; Beckmann et al., 2014; Sousa and Zaghini, 2007; Baks and Kramer, 1999). Moreover, some authors investigate the power of global liquidity to forecast global macroeconomic and financial conditions (Ratti and Vespignani, 2015; Alessi and Detken, 2011; Darius and Radde, 2010).

On the other hand, a strand of empirical literature investigates the performance of different monetary aggregates and monetary policy variables on the basis of different standards. For instance, Schunk (2001) discerns the ability of simple-sum and Divisia monetary aggregates in out-of-sample forecasting of real GDP and GDP deflator through vector autoregression (henceforth VAR) approach. And Belongia and Ireland (2017) appraise the effectiveness of monetary policy rules through correlations between the cyclical components of GDP and price level and the lags of the cyclical components of different monetary aggregates and other monetary policy indicators.

Motivated by these approaches, this study evaluates the performance of different global liquidity measures on the basis of their out-of-sample forecasting ability and the strength of the associations of the lags of their cyclical components with the cyclical components of other macroeconomic and financial variables. This section proceeds as follows: its first subsection describes the methodology employed for forecast analyses. The second subsection expresses the procedures adopted to investigate cross-correlation of cyclical components of the variables under inspection. The third subsection deals with the construction and description of variables.

3.3.1 Forecasting Performance

The out of sample forecasts are a good benchmark to assess the performance of indicators, if carried out within reliable econometric frameworks (Schunk, 2001). In this context, the VAR framework, introduced by Sims (1980), serves as a useful tool for describing dynamic nature of macroeconomic and financial time series, and as a benchmark of forecast analyses. Nonetheless, to the general opinion of econometricians, VAR model is principally designed for the forecast purposes. Moreover, the studies that attempt to investigate relationships between global liquidity and asset and commodity prices mostly employ VAR and vector error correction model (henceforth VECM) (Darius and Radde, 2010; Belke et al., 2010a, b; Giese and Tuxen, 2007).

Moreover, VAR technique is viewed as one of the best approaches for the analysis of out-of-sample forecasting (Schunk, 2001). The VAR modeling requires further pre-estimation diagnostic analyses, such as order of integration of variables and the existence of cointegrating relationships among the variables. To this end, this study, prior to obtaining the forecasts through VAR technique, investigates order of integration of variables and the existence of cointegrating relationships among the variables. The tests exploited for these diagnostic-checks are elaborated as under:

Unit Root Test

To test the stationarity and order of integration of variables, econometricians have devised many tests but the most widely used are Dickey and Fuller (henceforth DF) test, Augmented Dickey and Fuller (henceforth ADF) test by Dickey and Fuller (1979), PP test named after Phillips and Perron (1988) and KPSS test named after Kwiatkowski, Phillips, Schmidt and Shin (1992). All of these unit root tests are criticised on one ground or another. Thus, none of these tests is free of limitations. But Arltová and Fedorová (2016) argue that ADF test relatively performs better under most of the conditions hence is the best choice to detect the problem of unit root. Nonetheless, it is also most widely employed in the literature. In line with the prior literature, this study also employs ADF test to examine the order of integration of variables. The general form of ADF test can be sketched as:

$$\Delta y_t = (\alpha - 1)y_{t-1} + \sum_{i=1}^{\rho} \gamma_i \Delta y_{t-i} + \varepsilon_t \qquad \ldots \qquad (3.23)$$

Here, y is the time series whose stationarity is to be tested, ρ is optimal lag length chosen on the basis of Akaike Information Criterion and ε_t is the white noise error term in time t. The null hypothesis of the test is that the series is non-stationary against the alternative hypothesis that the series is stationary. Further, the distribution of the test statistic is identical to that of DF test statistic.

Cointegration Test

For meaningful results and long run relationships between non-stationary series, econometricians recommend cointegration analyses. For the purpose, the most frequently used tests are Johansen maximum eigenvalue and trace tests (Johansen, 1988, 1991), Engle-Granger test (Engle and Granger, 1991) and ARDL bounds test (Pesaran et al., 2001). But in the VAR setting, the popular tests are Johansen's maximum eigenvalue and rank tests. This study also exploits Johansen's maximum eigenvalue and trace tests for cointegration analysis in this section. The underlying methodology of Johansen's cointegration tests can be expressed as:
It takes starting point in VAR framework of order ρ.

$$y_t = \mu + \sum_{i=1}^{\rho} A_i y_{t-i} + \varepsilon_t \qquad \ldots \qquad (3.24a)$$

Where, y is $n \times 1$ vector of first order integrated variables and ε is $n \times 1$ vector of innovations. With a simple manipulation it can also be expressed as:

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{\rho-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \qquad \ldots \qquad (3.24b)$$

Where, $\Pi = \sum_{i=1}^{\rho} A_i - I \qquad \ldots \qquad (3.25)$

and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$ ... (3.26)

Further, if Π has reduced rank such as $r < n$, there exist $n \times r$ matrices, α and β, each having rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ turns out to be stationary. Moreover, r represents number of cointegrating relationships; each column of β refers to a cointegrating vector; and α contains adjustment parameters in the VECM. The trace and maximum eigenvalue tests can be outlined as:

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad \ldots \quad (3.27)$$

$$J_{\max\ eigenvalue} = -T \ln(1 - \lambda_{r+1}) \quad \ldots \quad (3.28)$$

Here, T is the sample size and λ_i represents ith canonical correlation between Δy_t and y_{t-1}. The trace test presumes null hypothesis that there are r cointegrating vectors against its alternative hypothesis of n cointegrating vectors, whereas maximum eigenvalue test tests null hypothesis of r cointegrating vectors against the alternative hypothesis of $r + 1$ cointegrating vectors.

Besides this, the VAR model undertakes some other specification diagnostic analyses. It requires which variables should be incorporated as exogenous and which ones as endogenous in the model. Since our analysis is on global scale where, by definition, no variable is exogenous (Belke et al., 2010b). Further, ordering of variables also matters in forecasting through VAR approach. The basic principles of specification suggest that monetary variables must be ordered last because they are expected to react faster than the real ones (Favero, 2001). We follow Belke et al. (2010b), Darius and Radde (2010) and Schunk (2001) in ordering the variables[14] and treat all variables as endogenous.

Moreover, the selection of lag length in VAR modeling is a cumbersome job. The most widely used criteria for the selection of lag length include Akaike Information Criterion (henceforth AIC), Schwartz Information Criterion (henceforth SIC), Hannan-Quinn Criterion (henceforth HQC) and Final Prediction Error Criterion (henceforth FPEC).There exist controversial views about the performance of these criteria in the literature. However, Ivanov and Killian (2005) recommend

[14] We have also used different ordering to check the robustness of results.

AIC for monthly and small (less than 60 observations) quarterly data and SIC and HQC for large (more than 120 observations) quarterly data. Here, the SIC and HQC suggest autoregression structure of lag two for all measures of global liquidity but AIC and FPE propose lag length two for GLDIV, GLSUM and GLPCA and lag length three for currency equivalent GLCE and GLGDPW[15].

Econometric Model

Hence, our VAR model becomes:

$$Z_t = \alpha + \sum_{i=1}^{\rho} \beta_i Z_{t-i} + \mu_t \quad \dots \quad (3.29)$$

Where,
$$Z = \begin{bmatrix} GIPI \\ GCPI \\ GINT \\ GL \\ GCMPI \\ MSCI \end{bmatrix} \quad \dots \quad (3.30)$$

Here, GL[16] is the measure of global liquidity, ρ is the optimal lag length whose value is two when the analysis exploits GLDIV, GLSUM and GLPCA and three in case of GLCE and GLGDPW, α is the intercept, μ is the white noise term. $GIPI$ is global industrial production index, $GCPI$ is global CPI, $GINT$ is global interest rate, $GCMPI$ is global commodity price index and $MSCI$ global equity price index.

Further, we evaluate forecasting performance of each measure[17] of global liquidity by comparing root mean squared error (henceforth RMSE), mean absolute error (henceforth MAE), and by visual inspection. For the purpose, we run five VARs, one for each global liquidity measure for the sample period 2001M12 to 2015M6 and use forecast horizon spanning over 2015M7 to 2017M12. Hence, our forecast horizon accounts for almost 15% of total sample period.

Suppose the forecast sample is, $T+1, T+2, \dots, T+h$ and actual and forecasted values of dependent variable in time t are y and $\hat{y}$ respectively. Then, the RMSE and MAE can be calculated as:

---

[15] We also tested other criteria, but the performance of these indicators was best with lag length three.
[16] We run five VARs, one for each measure of global liquidity under investigation.
[17] We also normalize GLCE, GLSUM and GLPCA to 100 for December 2001 to avoid scaling difference among all measures.

$$RMSE = \sqrt{\frac{\sum_{t=T+1}^{T+h}(\hat{y}_t - y_t)^2}{h}}$$

$$MAE = \frac{\sum_{t=T+1}^{T+h}|\hat{y}_t - y_t|}{h}$$

3.3.2 Cross-Correlation Analyses

This part of analyses attempts to measure the degree of linear association between the secular trends of the variables. For the purpose, following Belongia and Ireland (2017), we investigate strength of association between the cyclical components of the lags of the measures of global liquidity and the cyclical components of GIPI, GCPI, GCMPI and MSCI. Further, Belongia and Ireland (2017), view that on average business cycle takes four years to complete, hence they use 16 lags of the variables representing monetary stance because they utilize quarterly data. But we exploit monthly data, thus we investigate 48 lags of the cyclical components of global liquidity measures. Like Belongia and Ireland (2017), we also appraise the performance of the measures on the basis of the strength of association between lags of their cyclical components and cyclical components of other variables under investigation.

Computation of Cyclical Components

Traditionally, in business cycle analyses, Hodrick-Prescott (hereafter HP) filter is utilized to capture trend components of macroeconomic time series. The HP filter is one of the most popular and widely used tools to retrieve smooth long-term trends and secular components of variables by removing short-term fluctuations. Belongia and Ireland (2017) also compute trend components of income velocities of different monetary aggregates through this approach. But a very recent work of Hamilton (2018a) castigates HP filter on the ground that it generates the series having spurious dynamic relations with baseless data generating process. Moreover, the generated series is characterized by spurious dynamics. Further, he proposes another technique as a substitute of HP filter and advocates its use, arguing that the proposed technique circumvents all these limitations. He proposes different techniques for the series integrated of different order. However, he suggests the following technique to compute cyclical components of the first order integrated series. We also follow this technique because our series are first order integrated processes.

Let y_t be a first order integrated series. Then its cyclical component can be calculated as:

$$v_{t+h} = y_{t+h} - y_t \qquad \ldots \qquad (3.31)$$

He further argues that h has eight-quarter (equivalent to two years) horizon, and v_{t+h} represents long-run trend, seasonal or cyclical component. Since our study exploits monthly data, we use $h = 24$.

3.3.3 Description and Construction of Variables

All the global variables, as per their standard definitions, are not available in the accessible databases. Owing to this fact, it is a common practice in the existing literature that researchers construct their proxies. We follow the literature in defining and constructing the variables at global scale. Some variables of global nature or their proxies such as industrial production index of OECD and Morgan Stanley Capital International World index, are already constructed by different databases and are available. However, we construct some other variables at global scale by exploiting the data for the sampled high income countries and following the tradition set in the literature. The detailed description of each variable investigated in this section is given as under:

Global Liquidity

It measures the "ease of financing" in financial markets across the world. In other words, it is an indicator of the availability of official, private and funding liquidity in global financial markets. More specifically, it is the representative index of the broad money aggregate of the world hence reflects the value of monetary assets available in the world. Here we use all the five measures of global liquidity constructed in section 3.2.

GIPI

It refers to the volume of business activities carried out across the globe and reflects global economic conditions. The widely used proxies of global real economic activity are the world real GDP or real GDP of OECD countries. But at country level, the investigations that utilize monthly data mostly use industrial production index as an indicator of real economic activity (Kim and Roubini, 2000; Bernanke et al., 1997). Analogously, a number of studies utilize industrial production index of OECD countries as monthly indicator of global real economic activity (Ciccarelli and Mojon, 2010; Gerlach, 1988). However, Kilian (2009) devises a monthly measure of global real economic activity based on shipping costs. But Hamilton (2018b) points out the weaknesses of this measure and favours the use of OECD industrial production index instead of this. Motivated by this, we also use industrial production index of OECD countries as a proxy of global real economic activity and dub it as global industrial production index (GIPI). It covers production in mining and manufacturing sectors and public utilities (gas, electricity and water), but excludes construction. It precisely reflects real economic activity because the fluctuations in the level of industrial activity profoundly impact the remainder of the economy (the OECD Economic Outlook: Methods and Sources, 2018).

GCPI

Simply CPI measures the changes in price levels of the market basket of consumer goods and services which households purchase. On the same ground, GCPI reflects overall changes in the prices of consumer goods across the world. As far as its construction or proxy is concerned, a number of studies construct GCPI through GDP-weighted growth rates approach devised in the seminal work of Beyer et al. (2001), utilizing the data of sampled countries (Belke and Keil, 2016; Belke et al., 2010a, b; Darius and Radde, 2010; Ciccarelli and Mojon, 2010). But Barnett (2007) lends theoretical foundation to aggregation of CPI across the countries. We follow him in constructing the monetary-sector-weighted Divisia CPI for sampled countries. It is constructed as:

$$GCPI_t = \prod_{i=1}^{N}\left(\frac{CPI_{it}/e_{it}}{CPI_{i,t-1}/e_{i,t-1}}\right)^{W_{it}^{*}} . GCPI_{t-1} \qquad \dots \qquad (3.32)$$

Here, $GCPI_t$ is the across-countries-aggregated CPI in time t, we use it as an indicator of GCPI. CPI_{it} is the CPI of country i in time t, and e_{it} and W_{it}^* are same as described in section 3.2.5 (under Divisia index of global liquidity).

Global Interest Rate

In economics, interest rate is the reward of the services of capital. It usually refers to the additional amount charged as percentage of principal amount by the lender for the use of its monetary capital for a certain period. Further, it also serves as a measure of opportunity cost of holding cash. From the same token, global interest rate is the representative reward of the services of capital across the globe. It also depicts the charges at which monetary assets are available in the world. For the purpose of its construction, a number of studies employ GDP-weighted sum technique to construct aggregated interest rate across the countries. They assign weight equal to the share of GDP of a country in the group GDP to its interest rate and then derive weighted sum (Belke and Keil, 2016; Belke et al., 2010a, b; Darius and Radde, 2010).

But Alkhareif and Barnett (2012) utilize relatively better and comprehensive method to aggregate interest rate across the countries. Hence, acquiring insight from Alkhareif and Barnett (2012), our aggregation of interest rates over the countries is based on basic accounting principles. A portfolio of monetary assets $(m_{1it}, m_{2it}, \ldots\ldots, m_{Jit})$ with monetary asset j bearing interest rate r_{jit} can generate investment yield $\sum_j^J r_{jit} m_{jit}$ in country i. So, the following accounting identity must hold, if rate of return of the portfolio is $\tilde{R}_{it}$.

$$\tilde{R}_{it} \sum_j^J m_{jit} = \sum_j^J r_{jit} m_{jit} \qquad \ldots \qquad (3.33a)$$

or $$\tilde{R}_{it} = \sum_j^J r_{jit} m_{jit} \Big/ \sum_j^J m_{jit} \qquad \ldots \qquad (3.33b)$$

The expression of portfolio rate of return derived above represents the rate of return in a single country i. Applying the same modus operandi, the rate of return aggregated across the countries can be derived as:

$$GINT_t = \frac{\sum_{i=1}^{N}(\sum_{j=1}^{J} r_{jit}\, m_{jit} / e_{it})}{\sum_{i=1}^{N}(\sum_{j=1}^{J} m_{jit} / e_{it})} \quad \ldots \quad (3.34)$$

Through this method we construct aggregate interest rate of sampled high countries and dub it global interest rate (henceforth GINT).

GCMPI

It is an index that represents developments in the prices of basket of commodities across the globe. Putting it in another way, it is the representative of the price index of a broader commodity and asset class. As far as its exploitation in research is concerned, researchers commonly use GCMPI developed by the Commodity Research Bureau (Belke and Keil, 2016; Belke et al., 2010a, b; Darius and Radde, 2010). We also construct GCMPI assigning weights to the prices of different commodities, following the weighting-scheme used by the Commodity Research Bureau for the construction of it. For the purpose, we allot 39% weight to energy, 21% to beverages, 20% to grains and 20% to precious metal prices.

MSCI

It is the weighted average of a class of stocks. It measures overall developments in stock prices and indicates the performance of stock markets across the world. For its development, some empirical endeavours construct global stock price index, using stock price indices of sample countries through GDP-weighted growth rates aggregation technique (Belke et al., 2010b). But Morgan Stanley Capital International compiles and reports the world equity index, known as the MSCI World index, using data for 23 developed countries across the world. Moreover, Darius and Radde (2010) exploit this index for their investigation. We also utilize the MSCI World index as a proxy of global equity price index.

3.4 Determinants of Global Liquidity

Despite the fact that global liquidity has remained at the core of the recent discussion about the global financial stability, the empirical literature on the exploration of its determinants is surprisingly very scant. However, few works rigorously discuss the theoretical interactions of its determinants (Cohen et al., 2017; CGFS, 2011). Therefore, this section attempts to dig out the prospect determinants of global liquidity from the theoretical literature and connects them in the form of econometric model. For this reason, its first subsection discusses theoretical background; the second subsection delves into the econometric techniques employed for the purpose; and the third subsection sheds light on the construction of the variables investigated in this section.

3.4.1 Theoretical Framework

As noted earlier, global liquidity stems from two basic tributaries: official and private liquidity. Official liquidity is associated with monetary stances of central banks. Therefore, this component of global liquidity is primarily determined by the underlying targets that central banks strive to achieve through various monetary measures. In a broader sense, these objectives mainly comprise of price stability, economic growth, financial stability and regulation of fluctuations in business activity. On the other hand, private liquidity is driven by its demand and supply side factors. Therefore, its drivers can be associated with market and funding conditions: expected profit and cost of monetary and financial assets, risk sentiment in the market, willingness to take risk and overall business conditions (Cohen et al., 2017; CGFS, 2011).

In this way, the determinants of global liquidity can be classified into two broader categories: demand and supply side drivers. The demand side drivers are associated with the conditions that encourage or discourage people and business enterprises to keep liquidity. On the other hand, the supply side drivers refer to the conditions that prompt or dissuade financial institutions to offer liquidity. Hence, demand side drivers include business activity, expected profit or asset returns and rate of interest – the opportunity cost to hold the most liquid asset. The supply side drivers also include business conditions, market risk perception and the extent financial firms can permissibly be leveraged. Hence, theoretical foundations of the determinants of global liquidity can be conceptualized in the manner of money demand and supply framework (Cohen et al., 2017; CGFS, 2011).

However, theoretical literature classifies the drivers of global liquidity into major three categories: macroeconomic, other public sector policies, and financial factors. Macroeconomic factors comprise of monetary stance, exchange rate regime and investment conditions. Other public sector policies include the nature of central bank liquidity facilities - collateral policies and financial regulations. The financial factors include financial integration, financial innovation and risk appetite (CGFS, 2011). Nevertheless, the empirical literature investigates broker-dealers' leverage, short-term real interest rates, term spread (slope of yield curve), TED spread, VIX index, growth rate of M_2, real GDP growth, inflation, interest rate differentials, index of financial globalization and stock market turnover ratio as the determinants of global liquidity (Osina, 2019; Cerutti et al., 2017; Renata, 2015). But these studies exploit changes in cross-border bank claims and individual bank's loans normalized by its total assets as indicators of global liquidity.

3.4.2 Econometric Techniques

As far as econometric methods are concerned, the empirical literature mainly employs panel-data models to investigate the determinants of cross-border bank or capital flows, and VAR model to examine the linkages between global liquidity and other variables (Cerutti et al., 2017; Belke and Keil, 2016; Renata, 2015, Belke et al., 2013, 2010a, b). But it is generally advised that one should be very careful in the selection of econometric technique because the credibility of the findings of the study principally depends on the appropriateness of the econometric technique to the dynamics of data. On the other hand, time series econometrics often encounters a pertinent problem of non-stationarity of variables that potentially lead to unreliable inference and "spurious" results (Newbold and Granger, 1974). The simple and most common solution to this problem is differencing the series until they become stationary. But this solution itself entails problems: loss of degree of freedom and information loss on the levels of data generating processes. Fortunately, econometricians have succeeded in devising a technique that subtly addresses these issues – the cointegration technique. They are of the view that even non-stationary series yield reliable results, if they are cointegrated. Therefore, this study tests the stationarity of variables and the existence of cointegrating relationships among the variables. The tools used for this purpose are discussed as under:

Unit Root Test

It is a well-acknowledged fact that most of the economic time series are non-stationary. Hence, it is imperative to test stationarity of time series and their order of integration to derive right conclusions by selecting and employing suitable econometric technique. In this direction, econometricians have devised many tests to examine the order of integration of time series but we employ ADF test here also to check unit root. The justification and procedure of ADF test are elaborated in the earlier section (section 3.3.1).

Cointegration Analysis

As discussed earlier under section 3.3.1, the popular cointegration tests are Johansen, Engle-Granger and autoregressive distributed lag (henceforth ARDL) bounds tests. The Johansen and Engle-Granger tests require that the series under investigation must be first order integrated (unit root processes); none of them should be stationary. However, the ARDL bounds test tests the existence of long run relationship (cointegration) even if some series are stationary and some are unit root processes, but the orders of integration of all of the series must be less than two. We have a mixture of stationary and unit root series, with the highest order of integration being one. Further, we are interested in the short and long run determinants of global liquidity. Hence, ARDL bounds test conforms best to our analysis in this section. The procedure of ARDL bounds test of cointegration can be expressed as:

$$\begin{aligned} \Delta LGL_t = \alpha &+ \beta LGL_{t-1} + \gamma LGIPI_{t-1} + \delta LGBL_{t-1} + \eta LGCBBF_{t-1} + \theta GINF_{t-1} \\ &+ \vartheta GSTR_{t-1} + \kappa LVIX_{t-1} + \lambda GRINT_{t-1} + \mu GINTD_{t-1} \\ &+ \sum_{i=0}^{I} \nu_i \Delta LGIPI_{t-i} + \sum_{j=0}^{J} \pi_j \Delta LGBL_{t-j} + \sum_{k=0}^{K} \rho_k \Delta LGCBBF_{t-k} \\ &+ \sum_{l=0}^{L} \sigma_l \Delta GINF_{t-l} + \sum_{m=0}^{M} \tau_m \Delta GSTR_{t-m} + \sum_{n=0}^{N} \varphi_n \Delta LVIX_{t-n} \\ &+ \sum_{p=0}^{P} \phi_p \Delta GRINT_{t-p} + \sum_{q=0}^{Q} \psi_q \Delta GINTD_{t-q} + \sum_{r=1}^{R} \omega_r \Delta LGL_{t-r} + \varepsilon_t \end{aligned} \quad \ldots \quad (3.35)$$

Where the null hypothesis is:

$$H_0: \beta = \gamma = \delta = \eta = \theta = \vartheta = \kappa = \lambda = \mu = 0 \quad \ldots \quad (3.36a)$$

And alternative hypothesis is:
At least one of them is not zero. Stating other way it becomes:

$$H_1: \beta \neq \gamma \neq \delta \neq \eta \neq \theta \neq \vartheta \neq \kappa \neq \lambda \neq \mu \neq 0 \quad \ldots \quad (3.36b)$$

The null hypothesis of the test stipulates that there is no cointegration. Hence, if the null hypothesis is rejected, it can be concluded that the series are cointegrated. The conclusions, in this regard, are made by comparing the value of *F-statistic* with its lower and upper bounds provided by Pesaran et al. (2001). It is generally held that *F-test* suffices the existence of cointegrating relationships but Pesaran et al. (2001) also purpose *t-test* and further argue that there will be degenerated relationships among the variables, if *t-test* is not satisfied. For the existence of the cointegration relationships, the *t-test* requires that the coefficient β must be significantly different from zero (i.e. $\beta \neq 0$), following the bounds provided by Pesaran et al. (2001) for the *t-statistic*. We follow both F and t tests to derive conclusions.

Further, the long run form can be expressed as:

$$LGL_t = \alpha + \gamma LGIPI_t + \delta LGBL_t + \eta LGCBBF_t + \theta GINF_t + \vartheta GSTR_t + \kappa LVIX_t + \lambda GRINT_t + \mu GINTD_t + \varepsilon_t \quad \ldots \quad (3.37)$$

And the short run form can be sketched as:

$$\Delta LGL_t = \varpi + \sum_{j=0}^{J} v_j \Delta LGIPI_{t-j} + \sum_{k=0}^{K} \pi_k \Delta LGBL_{t-k} + \sum_{l=0}^{L} \rho_l \Delta LGCBBF_{t-l} + \sum_{m=0}^{M} \sigma_m \Delta GINF_{t-m} + \sum_{n=0}^{N} \tau_n \Delta GSTR_{t-n} + \sum_{p=0}^{P} \varphi_n \Delta LVIX_{t-p} + \sum_{q=0}^{Q} \phi_q \Delta GRINT_{t-q} + \sum_{r=0}^{R} \psi_r \Delta GINTD_{t-r} + \sum_{s=1}^{S} \omega_s \Delta LGL_{t-s} + \chi ECM_{t-1} + \varepsilon_t \quad \ldots \quad (3.38)$$

Here, LGL_t is the natural log of global liquidity[18] in time t, $LGIPI_t$ is the natural log of global real economic activity in time t, $LGBL_t$ is the natural log of global bank leverage in time t, $LGCBBF_t$ is the natural log of global cross-border bank flows in time t, $GINF_t$ is the global inflation in time t, $GSTR_t$ is the global stock return in time t, $LVIX_t$ is the natural log of VIX index in time t, $GRINT_t$ is the global real interest rate in time t, $GINTD_t$ is the global interest rate differential in time t, ECM_t is the error correction term in time t, ε_t is the white noise term and Δ represents first difference[19]. Further, the lag length can differ across variables, as ARDL model allows for it. The optimal lag length is chosen on the basis of AIC, here in this section too. Moreover, the coefficient of error correction term (χ) captures speed of adjustment of short term deviations to the long run equilibrium. Further, as recommended in the literature, it must be negative with absolute value less than one to ensure convergence to the long-run equilibrium path. And J, K, L, M, N, P, Q, R and S represent optimal lag lengths chosen on the basis of AIC. Their values may differ from one another and across different equations.

Post-Estimation Diagnostics

The ARDL model requires some post-estimation tests for the calibration of results. The post-estimation diagnostics examine the problems of serial correlation, heteroscedasticity, model misspecification and instability of parameters. In this context, we execute some diagnostic tests for the authenticity of our findings. These tests are described below.

Serial Correlation

The problem of serial correlation arises in time series analyses when the error term of one period correlates with that of other period(s). It may lead to misleading conclusions derived on the basis of the estimates because it deeply influences the efficiency of estimators. However, estimates remains unbiased and consistent even in its presence. Following the existing literature we employ Breusch-Godfrey serial correlation Lagrange-Multiplier (LM) test with lag length 12 to detect this problem.

[18] We estimate five separate models, one for each measure of global liquidity. Hence, LGL refers to one measure of global liquidity. Moreover, it is our baseline model, we use parsimonious model for each case.

[19] All the variables are in natural log form except global inflation, global stock return, global interest rate and global interest rate differential.

The null hypothesis of the test is that the error terms are not serially correlated up to the specified lag length against the alternative hypothesis that the error terms are serially correlated up to that lag length.

Heteroscedasticity

Heteroscedasticty refers to the situation whereby the variance of residuals does not remain constant rather it becomes dependent on explanatory variable(s). It may gravelly affect standard errors of the estimates hence may lead to wrong inference regarding the significance of the estimates. To avoid this problem, we exploit Newey-West method (Newey and West, 1987) to obtain hetero-auto consistent standard errors.

Model Specification

It is imperative for right conclusion and authentic findings that the model must be correctly specified. The misspecification of model may seriously challenge the credibility of conclusions. To confirm the correct specification of model, we employ Ramsey's regression specification error test (hereafter RESET). It is a functional form specification tests with null hypothesis that the model is correctly specified. It tests whether non-linear functional form better explain the dependent variable. We test linear specification against the non-linear (quadratic) specification through this test.

Stability of Parameters

It is critical for the credibility of the findings of an investigation that the coefficients of model do not substantially change over the time rather they remain stable (constant) during the whole period. To examine the stability of coefficient of our model, we follow Belloumi (2014), Pesaran et al. (2001) and Peseran and Peseran (1997), and apply cumulative sum (henceforth CUSUM) of recursive residuals and CUSUM of square (henceforth CUSUMSQ) tests on the error correction model to examine the stability of its coefficients.

3.4.3 Description and Construction of Variables

As noted earlier that all global variables, as per their standard definitions, are not available in the accessible databases. Owing to this fact, researchers have to resort to their proxies. To this end, they construct proxies by aggregating variables over the countries. We mostly follow the literature in defining and constructing the global variables. There exist various aggregation techniques in the literature but we attempt to pursue a relatively better technique in each case. The description and construction procedures of global liquidity and GIPI have been explained under section 3.2 and 3.3.3 respectively. However, the detailed description of other variables investigated in this section is given below.

Global Bank Leverage

Simply, bank leverage indicates the capability of a bank to increase earnings by financing assets with borrowed funds. It reflects funding conditions of banks and their risk taking attitude (Cerutti et al., 2017; Bruno and Shin, 2014). Its popular indicators are debt to equity, debt to capital and asset to equity ratios. But at global level, the US broker dealers' equity is also used as its proxy (Bruno and Shin, 2014). However, many authors use bank leverage of countries in panel framework (Cerutti et al., 2017; Renata, 2015). Following Cerutti et al. (2017), we also use assets to equity ratio of depository institutions of a country as a measure of bank leverage of that country. We construct weighted average of bank leverages of the sampled high income countries except Canada[20], assigning weight equal to the square[21] of the factor loading obtained through PCA technique (results are given in Table A6.1 in the Appendix) and name the weighted average as global bank leverage (henceforth GBL).

Financial Globalization

It implies an increasing degree of financial interdependence of countries across the world. It reflects the linkages of cross-border financial flows. There exists a wide range of proxy variables for financial integration (Baele et al., 2004) but the most widely used are ratio of total trade (exports plus imports) to GDP (Georgiadis, 2016; Chinn and Ito, 2003) and ratio of gross foreign asset and liabilities to GDP

[20] Its data is missing over a larger part of the sampled period.
[21] We use square of factor loadings because some of them carry negative sign.

(Georgiadis, 2016; Lane and Milesi-Ferretti, 2007). However, many studies exploit cross-border bank flows as a measure of financial globalization because they better depict global financial and banking conditions (Cerutti et al., 2017; Belke and Keil, 2016). Acquiring insight from these studies, we also use gross cross-border bank claims of the Bank for International Settlements (henceforth BIS) reporting countries as a measure of financial globalization.

Global Inflation

It refers to the rate at which general level of prices (of both goods and services) rises across the world. It is simply a rate of change of general price level. We calculate it as the growth rate of GCPI that has been elaborated in section 3.3.3. It is obtained as:

$$GINF_t = \left(\frac{GCPI_t - GCPI_{t-1}}{GCPI_{t-1}}\right) * 100 \qquad \ldots \qquad (3.39)$$

Global Stock Return

The stock return can be in the form of profit earned by trading the stock or dividend received or both. Generally, it is computed as growth rate of stock plus dividend or mere growth rate of the stock. We compute global stock return as the growth rate of MSCI that has been discussed under section 3.3.3. So, it can be calculated as:

$$GSTR_t = \left(\frac{GMSCI_t - GMSCI_{t-1}}{GMSCI_{t-1}}\right) * 100 \qquad \ldots \qquad (3.40)$$

Global Risk/Uncertainty

It indicates the expectations of market participants about future and the nature of market sentiments prevalent in the world. In this regards, the US VIX (volatility index) calculated by the Chicago Board Options Exchange can be used as a global measure of investor uncertainty and risk aversion (Cerutti et al., 2017; Rey, 2015; Forbes and Warnock, 2012). We also employ VIX index as a measure of global risk and uncertainty.

Global Real Interest Rate

It is inflation-adjusted global interest rate. It reflects real yield that a lender receives and a real cost of funds that a borrower pays. Generally, it is calculated through standard Fisher's equation. Here, we calculate it by subtracting GINF from GINT described in section 3.3.3. Hence, global real interest rate (henceforth GRINT) can be computed as:

$$GRINT_t = GINT_t - GINF_t \quad \ldots \quad (3.41)$$

Global Interest Rate Differential

Basically, the difference between interest rates of two different countries is termed as interest rate differential. Cerutti et al. (2017) take it as the difference between the federal funds rate and domestic interest rate of respective country. But we use the difference between the federal funds rate and discount rate of the Euro Area as a proxy of global interest rate differential (hereafter GINTD).

3.5 Global Liquidity Spillovers

This section sheds light on the theoretical foundation of international spillovers of global liquidity and then elaborates the econometric ways to capture them. It especially underpins spillovers of global liquidity to developing countries theoretically as well as econometrically, and also describes the construction of variables utilized in this section.

3.5.1 Theoretical Framework

The economic interdependence of countries across the world is a fact in this age of increasing globalization and openness (Bruno and Shin, 2014). Moreover, money supply of many countries is associated with the availability of funds in foreign currencies, especially in the currencies of major economies because they have to keep foreign exchange reserves against the issuing (creation) of their own money (currency) (Sahoo et al., 2020; Ait-Sahalia et al., 2012). Hence, through this act of pegging on the part of small economies of the world, the loosening or tightening monetary conditions in the major economies impact monetary conditions in the small economies. Furthermore, the capital flows among the countries motivated by interest rate differentials or any other policy measure results in the surpluses or shortages of funds in different monetary centres across the globe.

The roots of these spillover effects can be traced back to the New Keynesian dynamic general equilibrium and Mundell-Fleming frameworks. These frameworks envisage that global liquidity can potentially impact macroeconomic conditions of developing countries by many ways. First, global liquidity can potentially move exchange rates of developing versus developed countries currencies, directly impacting the prices of their imports and exports. Second, the surge in global liquidity will also fuel inflation in the advanced economies which is liable to have opposite effect as that of exchange rate appreciation in the developing economies. Third, central banks of developing countries, particularly of emerging economies like China, Russia and India may react to expansionary measures in advanced economies by lowering domestic interest rates or by any other expansionary measure to cope with external competition. Fourth, there might be liquidity arbitrage; global liquidity can affect regional financial conditions through "search for yield"[22] and "carry-trades"[23] strategies (Berger and Harjes, 2009).

Nevertheless, there also exists empirical evidence of the liquidity spillovers. In this regards, some researchers establish the existence of international spillovers of monetary developments in the major advanced economies (Diamond et al., 2020; Fratzscher et al., 2017; Kang et al., 2016b). Likewise, some investigations examine spillover effects of global liquidity on advanced economies (Darius and Radde, 2010; Sousa and Zaghini, 2008; Rüffer and Stracca, 2006; Baks and Kramer, 1999). Their investigations mainly explore these effects in the context of individual country. Some other authors inspect implications of cross-border bank flows to the EMEs, with a special look on the Asian EMEs (Choi et al., 2017; He and McCauley, 2013). Hence, it is very likely that developments in global liquidity may have spillover effects on developing countries.

[22] The strategy that involves increased risk taking during higher expected return and low interest rate.
[23] The strategy that refers to the act of borrowing at low interest rate and investing in the assets with higher returns.

3.5.2 Structural VAR

Researchers have employed a variety of techniques to examine cross-border spillovers. For instance, Baks and Kramer (1999) utilize granger causality to establish spillover effects. Rijckeghem and Weder (2003) rest their findings on panel data analysis. But most of the studies utilize the family of VAR models for the purpose. For illustration, Choi et al. (2017) employ a panel factor augmented VAR technique. Dekle and Hamada (2015) use global VAR model. Some authors exploit impulse responses generated from VAR framework (He and McCauley, 2013; Darius and Radde, 2010; Kim, 2001). Some other studies exploit structural VAR (henceforth SVAR) technique to examine the monetary spillovers in order to rest their findings on the theoretical foundations (Kang et al., 2016b; Sousa and Zaghini, 2008).

Moreover, the SVAR model has an advantage over simple VAR models because it can be constructed on a theoretical foundation while simple VAR models are generally considered as atheoretic ones. The SVAR model can produce reliable results under the necessary restrictions imposed in the light of economic theory. Further, the restrictions can either be contemporaneous or long-rung depending on the interest of analysis. Nonetheless, SVAR model better suits to capture economic shocks which can be used to generate impulse response and variance decomposition functions to gauge dynamic impact on the variables of choice. Further, this model is most widely used to capture international impact of asymmetric monetary shocks and exchange rate movements (Pfaff, 2008; McCoy, 1997). Thus, SVAR model is a powerful tool, if it is in the right hands, but it can be misleading if handled blindly (Kilian, 2011).

Keeping in view the advantages of SVAR models and in line with the existing literature, this study also employs SVAR model to capture spillovers of global liquidity to developing economies. The general form of SVAR model can be expressed as:

$$Ay_t = \sum_{i=1}^{\rho} A_i^* y_{t-i} + B\varepsilon_t \quad \ldots \quad (3.42a)$$

Its reduced form can be expressed as:

$$y_t = \sum_{i=1}^{\rho} A^{-1}A_i^* y_{t-i} + A^{-1}B\varepsilon_t \quad \ldots \quad (3.42b)$$

Hence the general form of corresponding VAR model will be:

$$y_t = \sum_{i=1}^{\rho} A_i y_{t-i} + \mu_t \quad \ldots \quad (3.42c)$$

Where, $A_i = A^{-1}A_i^*$ and $\mu_t = A^{-1}B\varepsilon_t$

Here, y_t is a vector of K endogenous variables, A_i^* and A_i are $(K \times K)$ matrices of structural and reduced form coefficients respectively for $i = 1,2, \ldots\ldots, \rho$; ρ is the optimal lag order of the VAR chosen on AIC whose value is 3 for each measure of global liquidity. Further, μ_t is a vector of reduced form residuals and ε_t is a vector of structural shocks. Both μ_t and ε_t are assumed to be white noise processes.

In general three types of SVAR are distinguished on the basis of restrictions imposed.

a) A model (where B is set to be I_K)

The minimum number of identification restrictions is $\frac{K(K-1)}{2}$

b) B model (where A is set to be I_K)

The minimum number of identification restrictions is $\frac{K(K-1)}{2}$

c) AB model (where restrictions can be imposed on both matrices)

The minimum number of identification restrictions is $K^2 + \frac{K(K-1)}{2}$

Further, the SVAR model allows for the imposition of restrictions of identification as suggested in the theory to capture structural relations among the variables and to analyze transmission mechanisms and feedbacks of variables to the shocks in some other variables. Thus, we have to formulate a set of assumptions about the structural form of the economy. For the purpose, we follow the existing literature (Kang et al., 2016b; Sousa and Zaghini, 2008; Kim, 2001; Kim and Roubini, 2000; Sims and Zha, 1995; Bernanke, 1986) and rest our analyses on the following SVAR scheme:

$$C\mu_t = \varepsilon_t \quad \ldots \quad (3.43)$$

Here, C is the matrix of structural coefficients representing contemporaneous relations among the variables, μ_t is the vector of reduced form residuals and ε_t is the vector of true structural shocks.

Acquiring insight from the literature, we impose two sets of identification restrictions. The first set includes the identification restrictions recommended and utilized in the empirical literature on the monetary spillovers and transmission mechanism. The second set of identification restrictions conforms to Cholesky decomposition scheme.

Identification Scheme-I

Our first identification scheme imposes the following non-recursive identification restrictions in the contemporaneous structure.

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & a_{53} & a_{54} & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{64} & a_{65} & 1 & a_{67} & 0 \\ a_{71} & 0 & 0 & 0 & 0 & a_{76} & 1 & a_{78} \\ a_{81} & 0 & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{DLGL} \\ \mu_t^{DLGIPI} \\ \mu_t^{DLGCMPI} \\ \mu_t^{DLIPID} \\ \mu_t^{DLCPI} \\ \mu_t^{DLMD} \\ \mu_t^{DINTD} \\ \mu_t^{DLREERD} \end{bmatrix} = \begin{bmatrix} \varepsilon_t^{DLGL} \\ \varepsilon_t^{DLGIPI} \\ \varepsilon_t^{DLGCMPI} \\ \varepsilon_t^{DLIPID} \\ \varepsilon_t^{DLCPI} \\ \varepsilon_t^{DLMD} \\ \varepsilon_t^{DINTD} \\ \varepsilon_t^{DLREERD} \end{bmatrix} \quad \ldots \quad (3.44)$$

Here, $DLGL$ is the log difference of each global liquidity measure, $DLGIPI$ is the log difference of GIPI, $DLCMPI$ is the log difference of GCMPI, $DLIPID$ is the log difference of industrial production index of developing countries, $DLCPID$ is the log difference of the CPI of developing countries, $DLMD$ is the log difference of the monetary aggregate of developing countries, $DINTD$ is the first difference of the interest rate of developing countries, $DLREERD$ is the log difference of the real effective exchange rate of developing countries. Further, we estimate model in log difference form to avoid the possible problem of multicollinearity as the variables are highly correlated, and also some variables at the level of their logarithmic transformation are stationary and some are first order integrated but all variables are stationary at the first difference of their logarithmic transformation, but interest rate is stationary at its first difference.

In this scheme of identification, we incorporate global liquidity, GIPI and GCMPI as contemporaneously exogenous which implies that the developments in all other variables (variables of developing countries) included in the model have no contemporaneous effects but the delayed ones on them. Similarly, the restrictions in the fourth equation in the above-setting imply that none of the variables under investigation contemporaneously impact real economic activity of the developing countries (hereafter IPID). However, they have lagged effects on it. It conforms to the fact that real economic activity sluggishly responds to the exogenous shocks (Kim and Roubini, 2000; Bagliano and Favero, 1998).

In line with Kim and Roubini (2000) and Kim (2001), the fifth equation assumes that CMPI and IPID have contemporaneous impact on the CPI of developing countries (hereafter CPID) while CPID is contemporaneously independent of all other variables. Hence, fourth and fifth equations envisage sluggish reaction of real sector of the developing countries to exogenous developments. Following the literature, the restrictions in the sixth equation indicate that monetary aggregate of developing countries (henceforth MD) is contemporaneously exogenous to global variables but is contemporaneously endogenous to all the variables of developing countries except their real effective exchange rate (henceforth REERD), implying that demand for money depends on real economic activity and interest rate.

On the other hand, interest rate is generally treated as a policy variable of monetary authorities, and monetary policy feedback rule recognizes information delays that the monetary authorities cannot react to economic developments very quickly (within a month), therefore interest rate does not respond contemporaneously to real sector variables (Kang et al., 2016b; Sims and Zha, 2006, 1995). Nonetheless, the seventh equation visualizes that the interest rate of developing countries (henceforth INTD) responds contemporaneously to the developments in global liquidity. Further, consistent with the literature and owing to the fact that exchange rate possesses forward-looking property and operates daily considering current economic activities, REERD contemporaneously responds to the developments in all variables incorporated in the model, except GIPI (Kang et al., 2016b; Sousa and Zaghini, 2008). This connection of REERD with other variables is expressed by the eighth equation in the above-setting.

Identification Scheme-II

This identification scheme conforms to the recursive identification scheme suggested in Cholesky decomposition. It imposes identification restrictions in a way that the restriction matrix becomes a lower triangular matrix. It can be expressed as:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 & 0 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{DLGL} \\ \mu_t^{DLGIPI} \\ \mu_t^{DLGCMPI} \\ \mu_t^{DLIPID} \\ \mu_t^{DLCPI} \\ \mu_t^{DLMD} \\ \mu_t^{DINTD} \\ \mu_t^{DLREERD} \end{bmatrix} = \begin{bmatrix} \varepsilon_t^{DLGL} \\ \varepsilon_t^{DLGIPI} \\ \varepsilon_t^{DLGCMPI} \\ \varepsilon_t^{DLIPID} \\ \varepsilon_t^{DLCPI} \\ \varepsilon_t^{DLMD} \\ \varepsilon_t^{DINTD} \\ \varepsilon_t^{DLREERD} \end{bmatrix} \quad \ldots \quad (3.45)$$

This scheme of identification differs from the previous one as: it assumes that global liquidity contemporaneously impact the global variables – GIPI and GCMPI. Further, GCMPI contemporaneously responds to GIPI too. Besides, global variables have contemporaneous effect on all developing countries variables. However, in this scheme, MD is contemporaneously exogenous to INTD that implies that monetary aggregate does not contemporaneously respond to adjustments in the interest rate. That, depositors take time to make decisions about their deposit and investment strategy. In the same vein, it is visualized that INTD does not contemporaneously respond to the fluctuations in REERD, while it contemporaneously responds in the previous scheme of identification. Lastly, interest rate contemporaneously responds to developments in real sector (IPID and CPID) of the developing economies, implying that monetary authorities of developing countries are quick enough in making decisions that they instantly react to the dynamics IPID and CPID.

3.5.3 Description and Construction of Variables

Like global variables, the regional variables are also not available in accessible databases. In similar fashion, proxies for regional variables are also devised. To this end, we use different aggregation procedures exploited in the literature, to aggregate variables over developing countries in this section. The existing literature employs various procedures to aggregate variables over countries, as it employs different techniques for different variables. The description and the procedures employed in the construction of global liquidity, GIPI and GCMPI are given under section 3.2 and 3.3.3. However, the discussion on the construction of other variables, utilized in this section, is provided below.

IPID

It refers to the volume of business activities carried out in the developing countries and reflects overall business conditions prevalent in them. As noted earlier in section 3.3.3, the investigations that utilize monthly data mostly use industrial production index as an indicator of real economic activity (Ciccarelli and Mojon, 2010; Kim and Roubini, 2000; Bernanke et al., 1997). Seeking insight from these empirical works, we also use industrial production index or any component(s) of it (the maximum data on whichever is available) for each developing country, and then derive aggregated indicator of real economic activity for the developing countries. For the aggregation over countries, we employ GDP-weighted growth rates procedure, as being widely exploited by empirical literature. Moreover, this procedure of aggregation withstands the divergence in the measurement of industrial production index across countries, narrower and broader concepts (components of industrial production index) and availability of data for varying periods for each country (Belke and Keil, 2016; Ratti and Vespignani, 2015; Belke et al., 2014). The aggregation procedure can be sketched as:

In the first step, each country's GDP share in the total group GDP is calculated. The GDP share of the country is used as a weight for that country. Hence country- specific weight of country i in time t is[24]:

$$w_{it} = \frac{GDP_{it}/e_{it}^{PPP}}{\sum_{i=1}^{N}\left(GDP_{it}/e_{it}^{PPP}\right)} \quad \ldots \quad (3.46)$$

Where, w_{it} is the weight, GDP_{it} is the nominal GDP and e_{it}^{PPP} is the purchasing power parity exchange rate of country i in time t and N represents number of sampled developing countries, it ranges from one to forty i.e. $i = 1,2, \ldots\ldots,40$.

[24] For more detail, please see section 3.2.2 of this chapter.

The growth rates of industrial production index, constructed across the countries, can be obtained by allotting the weights calculated above to the growth rate of industrial production index of the respective country.

$$G_t = \sum_{i=1}^{N} w_{it} g_{it} \quad \ldots \quad (3.47)$$

Here, g_{it} is the growth rate of industrial production index of country i in time t and G_t is the aggregate growth rate in time t. Some studies use year specific weights at this stage of aggregation because the data on GDP is generally available in annual frequency (Belke and Keil, 2016; Belke et al., 2014; Darius and Radde, 2010). We also use year specific weights at this step of aggregation.

The aggregate industrial production index across the developing countries $IPID$ can be constructed by using an initial level 100 and multiplying it by aggregate weights computed above.

$$IPID_T = \prod_{t=2}^{T}(1 + G_t).100 \quad \ldots \quad (3.48)$$

CPID

Simply CPI measures the changes in price levels of the market basket of consumer goods and services which households purchase. Hence, CPI of developing countries reflects overall changes in the prices of consumer goods across the developing countries. Following Belke and Keil (2016), Belke et al. (2014) and Darius and Radde (2010), it is aggregated across the sampled developing countries employing the same modus operandi, outlined above in real economic activity of the developing countries – GDP-weighted growth rates. But, here, we use growth rates of CPI instead of industrial production index of developing countries.

MD

Monetary aggregate, very simply, reflects the value of monetary assets available in an economy in a certain time. Here, it is tantamount to the term "broad money". Hence, MD measures the value of monetary assets available in the developing countries. In line with the huge body of literature (Belke and Keil, 2016; Belke et al., 2010a, b; Giese and Tuxen, 2007; Baks and Kramer, 1999), the over-the-countries aggregation of monetary aggregates is carried out in the same vein as elaborated above (in IPID), using GDP-weighted growth rates technique. But, here, the growth rates of monetary aggregates of the sampled developing countries are exploited.

INTD

In economics, interest rate is the reward of the services of capital. Usually, it refers to the additional amount charged as percentage of principal amount by the lender for the use of its monetary capital. Further, it also serves as a measure of opportunity cost of holding cash. Gaining evidentiary support from Cerutti et al. (2017), we use benchmark rates of interest like discount rate, policy rate, money market rate or a three-month Treasury bill rate (whichever is available for each country). To construct aggregate interest rate for developing countries, we follow the technique widely used in the literature (Belke and Keil, 2016; Belke et al., 2010a, b; Darius and Radde, 2010). According to this technique, aggregate interest rate is the weighted-sum of the interest rates of individual countries, whereby the weights are assigned according to the GDP-share of a country in the group GDP to its interest rate. It can be expressed in mathematical form as:

$$INTD_t = \sum_{i=1}^{N} \left(\frac{GDP_{it}^{PPP}}{\sum_{i=1}^{N} GDP_{it}^{PPP}} \right) * INT_{it} \qquad \ldots \qquad (3.49)$$

Here, $INTD_t$ represents aggregate interest rate of developing countries in t, GDP_{it}^{PPP} shows purchasing power parity value of GDP of country i in time t, INT_{it} is the interest rate of country i in time t.

REERD

Real effective exchange rate (hereafter REER) is a price deflator adjusted or index of costs adjusted value of one currency in terms of basket or index of other currencies. Simply, it measures the value of one currency against a weighted average (where the weights are normally allotted according to trade share) of some foreign currencies, especially the currencies of major trading partners. To keep the weighting scheme, used in aggregation over the countries, closer to this weighting scheme, we construct weighted average of the REERs of the sampled developing countries. For this, we assign weight equal to the trade share in the total trade of the group of sampled developing countries to respective country's REER. Hence, aggregated REER of developing countries is calculated as:

$$REERD_t = \sum_{i=1}^{N}\left(\frac{TRD_{it}}{\sum_{i=1}^{N} TRD_{it}}\right) * REER_{it} \quad \ldots \quad (3.50)$$

Here, $REERD_t$ represents aggregated REER for developing countries in time t, TRD_{it} shows volume of trade (sum of exports and imports) in terms of US dollar of country i in time t, $REER_{it}$ is the REER of country i in time t and N is total number of sampled developing countries i.e. 40.

3.6 Descriptive Statistics of the Variables

Table 3.1 demonstrates the descriptive statistics of the variables (in their basic form) exploited in different analyses of the exploration. It is evident from the table that all global liquidity measures, except GLGDPW (whose mean and median values are almost equal), have median values greater than the mean values. It substantiates that global liquidity is leftward skewed, indicating relatively squeezed global liquidity conditions over at least half part of the sample. Similar facts are also reported for most of the global variables such as GIPI, GCPI, GINTD and GCBBF which indicate overall unfavourable global economic conditions during the sample period. However, for GCMPI and VIX mean values exceed median values, pointing to the relatively heightened global risk over more than half sample period. Other global variables (MSCI, GINT and GBL) post almost same values of mean and median. On the other hand, for all the developing countries variables, except for IPID and REERD (whose mean and median values are of almost similar magnitudes), mean values exceed median values, referring to the fact that developing countries were not severely pinched by the GFC.

Table 3.1: Descriptive Statistics of the Variables

	Obs.	Mean	Median	Std. Dev.	Maximum	Minimum
GLCE	193	188.028	196.94	55.903	288.084	91.071
GLDIV	193	208.913	229.967	50.612	283.987	96.936
GLGDPW	193	141.493	140.378	26.902	191.182	99.999
GLSUM	193	181.327	193.632	41.464	244.101	96.421
GLPCA	193	194.213	214.677	44.870	251.425	95.175
GIPI	193	95.375	96.528	5.281	105.159	84.539
GCPI	193	148.387	150.717	18.033	173.662	97.149
GCMPI	193	84.045	79.509	28.534	135.075	32.219
MSCI	193	333.910	332.034	74.960	517.424	191.046
GINT	193	1.335	1.036	0.743	3.0609	0.433
GINTD	193	0.969	1.34	1.207	3.44	-1.25
GBL	193	18.948	18.631	1.708	24.430	13.889
VIX	193	19.638	16.68	8.743	60.47	9.59
GCBBF	193	25640714	28209688	6262392	35185610	11166680
IPID	193	132.584	135.748	13.763	153.240	100.324
CPID	193	162.571	158.497	42.203	241.468	100.013
MD	193	438.268	386.649	266.083	972.795	100.001
INTD	193	7.367	6.702	1.586	12.473	5.709
REERD	193	103.544	103.995	9.187	119.242	88.317

Notes: GLCE is currency equivalent measure of global liquidity; GLDIV is Divisia index of global liquidity; GLGDPW is GDP-Weighted measure of global liquidity; GLSUM is simple-sum measure of global liquidity; GLPCA is the PCA-based measure of global liquidity; GIPI is global industrial production index; GCPI is global consumer price index; GCMPI is global commodity price index; MSCI is Morgan Stanley Capital International world equity index; GINT is global interest rate; INTD is global interest rate differential; GBL is global bank leverage; VIX is global risk (implied volatility) index; GCCBF is global cross border bank flows; IPID is industrial production index for developing countries; CPID is consumer price index for developing countries; MD is monetary aggregate for developing countries; INTD is interest rate for developing countries and REERD is real effective exchange rate for developing countries.

On the other hand, Table 3.2 presents the correlation coefficients matrix of the variables. The global liquidity indicators are highly correlated with one another, however, the strongest correlation is between GLSUM and GLPCA (where the correlation coefficient is 0.988) and the weakest correlation is between GLCE and GLPCA (with correlation coefficient being 0.869). Further, though the strength of association varies across global liquidity measures, yet global liquidity is substantially correlated with other global variables. However, its relatively highest correlation is with GCBBF and the lowest with GINTD. Besides, global liquidity is positively correlated with the volume of global real activity and consumer goods, commodity and asset prices (GIPI, GCPI, GCMPI, MSCI and GCBBF) and negatively with interest rate and global risk (GINT, GINTD and VIX). All this supports the existence of firm association between global liquidity and other global real and financial developments.

Nonetheless, GIPI has the similar nature of correlation as global liquidity has with other global variables. Interestingly, global liquidity indicators are comparatively more correlated with the developing countries variables than with the global variables. It further strengthens the fact that economic and financial developments in the developing economies are considerably associated with those in the advanced economies. Even, the strong correlation between GIPI and IPID, with correlation coefficient being 0.822, indicates that real economic activity of developing countries is also well associated with that of the developed countries.

Table: 3.2: Correlation Matrix of the Variables

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA	GIPI	GCPI	GCMPI	MSCI	GINT	GINTD	GBL	VIX	GCBBF	IPID	CPID	MD	INTD	REERD
GLCE	1.000																		
GLDIV	0.890	1.000																	
GLGDPW	0.937	0.916	1.000																
GLSUM	0.917	0.984	0.940	1.000															
GLPCA	0.869	0.985	0.882	0.988	1.000														
GIPI	0.485	0.708	0.697	0.668	0.653	1.000													
GCPI	0.673	0.895	0.656	0.846	0.909	0.616	1.000												
GCMPI	0.539	0.786	0.554	0.784	0.853	0.486	0.895	1.000											
MSCI	0.629	0.749	0.787	0.714	0.678	0.921	0.590	0.421	1.000										
GINT	-0.818	-0.531	-0.709	-0.634	-0.551	-0.108	-0.275	-0.254	-0.270	1.000									
GINTD	-0.273	-0.284	-0.395	-0.255	-0.205	-0.622	-0.168	0.066	-0.668	0.071	1.000								
GBL	-0.476	-0.301	-0.554	-0.406	-0.308	-0.341	-0.016	-0.117	-0.473	0.619	0.262	1.000							
VIX	-0.137	-0.148	-0.221	-0.149	-0.114	-0.501	-0.132	-0.028	-0.566	0.062	0.645	0.376	1.000						
GCBBF	0.633	0.891	0.671	0.833	0.893	0.634	0.926	0.842	0.584	-0.170	-0.155	0.056	0.031	1.000					
IPID	0.846	0.971	0.929	0.959	0.949	0.822	0.842	0.733	0.837	-0.493	-0.434	-0.380	-0.274	0.851	1.000				
CPID	0.933	0.898	0.998	0.929	0.865	0.693	0.629	0.535	0.786	-0.730	-0.397	-0.596	-0.243	0.634	0.916	1.000			
MD	0.920	0.866	0.992	0.901	0.827	0.689	0.575	0.478	0.792	-0.733	-0.415	-0.631	-0.261	0.582	0.891	0.996	1.000		
INTD	-0.776	-0.853	-0.746	-0.858	-0.877	-0.592	-0.840	-0.724	-0.613	0.515	0.410	0.227	0.298	-0.775	-0.858	-0.731	-0.689	1.000	
REERD	0.849	0.869	0.926	0.899	0.860	0.617	0.649	0.653	0.709	-0.662	-0.232	-0.589	-0.141	0.663	0.879	0.926	0.915	-0.680	1.000

Notes: As for Table 3.1.

3.7 Data Description and Sources

The data collection and smoothing processes have undergone a number of statistical treatments because of various data issues: missing data, different frequencies and different measurement units. Besides, we have to resort to different data sources due to non-availability of data from one source. Further, our samples of countries and time period have primarily been determined by the availability of data. These data issues and their treatments, and availability of data are discussed as below.

Global liquidity

We use monthly data for 21 high income[25] countries (list of the sampled countries is given in Table A3.1 in the Appendix) spanning from December 2001 to December 2017 to construct measures of global liquidity. Since countries do not follow a uniform definition of monetary aggregates, we use broad money as defined by the IMF as the broadest aggregate for each country. The data on broad money and its components are available for maximum of the sampled countries except Hong Kong, New Zealand, Singapore, the UK and the US. Further, the *Monetary and Financial Statistics Compilation Guide* prepared by the IMF identifies the counterparts of broad money for these countries, for example, M2 for the US, M3 for the Euro Area, M4 for the UK and M3 for other countries. We use broad money counterparts for these countries and derive their subcomponents by classifying the constituents of M1, M2 and M3 separately. For the countries with the broadest aggregate of M3, we make their three subcomponents, M1[26], the assets incorporated in M2 but not in M1 and the assets included in M3 but not in M2. But for the US, we use subcomponents, currency in circulation, the assets included in M1 other than currency in circulation and the assets included in M2 but not in M1. Moreover, the broad money contains four components: currency in circulation, transferable deposits, other deposits included in broad money, deposits other than securities included in broad money. The data on monetary aggregates, interest rates, exchange rate, consumer price index and population has been extracted from the IFS, except the data on monetary aggregates of the US and the UK, which has been taken from the FRED and that of Canada has been taken from the Canadian central bank

[25] We follow the World Bank list of economies (2017) for the classification of countries into developed and developing ones.

[26] We use M1 because it comprises of currency in circulation and demand deposits which bear almost zero interest for almost all these countries.

(CANSIM). We use cubic spline interpolation for interest rates and linear interpolation for monetary aggregates where the period of missing data is less than one year otherwise for longer period (but less than three years) we use regression technique; regressing the variable whose data is missing on the related variables. For example, if the data on one component of broad money is short, we use the forecasted data obtained through regressing that component on other components. Similarly, for interest rates, we regress the type of interest rate whose data is short on other types of interest rates. All the series, except interest rates, are seasonally adjusted through the X11[27] process except where already seasonally adjusted are available[28]. We use linear interpolation to convert population data from annual frequency to monthly frequency.

Global Variables

We use monthly data for the same period specified above for sampled high income countries to construct global variables where already constructed global variables are not available from the accessible data sources. The data for global commodity prices has been extracted from the World Bank[29] and for the MSCI[30] world index from investing.com. The GIPI has been proxied by OECD[31] industrial production index whose data has been taken from OECD database. The data on share and equity, and assets of depository corporations has been extracted from IFS and we use cubic spline interpolation technique to convert it into monthly frequency for the countries whose quarterly[32] data is available. The data on cross-border bank flows has been taken from the Bank for International Settlements locational statistics, table A5, which is available in quarterly frequency and is converted into monthly frequency through cubic spline interpolation method. The source and description of interest rate data are the same as discussed under the preceding heading, global liquidity. All series, except interest rate and interest differential, are seasonally adjusted through X11 process.

[27] X11 is a filter-based method of seasonal adjustment and is grounded on "ratio to moving average procedure" presented by Macaulay (1931).
[28] The monetary aggregates of the UK and Canada were already seasonally adjusted.
[29] The World Bank Commodity Price Data (the Pink Sheet).
[30] The available data on MSCI world equity index starts from August 2004 we use forecasted data for December 2001 to July 2004 by regressing world MSCI on the US and the EU share prices.
[31] The OECD countries contribute more than 75% of the world GDP, so IPI of OECD countries can be a best proxy of global IPI.
[32] The data for New Zealand, the UK and the US is in quarterly frequency.

Variables of Developing Countries

Here, we also exploit monthly data for the aforementioned period for the sampled 40 developing countries (list of the sampled developing countries is given in Table A3.1 in the Appendix). The sample of developing countries is principally decided on the availability of industrial production index data. We exclude those countries from the sample whose data is not available for more than four years. We also use component of industrial production index, manufacturing index (can also be used as a measure of real economic activity as suggested in the IFS database) for the countries whose industrial production index data is not available. Further, we use cubic spline interpolation technique to convert the data into monthly frequency, where it is already not available in monthly frequency for some or the whole period[33]. The data on industrial production index and manufacturing index has been extracted from the IFS for all countries, except China, India and Russian Federation whose data has been taken from FRED. The data on CPI, monetary aggregates and interest rate has also been taken from IFS and has been interpolated through cubic spline method where there are missing observations within the data. Exports and imports data has been taken from the *Direction of Trade Statistics*. The data on REER has been obtained from the Bruegel[34]. All the variables, except interest rate, have been seasonally adjusted through X11 process in this section too.

[33] We convert quarterly data into monthly for some or the whole period for Albania, Algeria, Angola, Botswana, China, Georgia, Morocco, Pakistan, Senegal and Zambia.
[34] Bruegel is a European think tank specializes in economics, based in Brussels, Belgium.

CHAPTER 4

RESULTS AND DISCUSSION-I

Dynamics of Regional and Global Monetary Aggregates

This chapter discusses the dynamics of the monetary aggregates constructed though different techniques of the monetary aggregation and the Divisia user cost for monetary assets over time. It examines their interrelationships and behaviours, especially during the periods of financial turbulence in different regions and countries. The severe financial catastrophe with widespread impact erupted during the period of investigation of this study is the global financial crisis (henceforth GFC) of 2007-2008. This chapter proceeds on investigating the dynamics of monetary aggregates at a regional and then at a global level. Hence, its first section investigates the dynamics of monetary aggregates and Divisia user cost for monetary asset for East Asia and Pacific. The second section examines the developments in monetary aggregates and Divisia user cost for monetary assets for Europe and Central Asia. The third section inspects the dynamics of monetary aggregates for Latin America and Caribbean. The fourth section deals with the monetary aggregates for the Middle East and North Africa. The fifth section elaborates developments in the monetary aggregates of North America. And the last section investigates the dynamics of global monetary aggregates and Divisia user cost for monetary assets over time.

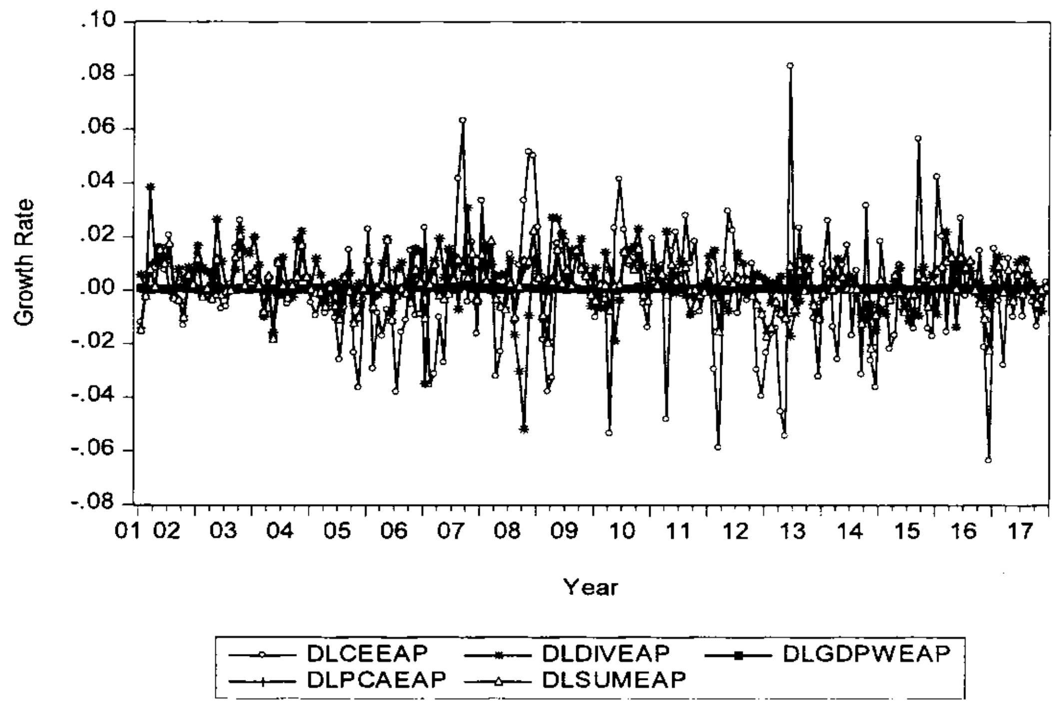
4.1 East Asia and Pacific

Figure 4.1 shows that the theory-based measures of monetary aggregates envelop the atheoretical ones. The currency equivalent (henceforth CE) and Divisia monetary aggregates undergo substantial variations especially during the GFC period (2007-2008) and its aftermath, which indicates the prevalent uncertainty during the period.

The positive growth rate of around 4% registered by the Divisia index in the beginning of 2002 indicates the recovery from the Asian financial crisis (1997) during which Japan and Korea were fiercely hit, and Japan took around seven years to recover (Reinhart and Rogoff, 2014). After this, till the end of 2005, all the measures show normal behaviour. From late 2005 to the beginning of 2007, the theoretic measures record a negative growth rate most of the times, indicating gradually squeezed liquidity.

Figure 4.1: Monthly Growth Rates of Monetary Aggregates of East Asia and Pacific

This Figure depicts the dynamics of monetary aggregates constructed through different aggregation techniques employed by the study for East Asia and Pacific. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

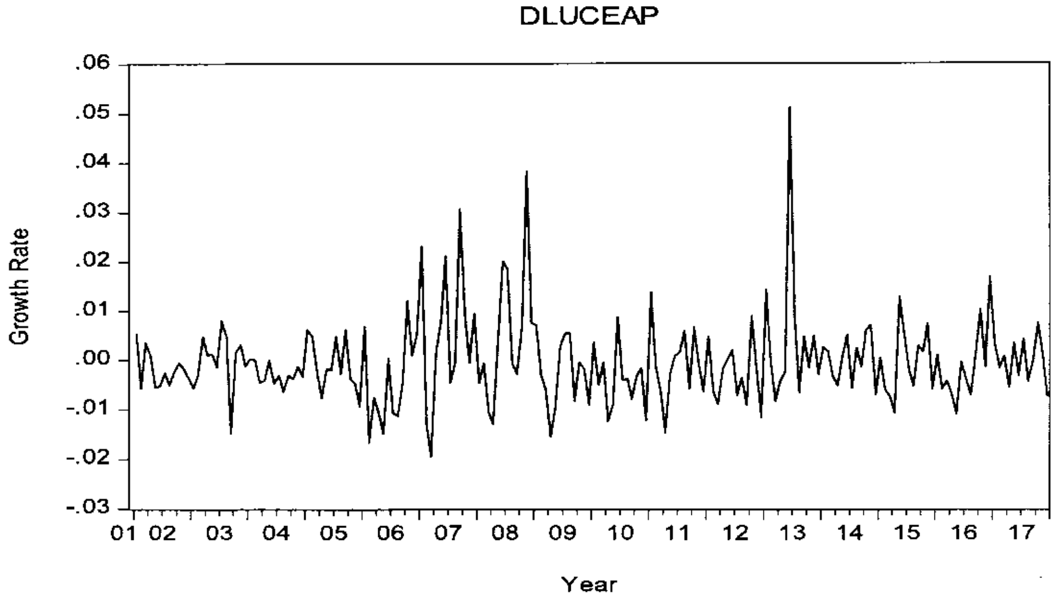


Further, both the measures record huge variations throughout 2007 to 2014 supporting the view of Reinhart and Rogoff (2014). They argue that the impact of the global financial crisis lasted for around seven years. During this period the Divisia and CE aggregates, most of the time, undergo negative growth rate. The Divisia index records the highest negative growth rate of about 6% at the end of 2008 while CE measure registers negative growth rate of around 4% in 2010, 2012 and then in 2013. The period spanning from the end of 2013 to 2015 is the period of relative tranquility. After this the CE measure records variations again. Contrarily, the atheoretical measures fail to indicate changing financial conditions and especially that the GDP-weighted growth rates measure registers very smooth dynamics in all conditions. Hence, theoretic measures perform better than atheoretical ones as indicators of financial conditions.

It is evident from Figure 4.2 that the growth rate of Divisia user cost undergoes substantial variations during the period of 2007 to 2009 indicating uncertain financial conditions. The Divisia user cost records normal behaviour except in the period when the intensity of the global financial crisis was very high and at the end of 2013. The spike in 2013 is ephemeral in nature and disappears very soon.

Figure 4.2: Monthly Growth Rate of Divisia User Cost for East Asia and Pacific

This Figure depicts the dynamics of Divisia user cost of monetary assets for East Asia and Pacific. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



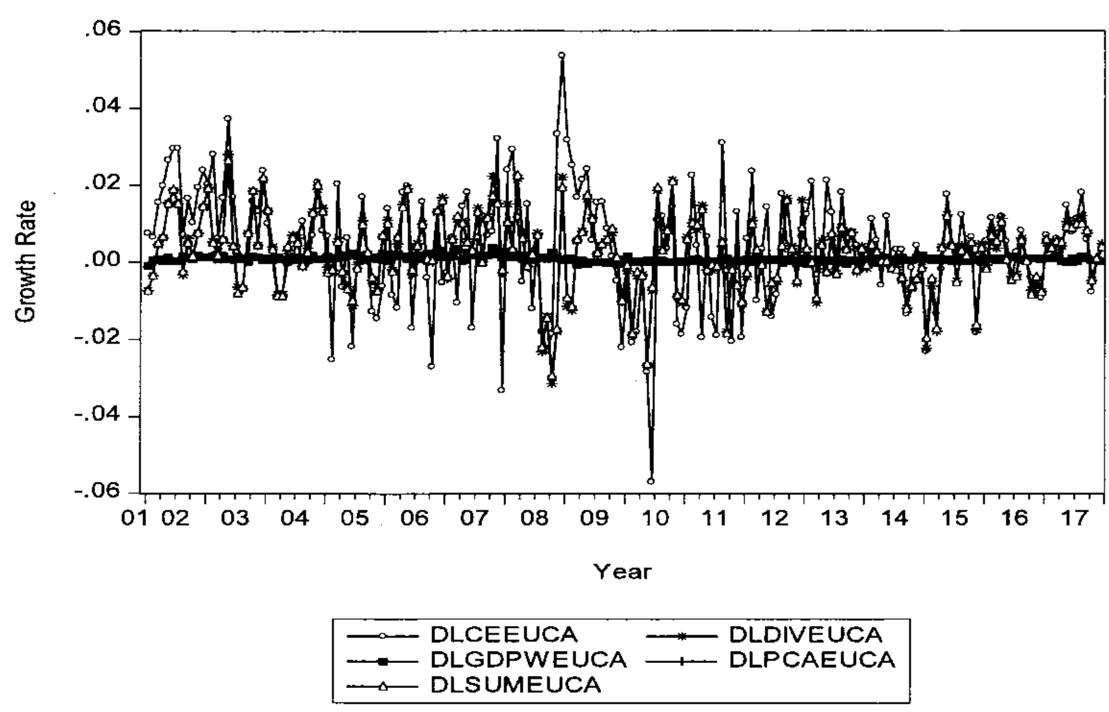
However, the variations recorded from 2007 to 2009 indicate uncertain and fragile financial conditions which were felt almost across the globe. It supports the stance of Alkhareif and Barnett (2012) that the Divisia user cost can be a good indicator of financial and liquidity conditions.

4.2 Europe and Central Asia

Figure 4.3 depicts that the theoretic monetary aggregates are more volatile as compared to the atheoretical ones. The CE and Divisia aggregate curves wrap the curves of other aggregates. The fluctuations in CE and Divisia aggregates gradually increase from 2006 but the amplitude of the swings becomes larger from the end of 2007 onward till 2010. Afterwards, the amplitude of fluctuations decreases gradually, though not as that in normal conditions till 2013. Overall, the oscillations in the growth rates of CE and Divisia aggregates portray the period of 2007 to 2013 as a period of distress. This is in line with the reality that many of the European countries were pinched during the GFC. The European economies suffered from the financial panic in 2007 and 2008 severely and could not recover fully till 2013 (Reinhart and Rogoff, 2014). However, the other measures of monetary aggregation fail to represent and distinguish financial and liquidity conditions clearly.

Figure 4.3: Monthly Growth Rates of Monetary Aggregates of Europe and Central Asia

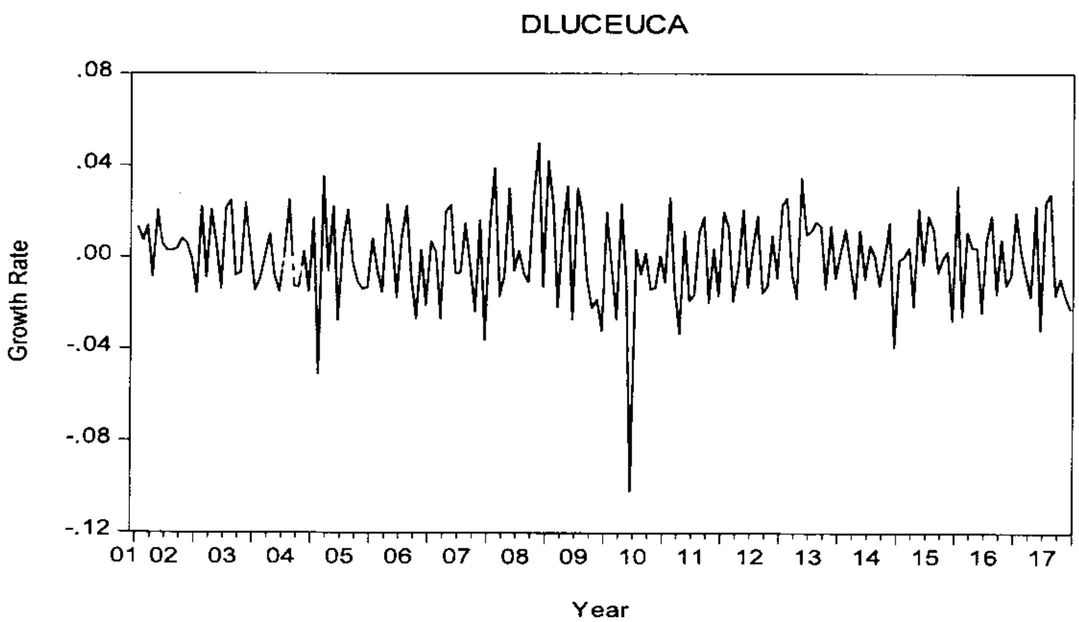
This Figure depicts the dynamics of monetary aggregates constructed through different aggregation techniques employed by the study for Europe and Central Asia. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



The Divisia user cost of monetary assets for the region of Europe and Central Asia behaves normally except in few periods where it registers unusual peaks (Figure 4.4). However, the amplitude of oscillations in 2008 to 2010 is relatively larger than that in other periods which indicates uncertainty in financial markets. The Divisia user cost posts highest positive growth rate around 5% in 2008 and negative around 10% in 2010. Anyhow, it can be deduced that the Divisia user cost for this region has also indicated the financial catastrophe of 2007-2008.

Figure 4.4: Monthly Growth Rate of the Divisia User Cost for Europe and Central Asia

This Figure illustrates the dynamics of Divisia user cost of monetary assets for Europe and Central Asia. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



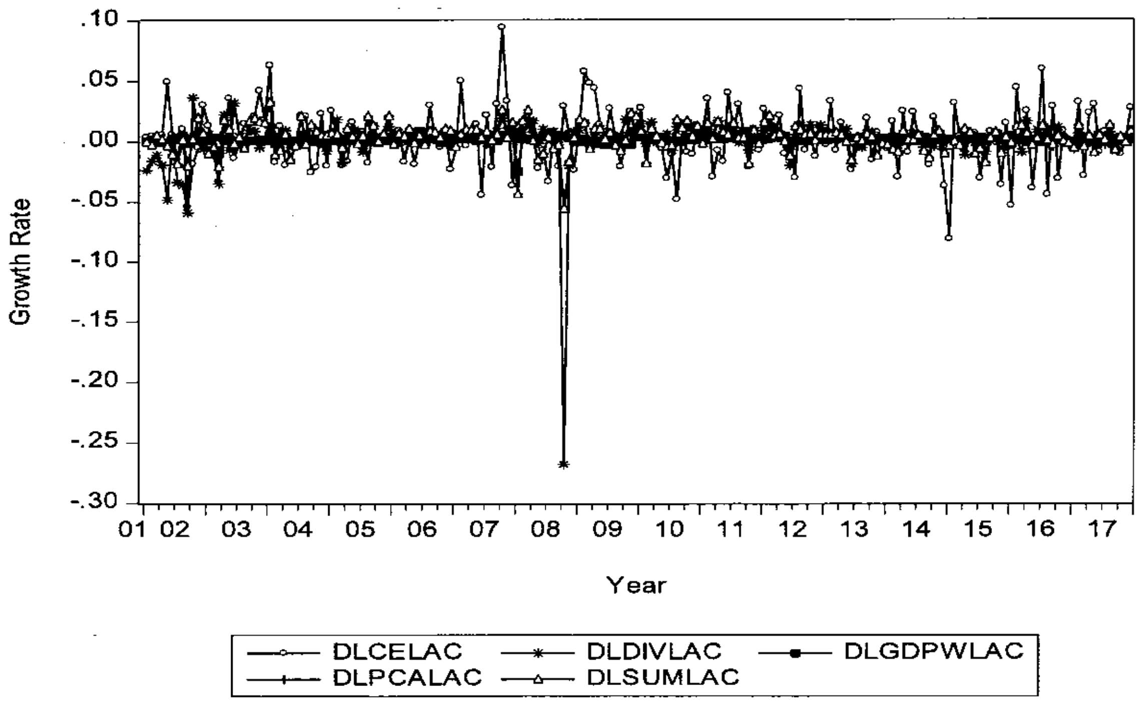
4.3 Latin America and Caribbean

In Figure 4.5, a cluster of negative growth rates posted by the Divisia monetary aggregate in 2002 accurately indicates the banking crisis of Uruguay in 2002. The severity index of this crisis, as noted by Reinhart and Rogoff (2014), is 26.9. Later, from 2003 to 2007, a period of tranquility is portrayed in the figure. During the period of 2007 to 2009 the CE aggregate witnesses two peaks of positive growth rates while the Divisia aggregate undergoes a plunge with negative growth rate of above 25% in 2008. The plunge undertaken by the Divisia aggregate corresponds to the financial panic engendered by the GFC. Afterwards, all the measures depict tranquil economic conditions, except for in 2016, where the CE aggregate indicates uncertain financial conditions. The CE measure appropriately captures the uncertain conditions resulting due to slowdown in Uruguay's economy and consequent fiscal and monetary measures taken by the government in 2016. Moreover, the CE and

Divisia measures indicate financial and liquidity conditions in a far better way than other measures even in this case.

Figure 4.5: Monthly Growth Rates of Monetary Aggregates of Latin America and Caribbean

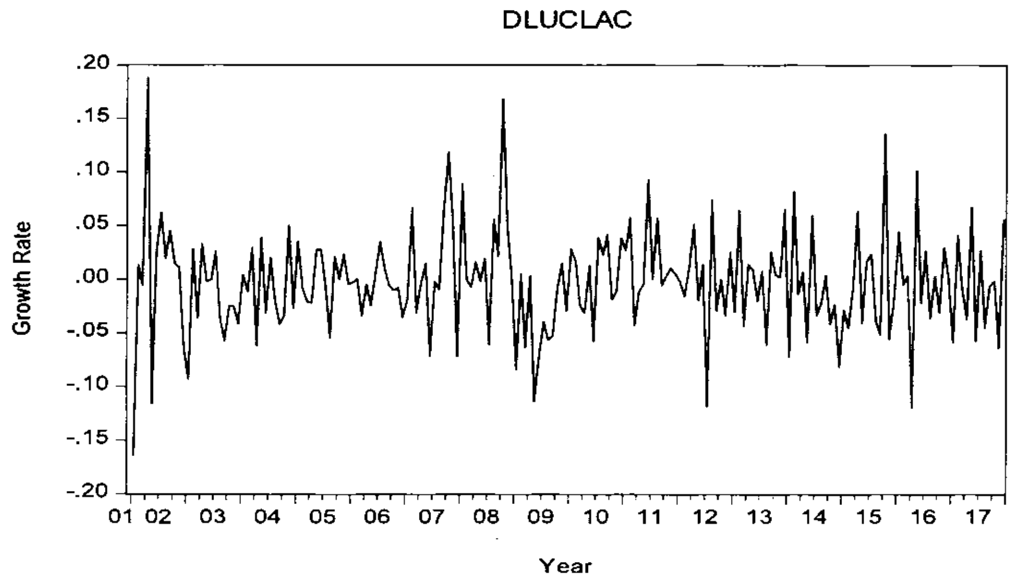
This Figure illustrates the dynamics of monetary aggregates constructed through different aggregation techniques employed by the study for Latin America and Caribbean. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



In Figure 4.6, the Divisia user cost of monetary assets for Latin America and Caribbean indicates financial distress in 2002 as it registers larger variations. Hence, it appropriately signals the Uruguay crisis of 2002. Later it again posts visible fluctuations in 2007 to 2009 which indicates uncertain financial conditions associated with the GFC. The plunge of the Divisia user cost with negative growth rate of above 10% in 2012 may be accorded to the repercussions of the GFC. Moreover, it also indicates financial uncertainty of some degree in 2016 as represented by the CE measure.

Figure 4.6: Monthly Growth Rate of the Divisia User Cost forLatin America and Caribbean

This Figure illustrates the dynamics Divisia user cost of monetary assets for Latin America and Caribbean. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



4.4 The Middle East and North Africa

As mentioned earlier, we have only one country, Israel, in our sample as a representative of this region. In Figure 4.7, the CE aggregate presents much variation in 2002-2003 which is the period during which the Israeli government took various steps to strengthen financial stability. As per the Financial Stability Report 2003 prepared by the central bank of Israel, financial conditions in the economy improved because of the fiscal and monetary measures taken by the government. However, the Divisia and other aggregates do not show any kind of financial or liquidity turbulence in the economy during this period. The CE aggregate again posts fluctuations in the span of 2007 to 2009, while the Divisia aggregate registers very small variations. The Israeli economy was not affected by the GFC to the extent as compared with other major economies of the world. Yet, the Israeli authorities undertook some measures to ward off the impact of the GFC. All the aggregates show a smooth trend after 2009.

Figure 4.7: Monthly Growth Rates of Monetary Aggregates of Israel

This Figure illustrates the dynamics of monetary aggregates constructed through different aggregation techniques employed by the study for Israel. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

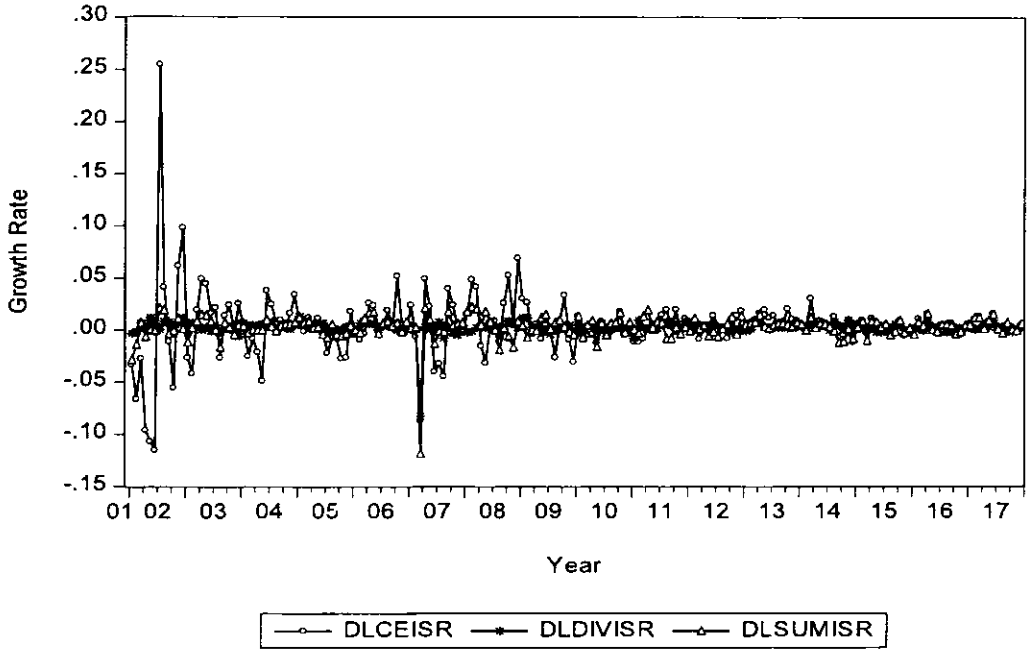
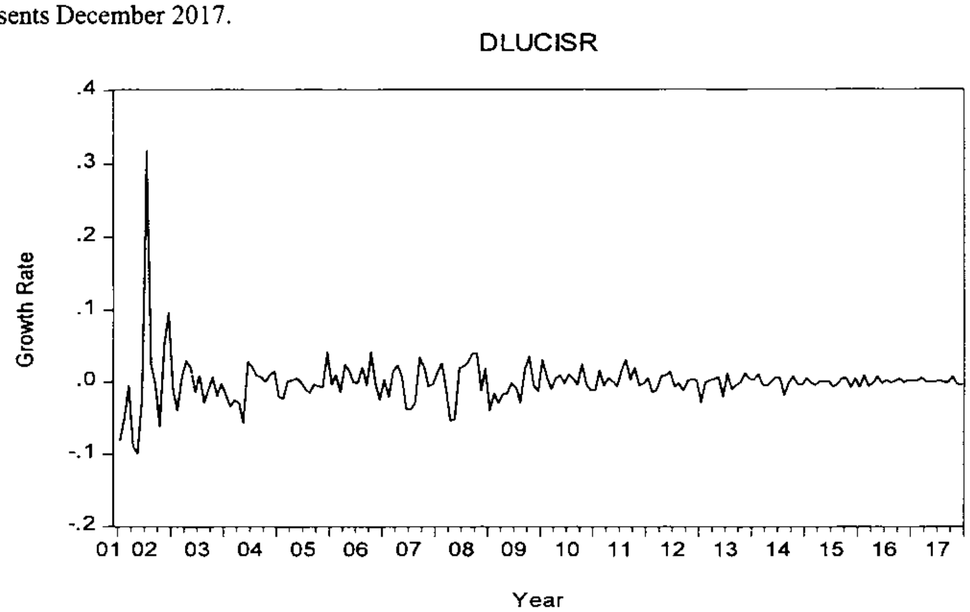


Figure 4.8 reveals that the Divisia user cost of monetary assets for Israel substantially fluctuates in 2002 to 2003 which is the period during which the Israeli authorities undertook visible shift in their fiscal and monetary stance.

Figure 4.8: Monthly Growth Rate of the Divisia User Cost of Monetary Assets for Israel

This Figure illustrates the dynamics of Divisia user cost of monetary assets for Israel. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



Though the amplitude of oscillations is small, but it fluctuates in 2007 to 2009 indicating the financial uncertainty and consequent measures taken by the authorities to pacify it. So, the user cost of monetary assets appropriately signals the change in policy stance as well as the change in financial and liquidity conditions.

4.5 North America

In Figure 4.9, the CE monetary aggregate records huge variations from the beginning of the sample period to 2004, pointing to the uncertain conditions prevailing in the US due to the 9/11 incident, and the subsequent Afghan and Iraq wars. The economic and financial horizons of the country were overcast with uncertainty resulting in the loss of investor and consumer confidence. However, the other monetary aggregates do not show any panic during this period (Figure 4.10). This might be due to the fact that the US economy did not witness any severe setback during this period.

Figure 4.9: Monthly Growth Rate of the CE Monetary Aggregate of North America

This Figure illustrates the dynamics of currency equivalent monetary aggregate for North America. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

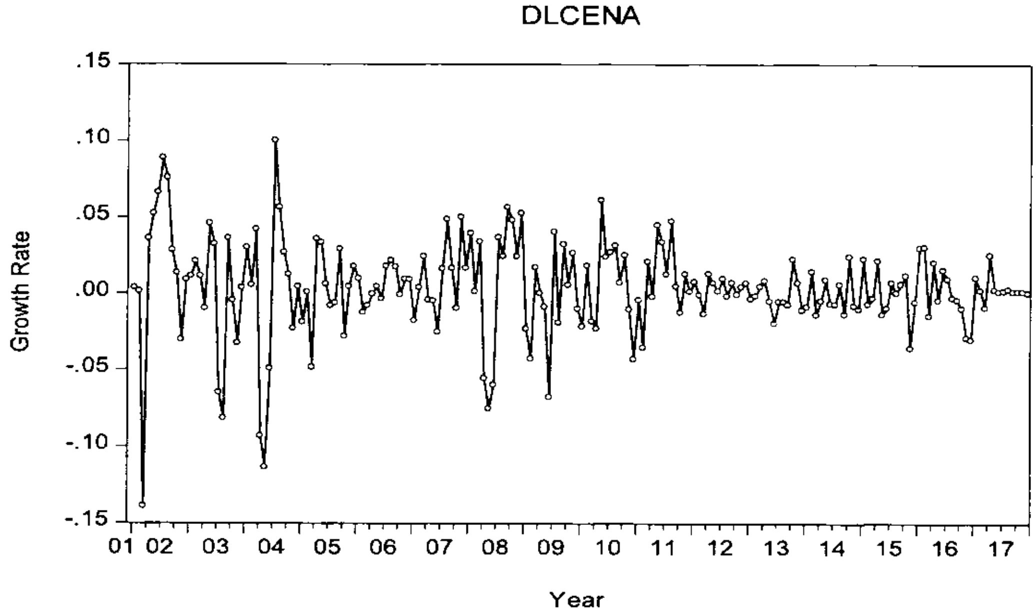
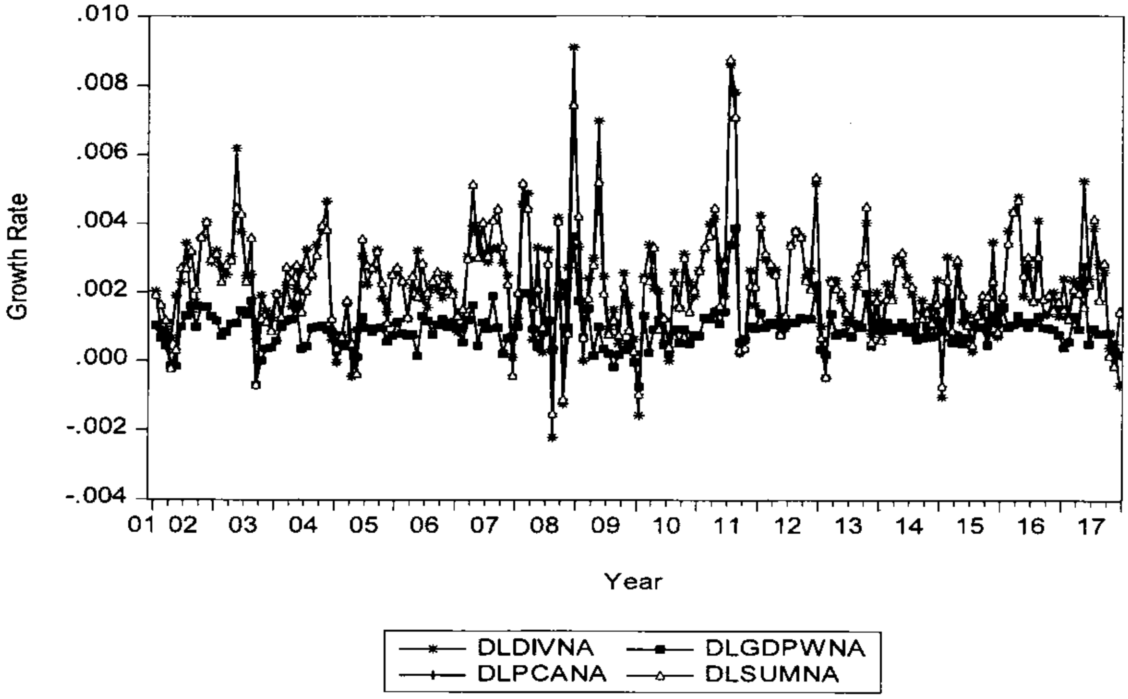


Figure 4.10: Monthly Growth Rates of Monetary Aggregates (other than CE) of North America

This Figure illustrates the dynamics of monetary aggregates other than currency equivalent, constructed through different aggregation techniques employed by the study for North America. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

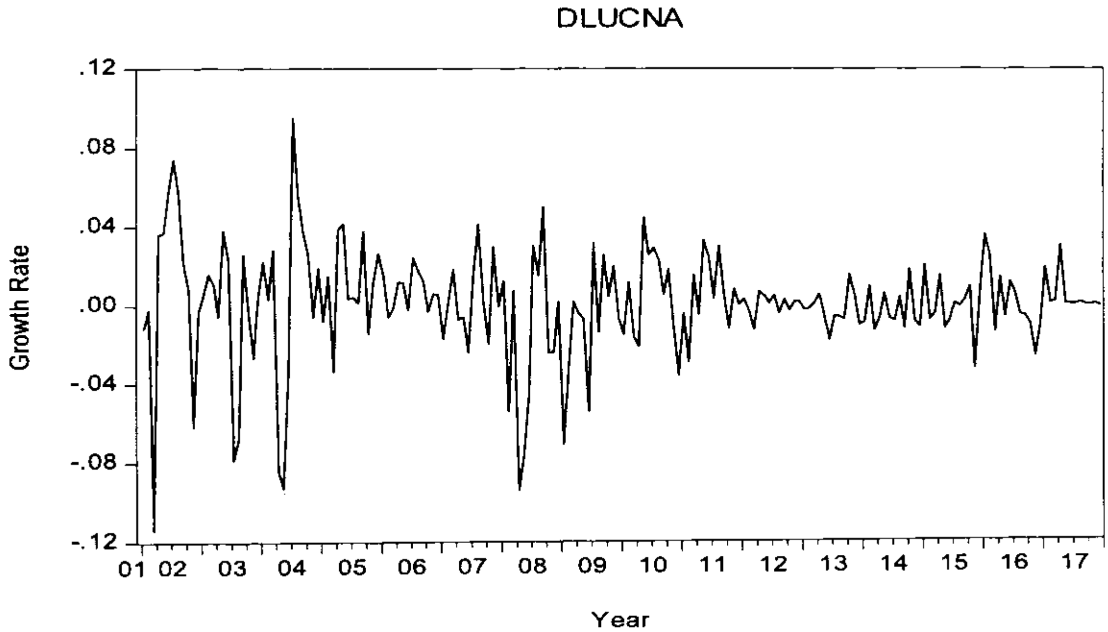


Nevertheless, the US government undertook some fiscal and monetary steps to pacify the situation and to muster investor and consumer confidence, as reported by the Presidential Economic Reports of 2003 and 2004 of the US. All the monetary aggregates undergo considerable fluctuations in 2007 to 2012, pointing to fragile financial and liquidity conditions of the US economy during the GFC (Figures 4.9 and 4.10). The US economy was squeezed by this financial panic in 2007 and recovered from it in 2013 (Reinhart and Rogoff, 2014).

In Figure 4.11, the Divisia user cost of monetary assets for North America indicates uncertainty of economic and financial conditions in the region by presenting unstable behaviour from the beginning of sample period to 2004. Its growth rate shows oscillations with a relatively larger amplitude during this period. This period is characterized by the least confidence of economic agents in the US economy due to of 9/11 terrorist attack and consequent Afghan and Iraq wars. Again, from 2007 to 2012 the unusual fluctuations represent financial instability emanated by the GFC. Afterwards, it posts normal patterns.

Figure 4.11: Monthly Growth Rate of the Divisia User Cost of Monetary Assets for North America

This Figure illustrates the dynamics of Divisia user cost of monetary assets for North America. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

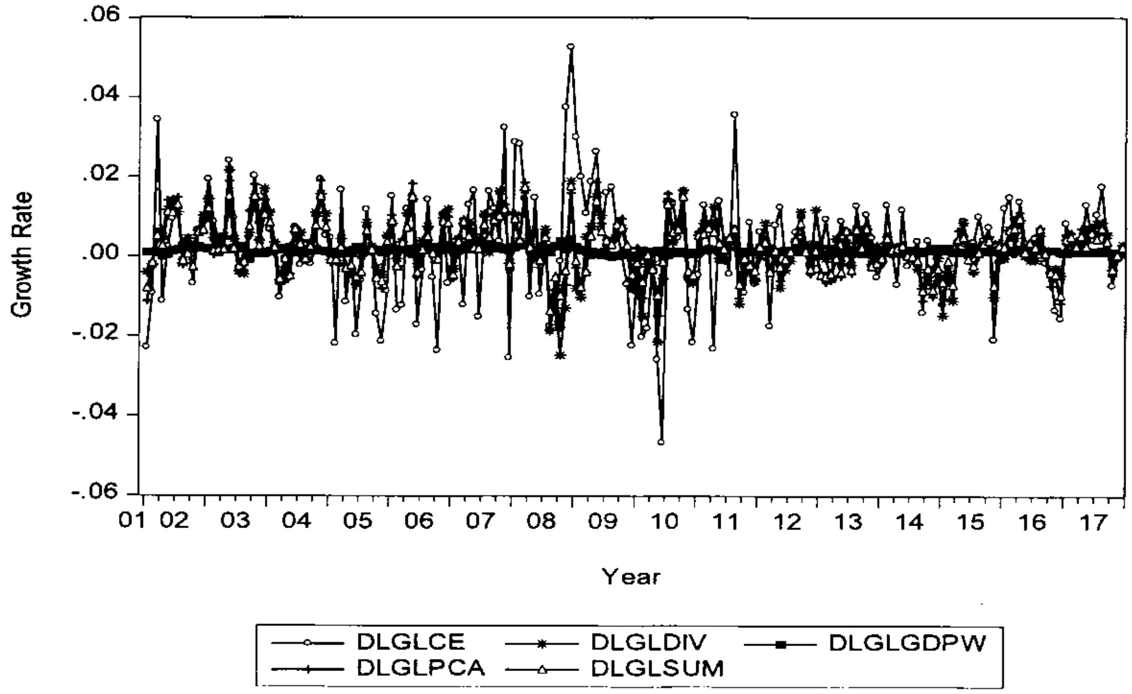


4.6 Global Scenario

Figure 4.12 depicts global financial and liquidity conditions through the lens of monetary aggregates. All the aggregates fluctuate, but the CE aggregate is the most variant, and the GDP-weighted growth rates aggregate is the least variant throughout the sample period. The CE and Divisia aggregates encompass the other measures. However, the amplitude of variations in the Divisia aggregate is smaller than that of the CE aggregate. The larger variation posted by the CE aggregate in 2002 might be due to the uncertainty engendered by the 9/11 incident. A cluster of positive growth rates indicates an expansionary period after the Asian financial crisis and Uruguay crisis of 2002. From 2002 to the start of 2007, all the aggregates show normal behaviour with a mixture of positive and negative growth rates. It is from 2007 to the end of the sample period that clusters of positive and negative growth rates start to follow each other frequently. The clusters of positive and negative growth rates might be due to the fact that we use monthly data. During the period of 2007 to 2013, all the aggregates oscillate with larger amplitude, which can be accorded to the uncertain and fragile financial conditions resulting from the GFC. From 2014 to the end of the sample period, smaller amplitude of variations represents normalized conditions.

Figure 4.12: Monthly Growth Rates of Global Monetary Aggregates

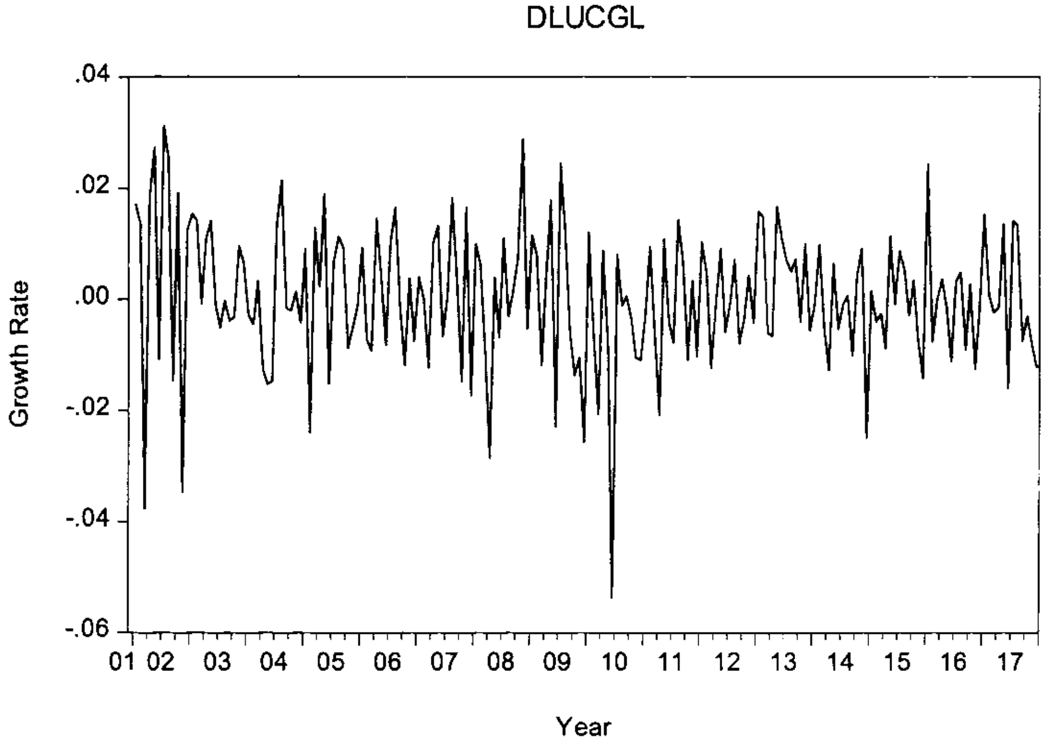
This Figure illustrates the dynamics of global monetary aggregates constructed through different aggregation techniques employed by the study. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



In figure 4.13, the Divisia user cost of monetary assets for global level register variations of larger amplitude which indicates atmosphere of uncertainty caused by the Asian financial crisis of 1997, Uruguay crisis of 2002, and the last but not the least 9/11 incident and consequent war against terrorism. The US economy being one of the world's largest economies and deeply integrated with the world functions as a potential driver of global activities. Therefore, the variability of user cost in 2002 might be accorded to the uncertainty prevailing in the US economy at that time. The period of 2003 to 2006 can be described as a period of tranquility as the growth rate of the Divisia user cost shows normal trends. Again, the amplified oscillations of growth rate of user cost of monetary assets in the span of 2007 to 2010 indicate financial and liquidity turmoil. Many of the countries especially the European countries and the US were pinched by the eruption of financial volcano during this period. Afterwards, the growth rate of user cost of monetary assets presents normal behavior, indicating economic and financial serenity.

Figure 4.13: Monthly Growth Rate of the Divisia User Cost for Global Monetary Assets

This Figure illustrates the dynamics of global Divisia user cost of monetary assets. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



Putting together, the CE aggregate in almost all the cases remains the most variant while the GDP-weighted growth rates aggregate remains the least variant. The CE aggregate is highly sensitive to changes in the quantities of monetary assets and their returns. The larger fluctuations presented by the CE measure can be imputed to the couplet effect of change in monetary quantities and their user costs. After the CE, the Divisia aggregate posts larger variations than other aggregates. Moreover, the CE and Divisia aggregate appropriately identify the GFC and its repercussions through presenting unusual fluctuations in this period. However, all the aggregates are highly correlated. Additionally, the Divisia user cost of monetary assets accurately delineates the financial conditions and policy stance of each region and on a global scale. This reflects the uncertainty and fragility of financial conditions in almost every economic and financial distress such as the 9/11 incident, the Uruguay banking crisis of 2002 and the global financial crisis of 2007-2008. It subtly distinguishes the periods of tranquillity and turbulence. For this reason, it supports the stance of Alkhareif and Barnett (2012) that the Divisia user cost can act as a good indicator of financial and liquidity conditions.

CHAPTER 5

RESULTS AND DISCUSSION-II

Relative Performance of the Global Liquidity Measures

This chapter elaborates the results of diagnostic tests carried out to establish the validity of econometric techniques executed to appraise the performance of the global liquidity measures devised in this study. Further, it also evaluates their relative performance on the ground of the results obtained under different analyses. For the purpose, it evaluates the findings derived about the relative ability of the measures to forecast global real activity (henceforth GIPI), global CPI (henceforth GCPI), global commodity price index (henceforth GCMPI) and global equity price index (MSCI). Besides this, it also investigates the strength of associations between the lags of the secular components of the global liquidity measures and other global variables under inspection by taking into account the outcomes of correlation analysis. For this, its first section discusses the relative forecasting performance of global liquidity measures and the second section elaborates the findings of correlation analysis.

5.1 Forecasting Performance of the Global Liquidity Measures

To appraise the forecasting performance of the global liquidity measures, the study investigates the order of integration of variables, executes cointegration analyses, probes into the statistics of root mean squared error (henceforth RMSE) and mean absolute error (henceforth MAE) and undertakes visual inspection of forecasts. This section analyses the results of all these explorations.

Unit Root Test Results

As already mentioned in the earlier chapter (chapter 3), we perform the augmented Dickey-Fuller (henceforth ADF) test to determine the level of integration of variables. In this experiment, the lag length, for each variable, is selected through automatic lag selection procedure with maximum lag length up to 14 on the basis of Akaike Information Criterion (henceforth AIC). The results of ADF test show that all variables, at level, are nonstationary at 5% level of significance[35] as the null hypothesis, in each case, is not rejected at this level of significance (Table 5.1). However, all of them become stationary at their first difference at 5% level of significance.

Table 5.1: ADF-Test Results

	Level		**First Difference**	
Variable	***t-Satistic***	***P-Value***	***t-Statistic***	***P-Value***
GLCE	-0.879	0.793	-4.994***	0.000
GLDIV	-1.744	0.407	-5.887***	0.000
GLGDPW	-1.856	0.673	-5.178***	0.000
GLSUM	-1.523	0.519	-10.325***	0.000
GLPCA	-1.831	0.364	-5.873***	0.000
GIPI	-2.129	0.233	-3.992***	0.001
GCPI	-2.603*	0.094	-5.907***	0.000
GINT	-1.659	0.450	-3.007**	0.036
GCMPI	-2.049	0.266	-6.384***	0.000
MSCI	-0.445	0.897	-11.853***	0.000

Notes: As for Table 3.1. ***, ** and * imply significance at 1%, 5% and 10% level respectively.

[35] The GCPI is stationary at 10% level of significance in its level form.

Furthermore, the first difference of all variables is stationary at 1% level of significance, except that of global interest rate (henceforth GINT) which is stationary at 5% level of significance. All this suggests that the order of integration of all variables is the same, which is I (1). Hence, it justifies the use of VAR model and Johansen cointegration test for further analyses.

Cointegration Test Results

The model for cointegration analysis includes constant but no trend term in case of all measures of global liquidity[36]. The results presented in the Tables 5.2 and 5.3 substantiate that there exists stable long-run relationship among the variables under investigation. Both the cointegration rank tests (trace and maximum eigenvalue criteria) establish the existence of long run relationship among variables at 5% level of significance, as both the null hypotheses that there exists no cointegrating vector against the existence of six cointegrating vectors, under trace test, and that there exists no cointegrating vector against the existence of one cointegrating vector, under maximum eigenvalue test, are rejected at, at most 5% level of significance.

Table 5.2: Cointegration Rank Test (Trace) Results

Global Liquidity Measure	No of Cointegrating Equation(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	*P-Value*
GLCE	None ***	0.264	113.433	95.753	0.001
GLDIV	None ***	0.227	113.258	95.753	0.001
GLGDPW	At most 1 **	0.151	73.7686	69.818	0.023
GLSUM	None **	0.196	100.688	95.753	0.021
GLPCA	None **	0.198	103.158	95.753	0.014
Notes: As for Tables 3.1 and 5.1.					

[36] We execute five independent tests one for each global liquidity measure.

However, trace and maximum eigenvalue criteria produce different results when GLGDPW is exploited; as trace statistic indicates two cointegrating vectors while maximum eigenvalue statistic suggests one. Nonetheless, it can be inferred that at least one cointegrating equation exists in case of GLGDPW too. Overall, both criteria ascertain the existence of at least one cointegrating vector for all cases. Hence, this evidence significantly rejects the possibility of spurious relationships.

Table 5.3: Cointegration Rank Test (Maximum Eigenvalue) Results

Global Liquidity Measure	No of Cointegrating Equation(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	*P-Value*
GLCE	None ***	0.264	58.056	40.077	0.000
GLDIV	None ***	0.227	48.955	40.077	0.003
GLGDPW	None **	0.211	44.938	40.077	0.013
GLSUM	None **	0.196	41.646	40.077	0.033
GLPCA	None **	0.198	42.087	40.077	0.029
Notes: As for Tables 3.1 and 5.1.					

Evaluation of Forecast Ability on RMSE and MAE Criteria

Table 5.4 portrays RMSEs and MAEs registered by all the five measures of global liquidity exploited in the study in forecasting GIPI, GCPI, GCMPI and MSCI. It exhibits that GLCE is the surpassing indicator of GIPI with the smallest RMSE and MAE in the class of five global liquidity indicators under inspection. Though the difference among RMSEs and MAEs of indicators is not sizeable, yet both theoretical measures, GLCE and GLDIV, outperform other atheoretical measures in precisely forecasting GIPI. The best predictor of GIPI is GLCE with the lowest RMSE (4.182) and MAE (3.796), whereas the relatively worst predictor is GLGDPW with highest RMSE (7.821) and MAE (7.059).

Table 5.4: RMSE and MAE Results

Forecasted Variable	Global Liquidity Measure	RMSE	MAE
GIPI	GLCE	4.182	3.796
	GLDIV	6.222	5.482
	GLGDPW	7.821	7.059
	GLSUM	7.171	6.487
	GLPCA	6.598	6.032
GCPI	GLCE	3.697	2.153
	GLDIV	14.574	9.207
	GLGDPW	17.070	10.852
	GLSUM	11.498	7.299
	GLPCA	11.908	7.538
GCMPI	GLCE	7.014	8.141
	GLDIV	19.478	24.272
	GLGDPW	23.678	29.441
	GLSUM	19.873	24.914
	GLPCA	25.290	31.658
MSCI	GLCE	64.937	14.202
	GLDIV	114.660	25.623
	GLGDPW	128.840	29.070
	GLSUM	102.940	23.221
	GLPCA	89.652	20.098

Notes: As for Table 3.1.

Moreover, the performances of GLDIV and GLPCA are much close to each other as there is very negligible difference between RMSEs and MAEs generated by them. Nonetheless, the RMSE and MAE produced by GLCE are substantially different from those of all other measures. Further, the RMSE and MAE generated by VAR utilizing GLCE are sizably smaller than those produced by VARs using other measures in forecasting GCPI. The GLCE sustains to be the best predictor of GCPI with the smallest RMSE (3.697) and MAE (2.153) as compared to those of all other measures. Strangely, the performance of GLSUM and GLPCA is better than that of GLDIV in forecasting GCPI. This evidence contradicts the stance maintained by the empirical work that relies on country level information (Schunk, 2001). It might be due to the fact that most of the monetary authorities across the world use monetary aggregates based on simple sum technique to make decisions – target inflation. Owing to this practice, GLSUM and GLPCA have closer association with, and consequent more predictive power of GCPI than GLDIV. However, the relatively poorest performance can be attributed to GLGDPW in this case too, as it generates the highest RMSE (17. 070) and MAE (10.852).

In forecasting GCMPI, the smallest RMSE and MAE are 7.014 and 8.141 respectively which are associated with the VAR employing GLCE and the largest RMSE and MAE are 25.310 and 31.658 respectively, associated to GLPCA. In this case again the relatively best performance is of GLCE and GLDIV. However, the remarkably best performance is of GLCE. Further, the values of RMSEs and MAEs posted by the measures other than GLCE are much closer to one another. In this case too, the performance of GLDIV, though is slightly better, yet falls in the spectrum of the performance of atheoretical measures. Moreover, though the gap between the values of RMSEs and MAEs associated to GLGDPW and GLPCA is not very large, yet the values RMSE and MAE produced by GLPCA are greater than that of RMSE and MAE produced by GLGDPW.

Again, GLCE is the best predictor of MSCI posting RMSE and MAE of the smallest magnitude of 64.937 and 14.202 respectively. The second-best predictor of MSCI is GLPCA with 89.652 and 20.098 values of RMSE and MAE respectively. Nonetheless, the performance of GLGDPW remains relatively worst even in forecasting MSCI with the largest RMSE and MAE equal to the magnitude of 128.840 and 29.070 respectively. These findings concede with the evidence presented in the literature that global liquidity poorly signal the dynamics of MSCI because this sort of literature exploits GLDIV, GLSUM and GLGDPW measures of global liquidity (Brana et al., 2012; Belke et al., 2010b; Darius and Radde, 2010; Giese and Tuxen, 2007). But it further indicates the pitfall of existing literature of not exploiting GLCE measure of global liquidity which performs relatively better in this context. In sum, GLCE presents the best ability and GLGDPW puts forward the worst ability of forecasting all the four global macroeconomic and financial variables.

Visual Inspection

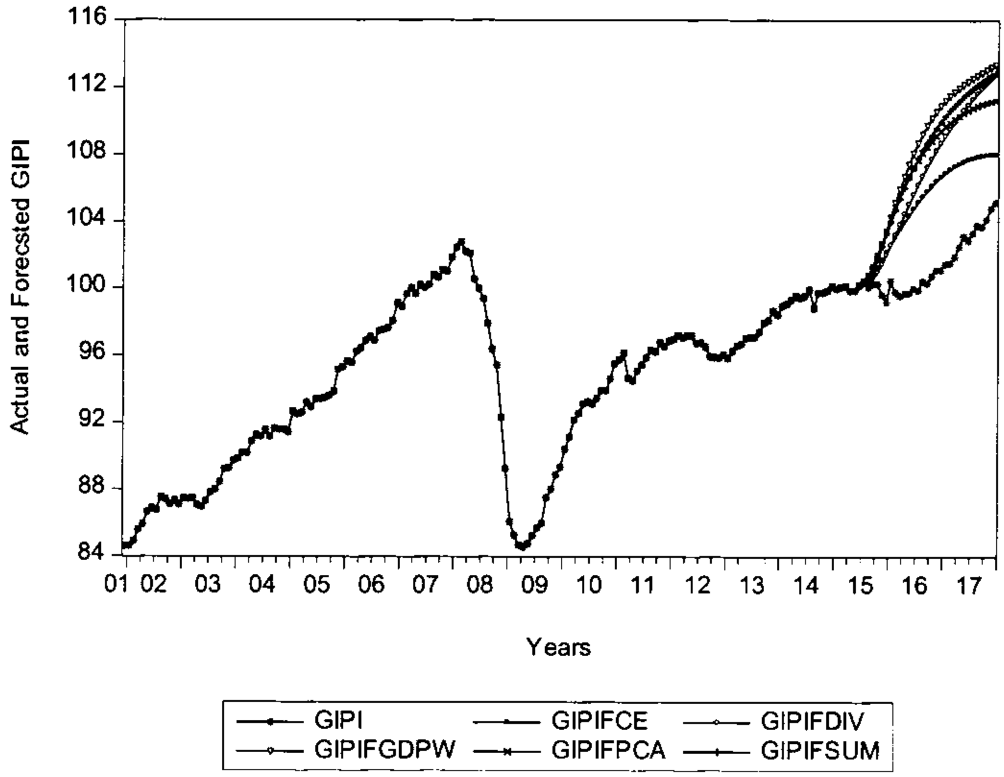
We inspect the forecasted graphs produced by each measure of global liquidity for GIPI, GCPI, GCMPI and MSCI to compare forecasting performances of global liquidity measures. To this end, we evaluate trends and gaps between forecast lines and actual lines of forecasted variables. Moreover, we put forecasted graphs of one variable in one diagram and forecasts with 95% confidence band in another diagram for comparison purpose. In this way, we investigate the forecasts of variables one by one.

GIPI

At the first glance on Figure 5.1, it is apparent that all the forecast lines rapidly rise and diverge away from the actual line. However, the forecast line generated by the VAR exploiting GLCE remains closer to the actual line as compared to the other forecast lines. Further, the forecast line generated by GLDIV lies under the forecast lines yielded by all other measures except that of GLCE but after an interval of time it crosses the forecast line of GLSUM and tends to lie above it. It is also observed that the speed of divergence of forecast contours from the actual one diminishes over time and after the lapse of almost half forecast period a tendency of convergence to original line is witnessed, especially in forecast lines generated through GLCE and GLSUM. Nonetheless, the gap between the forecast line generated by GLCE and those by other measures is significantly large. However, all the forecast lines generated by the measures other than GLCE are much closer to one another. But the most divergent forecast can be attributed to GLGDPW. Hence, it can be concluded that the VAR exploiting GLCE produces more exact forecast for GIPI than the VARs utilizing all other measures of global liquidity. Moreover, all VARs over-predict real economic activity which might lead the policymakers, relying on such economic forecasts, to pursue erroneous policy measures – unnecessarily contractionary measures to curb overheating of the economy.

Figure 5.1: Actual GIPI and its Forecasts

This Figure illustrates the relative ability of the global liquidity measures to forecast GIPI. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

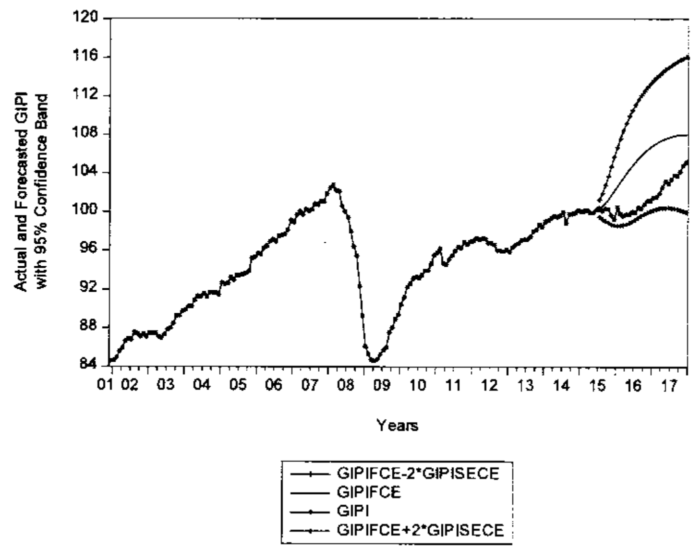


Besides, it is also obvious from Figure 5.2 that the forecasted graph of GIPI through the VAR incorporating GLCE is much closer to the actual data graph of GIPI and also the actual data graph remains within 95% confidence band in this case throughout the whole forecast horizon (part *a* of Figure 5.2). Whereas, the forecasted graphs of GIPI through the VARs exploiting the measures other than GLCE are distant from the actual data graph of GIPI and also the original line does not lie within their 95% confidence bands most of the time over the forecast horizon. Moreover, the confidence band associated with GLDIV contains actual line in the beginning while that associated with GLPCA contains at the end of the forecast horizon (part *b* and *e* of Figure 5.2). But the actual line does not lie within the confidence bands related to GLSUM and GLGDPW throughout the whole forecast horizon (part *c* and *d* of Figure 5.2). However, there is a visible tilt in the confidence bands allied to GLDIV, GLSUM, GLPCA and GLGDPW towards actual line at the end of the forecast period.

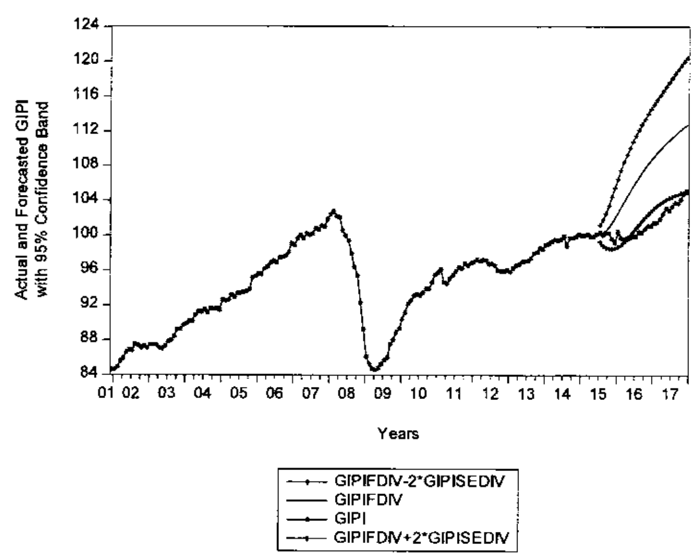
Figure 5.2: Forecasts of GIPI with 95% Confidence Band

The following Figures illustrate the potential of the global liquidity measures to forecast GIPI. On the horizontal axis in each Figure, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

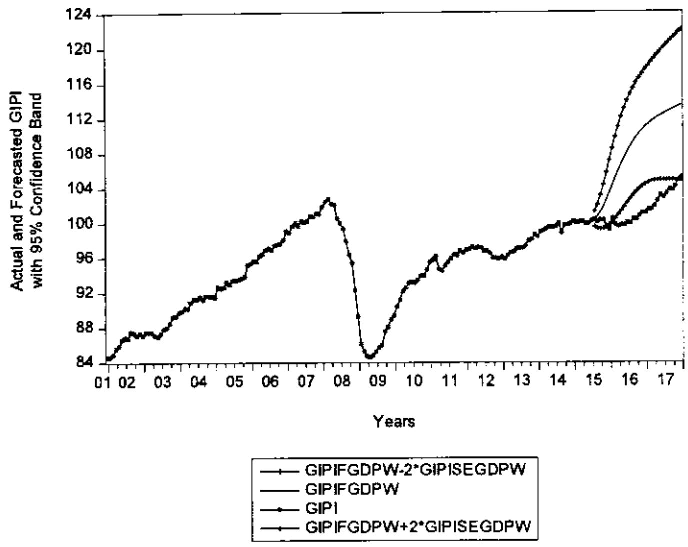
(a) When GLCE is exploited



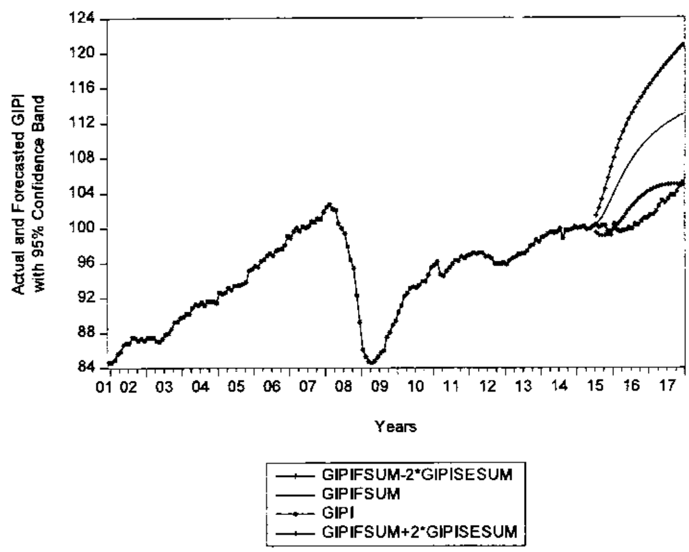
(b) When GLDIV is exploited



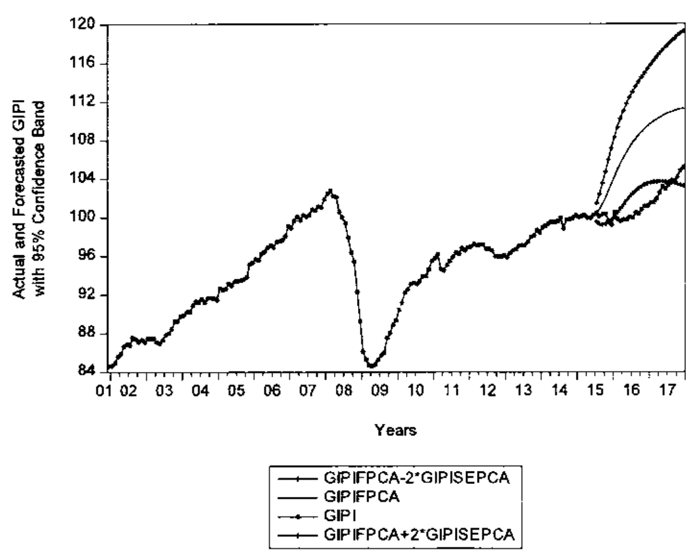
(c) When GLGDPW is exploited



(d) When GLSUM is exploited



(e) When GLPCA is exploited

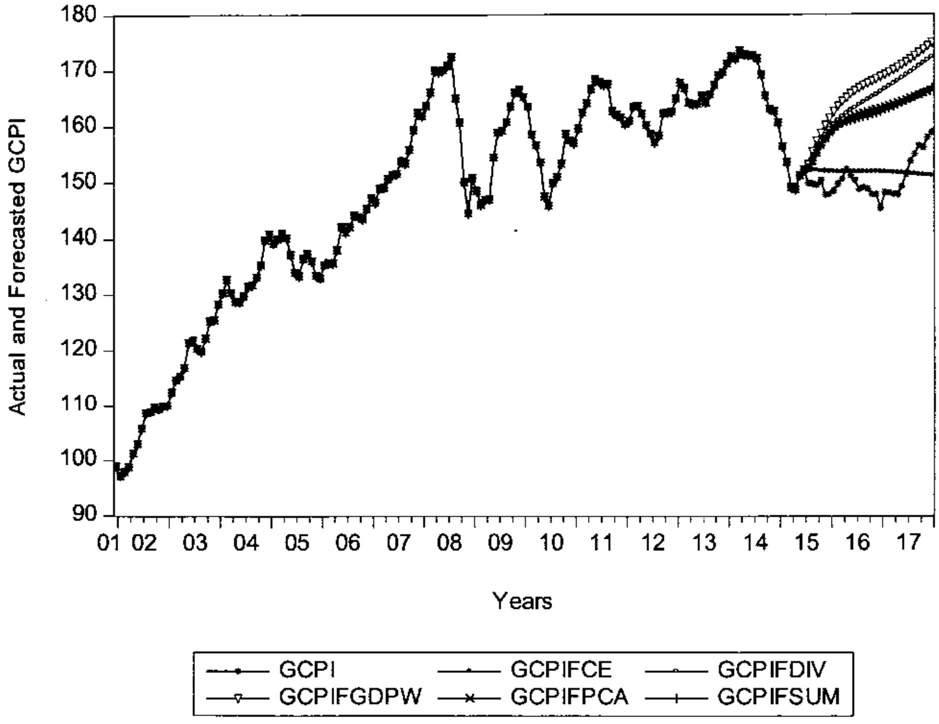


GCPI

Figure 5.3 demonstrates that the best forecast of GCPI is also produced by the VAR employing GLCE. The forecast line generated by GLCE converges to the actual line right from the beginning of the forecast period, while the forecasts lines produced by other measures swiftly diverge away from the actual line in the beginning, however, then the speed of divergence gradually decreases over time. Moreover, the forecast contour by GLCE passes through the original contour. Further, though the gaps between the forecast lines generated by the measures other than GLCE are not sizeable, yet the forecasts by GLSUM and GLPCA are closer to original line than that of GLDIV and GLGDPW. However, the farthest forecast line from the original line is that generated by GLGDPW. Hence, GLGDPW remains the poorest predictor of GCPI too. Moreover, it can also be observed that there exists a tendency of convergence in forecasts to the actual GCPI, as the rising speed of forecast lines is less than that of actual line at the end of the forecast horizon. Further, all the measures overstate GCPI over the entire forecast horizon, except GLCE which overstates when there is declining trend and understates when there is rising trend in GCPI.

Figure 5.3: Actual GCPI and its Forecasts

This Figure illustrates the relative ability of the global liquidity measures to forecast GCPI. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

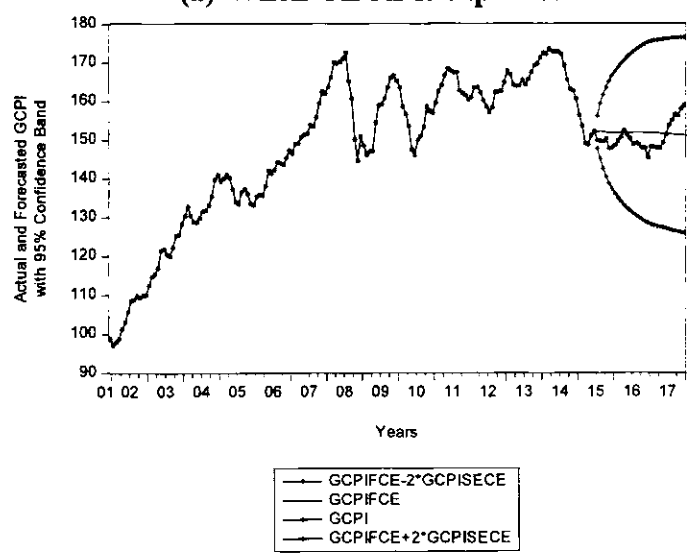


On the other hand, it is clear from Figure 5.4 that actual GCPI lies within 95% confidence bands allied to all the measures over most of the time.

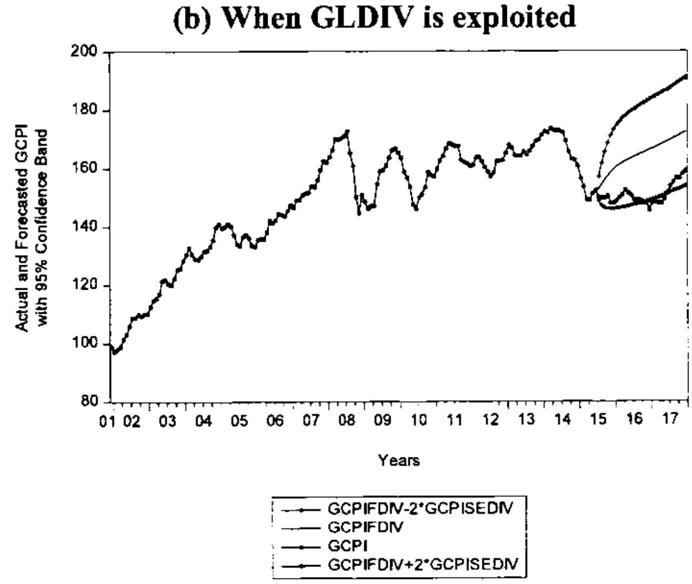
Figure 5.4: Forecasts of GCPI with 95% Confidence Band

The following Figures illustrate the potential of the global liquidity measures to forecast GCPI. On the horizontal axis in each Figure, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

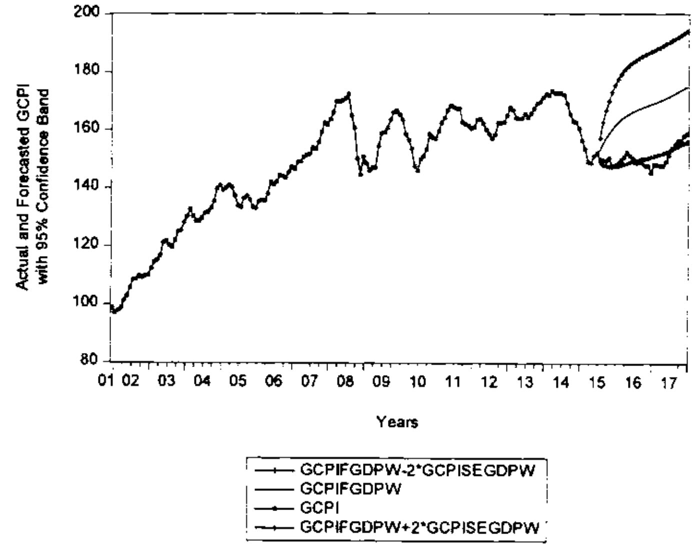
(a) When GLCE is exploited



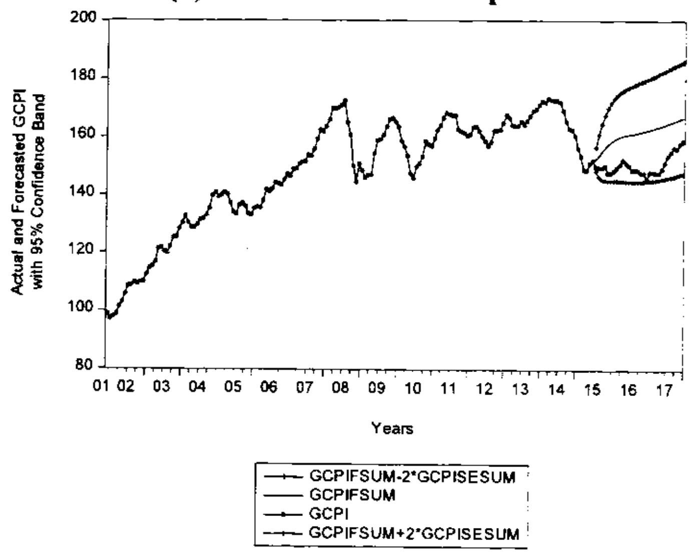
(b) When GLDIV is exploited



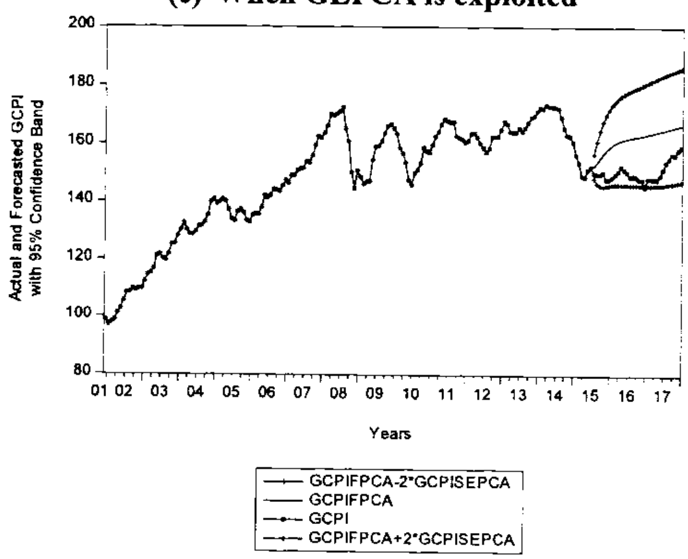
(c) When GLGDPW is exploited



(d) When GLSUM is exploited



(e) When GLPCA is exploited



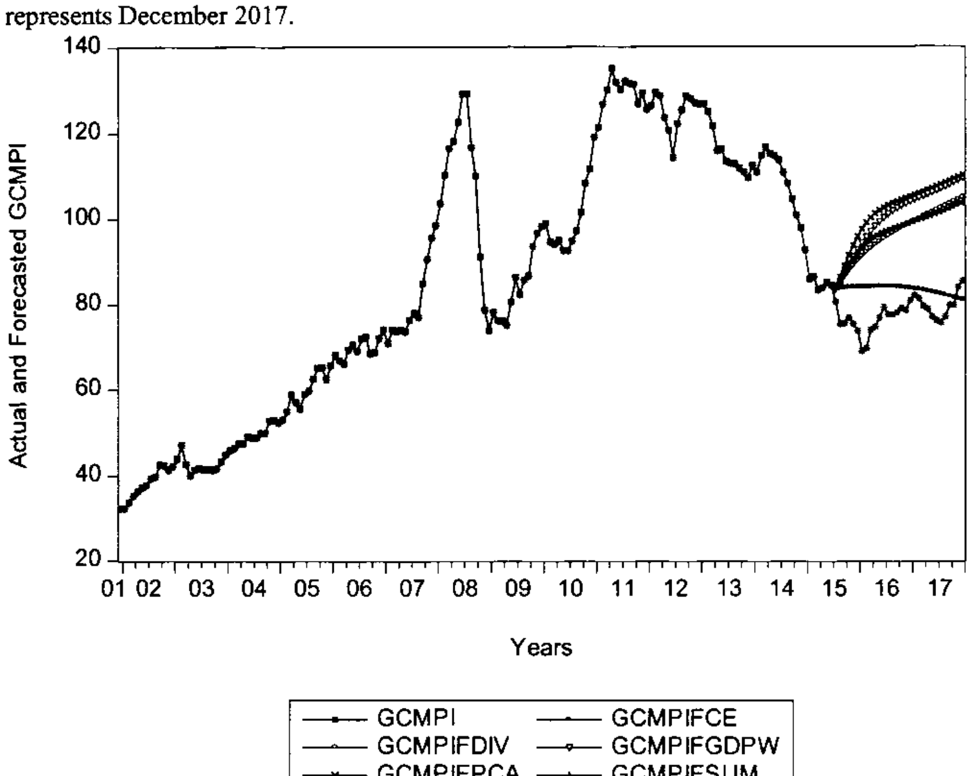
However, the actual GCPI tips out of the confidence band allied to GLDIV for one or two times (part *b* of Figure 5.4). This contends that GLDIV is relatively poor predictor of GLCPI but not in absolute sense. However, it transgresses the confidence band constructed through GLGDPW for a noticeable period, indicating relatively worst performance of GLGDPW (part *c* of Figure 5.4). Furthermore, the actual GCPI tips out or draws very near to the boundaries of confidence bands associated to all the measures, except GLCE where it lies well in the centre of confidence band. This altogether substantiate that GLCE is the most precise and accurate indicator of the developments in GCPI.

GCMPI

It is apparent from Figure 5.5 that all VARs comparatively better forecast GCMPI but the GLCE VAR's forecast is the best in this case too. The forecast generated by GLCE starts converging to actual GCMPI right from the beginning of the forecast period. Whereas, the forecasts generated by the measures other than GLCE rapidly diverge away from the actual GCMPI in the start of the forecast horizon but the speed of divergence gradually plummets over time.

Figure 5.5: Actual GCMPI and its Forecasts

This Figure illustrates the relative ability of the global liquidity measures to forecast GCMPI. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.



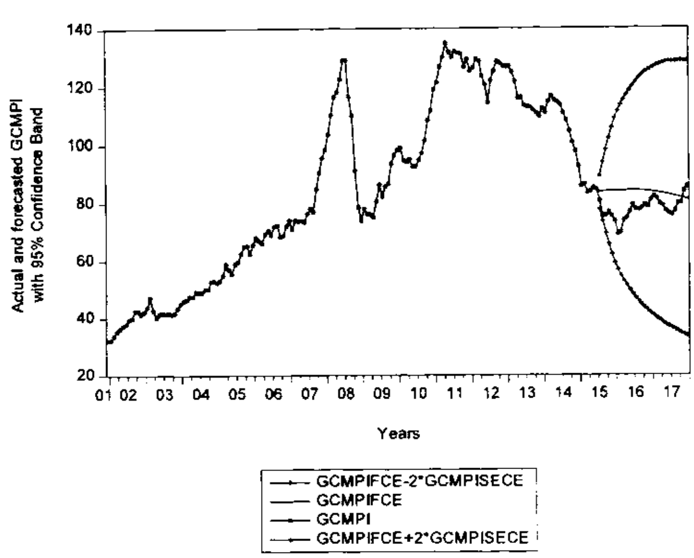
Further, the forecast line associated with GLCE possesses the tendency of convergence from the beginning and finally crosses the actual line a little before the end of forecast period. Besides, the forecast lines allied to GLDIV and GLSUM are much closer to each other and also overlap for an interval of time. Similarly, the forecast lines generated by GLPCA and GLGDPW are very close to each other and also overlap over some period. However, the farthest forecast line from the actual line is that related to GLPCA. Hence, comparatively worst performance can be attributed to GLPCA in this case.

In addition to the above, Figure 5.6 illustrates that actual GCMPI lies within the confidence bands allied to all the measures of global liquidity over the entire forecast period. However, in case of GLSUM and GLPCA, the actual GCMPI touches the boundaries of confidence bands at least once (part *d* and *e* of Figure 5.6). This implies that global liquidity is a reasonably good predictor of developments in GCMPI, it does not matter whichever the measure of global liquidity is employed. Although all the measures of global liquidity under investigation have good predictive power, yet the most exact and precise predictor of GCMPI is also GLCE as the actual GCMPI lies well in the centre of confidence band constructed through this measure (part *a* of Figure 5.6).

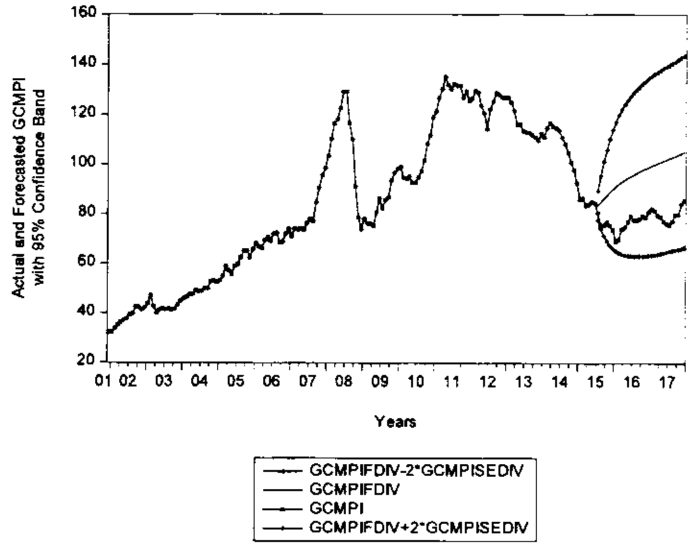
Figure 5.6: Forecasts of GCMPI with 95% Confidence Band

The following Figures illustrate the potential of the global liquidity measures to forecast GCMPI. On the horizontal axis in each Figure, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

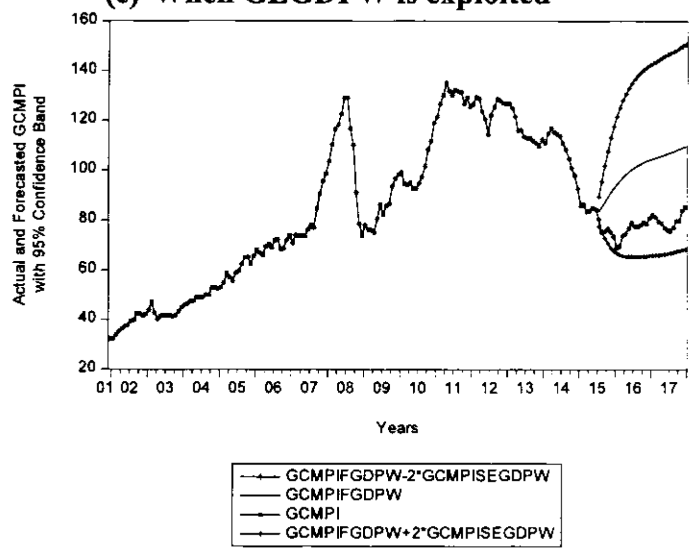
(a) When GLCE is exploited



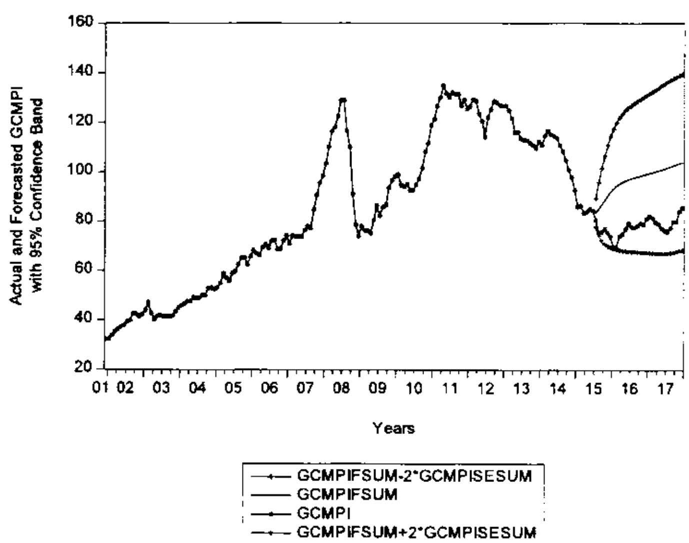
(b) When GLDIV is exploited



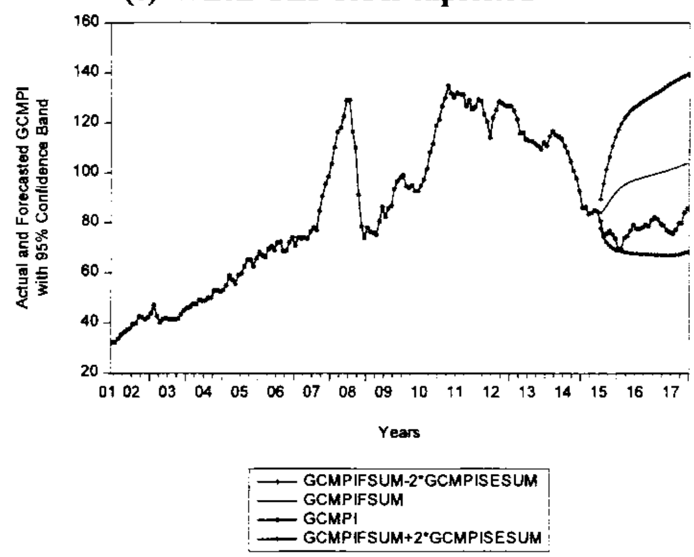
(c) When GLGDPW is exploited



(d) When GLSUM is exploited



(e) When GLPCA is exploited

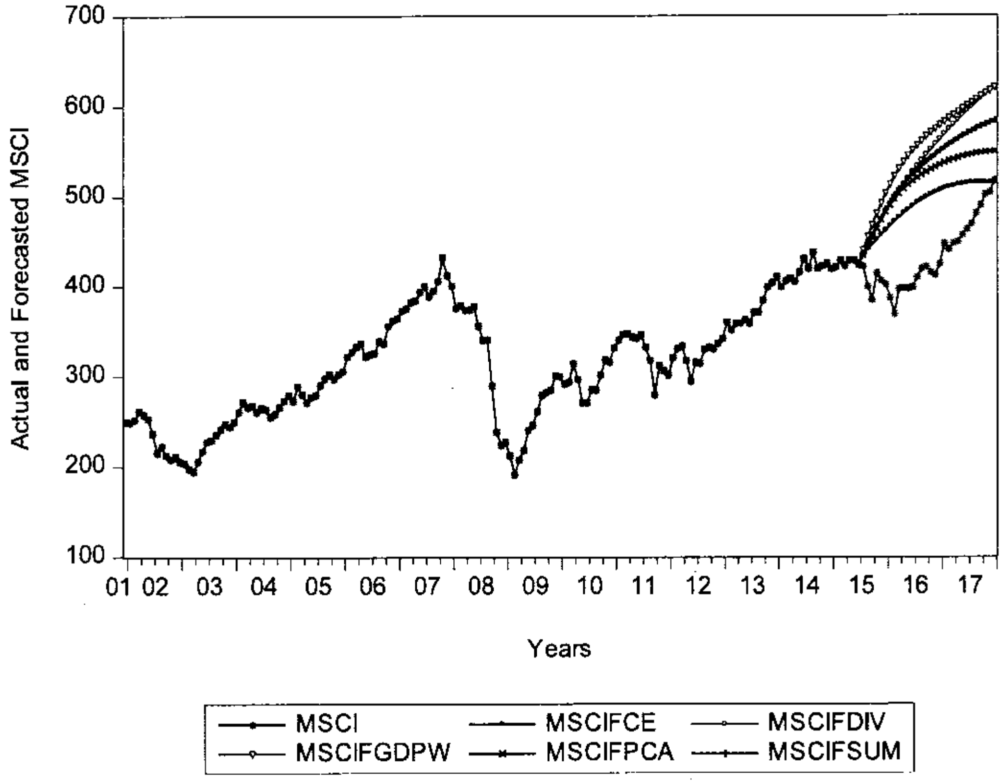


MSCI

It is evident from Figure 5.7 that the forecasts of MSCI produced by all the measures rapidly soar but actual MSCI has declining trend. In this way, forecasts and actual MSCI drift away from one another in the beginning. However, the forecast generated by GLCE, as compared to those generated by other measures, remains closer to actual MSCI over the entire horizon. It validates the superiority of GLCE over other measures in this context too. Further, the forecast contour produced by GLDIV overlaps those produced by GLSUM and GLPCA in the beginning but drifts away from them over time and meets the forecast contours produced by GLDPW at the end of the forecast period. Furthermore, the forecast contours emerged from the exploitation of GLSUM and GLPCA are much closer to each other. However, the forecast line accorded to GLCE is far away from those generated by other measures and is closer to actual MSCI line. Nonetheless, the gap between the forecast contour produced by GLCE and those generated by other measures widens over time. Additionally, all the forecast lines possess some converging tendency, but it is quite visible in those produced by GLCE, GLSUM and GLPCA. Yet, the forecast generated by GLCE speedily converges and meets the actual MSCI at the end of forecast period.

Figure 5.7: Actual MSCI and its Forecasts

This Figure illustrates the relative ability of the global liquidity measures to forecast MSCI. On the horizontal axis, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

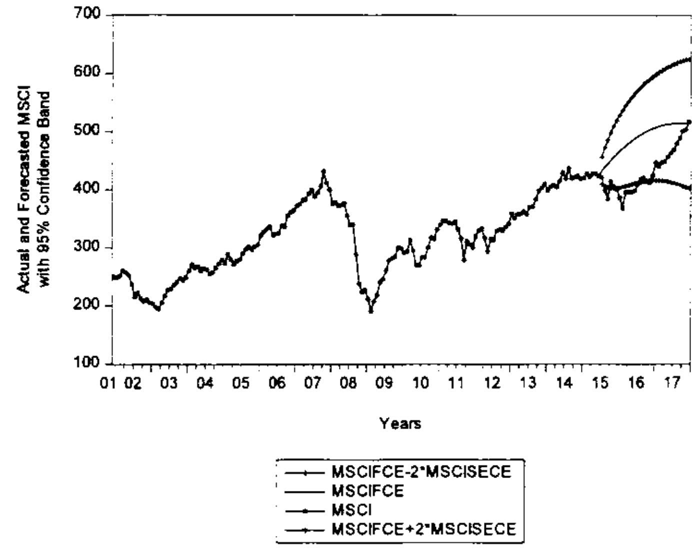


Additionally, Figure 5.8 elucidates that overall the power of global liquidity measures to forecast MSCI is not remarkable. This evidence concedes with the findings of a strand of literature that notes poor ability of global liquidity to indicate developments in MSCI. However, GLCE succeeds to predict MSCI in a somewhat better way than all other measures (part *a* of Figure 5.8) as the actual MSCI falls within the confidence band established by utilizing this measure of global liquidity most of the time. But all other measures, particularly GLDIV and GLGDPW badly fail to predict MSCI, though GLSUM and GLPCA have a very weak forecasting ability as reflected in the *d* and *e* parts of Figure 5.8. This evidence argues that the weak potential of global liquidity to forecast equity prices, as document by some earlier studies, is due to the use of some inefficient measures of global liquidity. The findings of those studies mainly rest on GLSUM, GLGDPW and GLDIV measures of global liquidity (Brana et al., 2012; Belke et al., 2010b; Darius and Radde, 2010; Baks and Kramer, 1999). However, GLCE has admissible potential to subtly predict global equity prices.

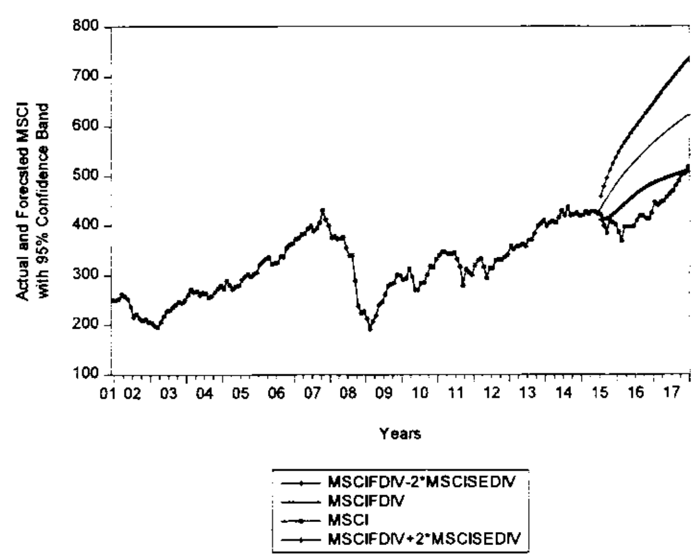
Figure 5.8: Forecasts of MSCI with 95% Confidence Band

The following Figures illustrate the potential of the global liquidity measures to forecast MSCI. On the horizontal axis in each Figure, 01 refers to December 2001, 02 represents December 2002 and so on, and 17 represents December 2017.

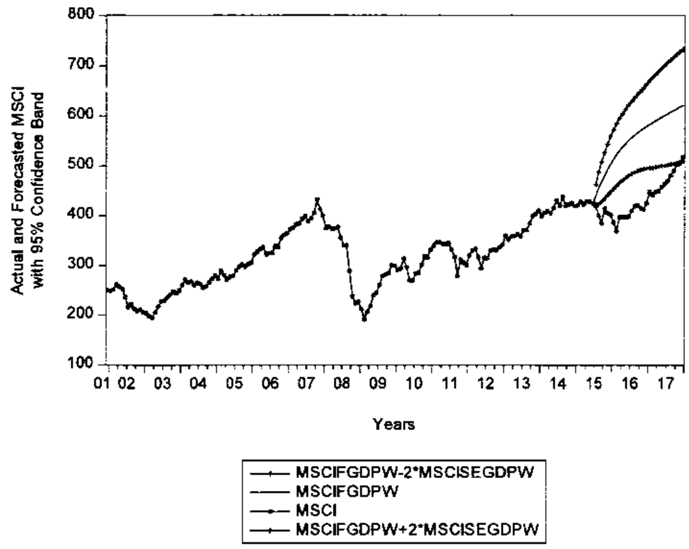
(a) When GLCE is exploited



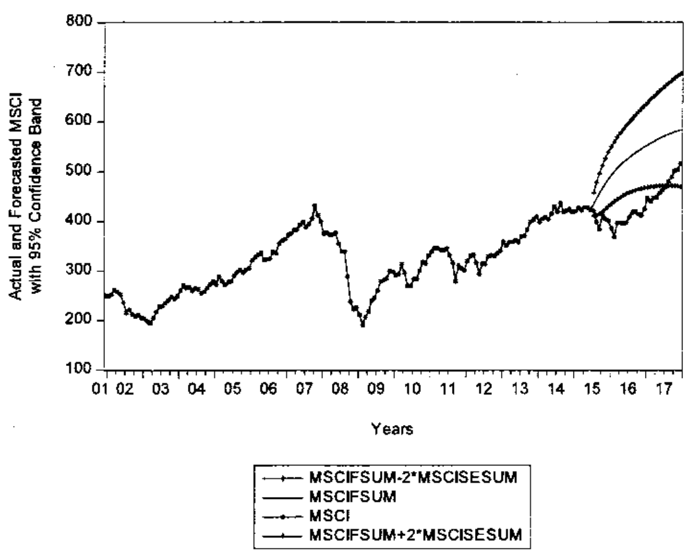
(b) When GLDIV is exploited



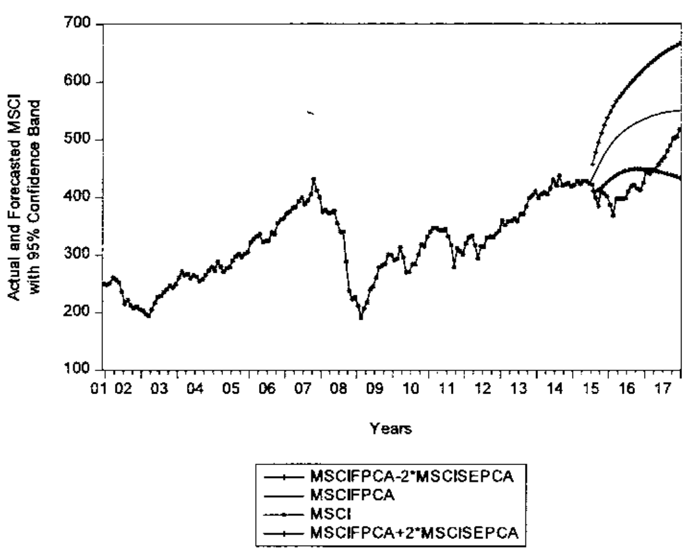
(c) When GLGDPW is exploited



(d) When GLSUM is exploited



(e) When GLPCA is exploited



5.2 Analysis of Cross-Correlation between Cyclical Components

In this section, we examine strength of correlation between the cyclical components of GIPI, GCPI, GCMPI and MSCI and up to 48 lags of the cyclical components of the measures of global liquidity. As far as the association between the cyclical components of GIPI and the lags of the cyclical components of global liquidity measures is concerned, the highest correlation coefficient for the case of GLCE is -0.8471 at its current level (zero lag), for GLDIV is -0.7101 at its 16th lag, for GLGDPW is -0.589 at its 10th lag, for GLSUM is -0.5593 at its 14th lag and for GLPCA is -0.5865 at its 17th lag (Table A5.1, given in the Appendix). All this indicates the supremacy of GLCE over other measures, as it has the strongest association with GIPI.

Further, we document quite a variety of results; as the correlation between the cyclical components of GIPI and current level of the cyclical components of GLCE and GLGDPW is negative while it, though possibly negligible, is positive for current level of cyclical components of GLDIV, GLSUM and GLPCA. Interestingly, we also observe a cyclical trend in the correlation coefficients; they gradually plummet and then start soaring after switching from being negative to positive at 15th lag when GLCE is exploited, for other measures they first rise and then fall, switching from negative to positive at 34th lag of GLDIV, 24th lag of GLGDPW, 30th lag of simple-sum and 32th lag of GLPCA.

Moreover, for the case of GCPI, the highest correlation coefficient for GLCE is 0.3892 at the 48th lag of its cyclical component, for GLDIV is 0.9191 at its current level (zero lag), for GLGDPW is -0.46 at the 35th lag, for GLSUM is 0.7657 at the zero lag and for GLPCA is 0.841 also at its current level (Table A5.2). Hence, this evidence, on account of being highly associated, endorses that GLDIV is a surpassing indicator of the developments in GCPI. Nevertheless, we also note cyclicality in correlation coefficients irrespective the measure of global liquidity exploited. The correlation coefficients shift from being positive to negative and then again to positive in case of all measures of global liquidity, except for the case of GLGDPW where they remain negative throughout all lags. Overall, the notably strong association between the secular components of GCPI and that of global liquidity refutes the notion of (super) neutrality of money documented by Hendry (2001) and Juselius (2007) to some extent, and supports the stance maintained by

Ciccareli and Mojon (2010) and Giese and Tuxen (2007) that the notion of (super) neutrality will not hold in global context.

Furthermore, it is evident from Table A5.3 (given in the Appendix) the cyclical components of GCMPI and that of global liquidity measures are also highly correlated. In this regard, the highest correlation coefficient for GLCE is 0.3357 at the 36th lag of its secular component, for GLDIV is 0.7152 at the 40th lag, for GLGDPW is 0.5138 at the 12th lag, for GLSUM is 0.8690 at the first lag and for GLPCA is 0.8697 at the first and second lags. Hence, in this case the strongest association can be attributed to GLPCA. Moreover, we also document diverse results regarding cyclicality in correlation over lags of secular components of all the measures of global liquidity, in this case too. For illustration, correlation coefficients for GLDIV, GLSUM and GLPCA shift from being positive to negative, while the correlation coefficients related to GLCE and GLGDPW shift from being negative to positive.

Additionally, Table A5.4 (in the Appendix) exhibits that there exists substantially strong association, though not as strong as documented in other cases, between the secular components of MSCI and the lags of secular components of global liquidity. In this context, the correlation coefficient representing the highest degree of association, for GLCE is –0.5565 at the current level (zero lag) of its cyclical component, for GLDIV is 0.5887 at the 12th lag, for GLGDPW is -0.3710 at the 4th lag, for GLSUM is -0.5528 at the 11th lag and for GLPCA is -0.5629 at the 12th lag. This reflects that GLDIV is a leading indicator of the developments in MSCI for having the strongest association with it among the class five measures of global liquidity under investigation. Further, we also witness cyclical behaviour of correlation coefficients in this case too. The coefficients for GLCE, GLDIV and GLSUM alter from negative to positive while the coefficients for GLGDPW and GLPCA alter from positive to negative and again to negative over the lags of their secular components.

Taken together, both forecast and cross-correlation analyses authenticate the superiority of theoretical measures over atheoretical ones. The GLCE outperforms all other measures by yielding relatively more precise and accurate forecasts for all the four global macroeconomic and financial variables: GIPI, GCPI, GCMPI and MSCI. Moreover, it also has the strongest association with GIPI. However, GLDIV outperforms other measures on the basis of strength of association between the secular components, as the lags of its cyclical components have the strongest association with that of GCPI and MSCI. Whereas, all the criteria indicate relatively worst performance of GLGDPW in almost all cases. This altogether lends support to the stance maintained in prior literature that theoretical measures outperform atheoretical ones (Hjertstrand et al., 2018; Huang and Xia, 2015; Alkhareif and Barnett, 2012; Schunk, 2001; Barnett et al., 1984). Besides this, it also, by advancing global level evidence, complements that sort of prior literature that presents country level evidence in this regard (Huang and Xia, 2015; Schunk, 2001; Barnett et al., 1984).

CHAPTER 6

RESULTS AND DISCUSSION-III

Determinants of Global Liquidity

This chapter elucidates the results obtained in the analyses of exploring the determinants of global liquidity and conclusions derived on the basis of them. It further discusses whether the findings are in agreement or in contradiction with that of the existing literature. In this way, it explains whether the economic theories support the stance built on these findings or not. Further, in case of any disagreement with economic theories, it also attempts to dig out the underlying reasons. Besides, it also discusses the nature and magnitude of the effects of the short and long run determinants of global liquidity on it. Since this analysis (exploration of the determinants of global liquidity) performs several pre- and post-estimation diagnostic tests in addition to the main experiment, this chapter evaluates the results of a variety of econometric exercises. It begins with the examination of the results about the order of integration of variables utilized in this analysis and proceeds further to probe into the outcomes of cointegration and post-estimation diagnostic tests, and finally deals with the short and long run determinants.

6.1 Results of Pre-Estimation Diagnostic Tests

Before proceeding on for further analyses to identify the short and long run determinants, it is imperative to determine the order of integration of variables exploited for this purpose. In this regard, we make decisions on the basis of ADF-test results.

Unit Root Test Results

It is apparent from Table 6.1 that some variables are stationary at their level and some are first order integrated (stationary at their first difference) but none of them is second or higher order integrated. Further, the Divisia measure of global liquidity (henceforth GLDIV), simple-sum measure of global liquidity (henceforth GLSUM), PCA-based measure of global liquidity (henceforth GLPCA), global cross-border bank flows (hereafter GCBBF), global inflation (hereafter GINF), global stock return (hereafter GSTR) and global VIX index (henceforth VIX) are stationary at their level as we can reject the null hypothesis that the variable is non-stationary at up to 5% level of significance in every case.

Table 6.1: ADF-Test Results

	Level		First Difference	
Variables	***t-Statistic***	***P-Value***	***t-Statistic***	***P-Value***
LGLCE	-1.5472	0.507	-11.1206***	0.000
LGLDIV	-3.3304**	0.014		
LGLGDPW	-0.6834	0.847	-8.7135***	0.000
LGLSUM	-3.0122**	0.035		
LGLPCA	-3.4185**	0.011		
LGIPI	-2.1447	0.227	-4.7882***	0.000
LGBL	-2.4978	0.117	-17.087***	0.000
LGCBBF	-3.0692**	0.030		
GINF	-9.3104***	0.000		
GSTR	-11.4881***	0.000		
LVIX	-3.6861***	0.005		
GRINT	-1.2599	0.647	-7.3159***	0.000
GINTD	-2.2716	0.182	-3.9821***	0.002

Notes: As for Tables 3.1 and 5.1, however, the letter "L" in the start of the variables denotes their logarithmic transformation.

On the other hand, for the currency equivalent measure of global liquidity (henceforth GLCE), GDP-Weighted measure of global liquidity (henceforth GLGDPW), global industrial production index (henceforth GIPI), global bank leverage (hereafter GBL), global real interest rate (hereafter GRINT) and global interest rate differential (hereafter GINTD), we cannot reject the null hypothesis that the variables are non-stationary at their level, even up to 10% level of significance. However, these variables are stationary at their first difference as we can reject the null hypothesis of non-stationarity for variables at up to 5% level of significance, for their first differences. Furthermore, the first difference of all these variables is stationary at 1% level of significance. Hence, all these variables are first order integrated that is I (1).

Results of Cointegration Tests

It is obvious from the findings documented above about the order of integration of variables that some variables are stationary at their level (I (0)), some are first order integrated (I (1)) and none of them is second (I (2)) or higher order integrated. These results collectively justify the use of autoregressive distributed lag (henceforth ARDL) bounds testing approach to examine the existence of stable long-run (cointegration) relationships among the variables. In this context, Table 6.2 corroborates the existence of cointegration relationships for all models (as one model for each measure of global liquidity is estimated). The calculated value of *F-statistic* of ARDL bounds test for GLCE is 4.6767 which exceeds the value of upper bound of *F-statistic* (3.61) recommended by Pesaran et al. (2001) for number of parameters (K) equals to 6. Similarly, the value of calculated *F-statistic* (51.4958) for GLDIV also exceeds the value of upper bound of *F-statistic* (4.01) for K = 4. Analogously, the value of calculated *F-statistic* for each other measure of global liquidity (GLGDPW, GLSUM and GLPCA) is also greater than the values of upper bound of respective *F-statistic* specified to corresponding number of parameters.

Besides, Pesaran et al. (2001) recommend another test (*t-test*) complementary to *F-test* to establish the existence of cointegration relationships among variables. It is also clear from the Table 6.2 that the results of *t-test* verify the presence of cointegration relationships among the variables in all experiments, except the case when GLGDPW is exploited. The value of *t-statistic* for GLGDPW is -2.9784 which is less than the upper bound value of corresponding *t-statistic* however it exceeds the value of lower bound of *t-statistic*. Pesaran et al. (2001) argues that it is likely to be degenerated relationships among the variables in such a situation. However, the *F-statistic* validates the existence of cointegration relationships in this case too. Furthermore, the main thrust of the study is to investigate the determinants of global liquidity but not that of its measures. Hence, the findings derived from the exploitation of other measures of global liquidity would surely make up this deficiency. Further, the value of calculated *t-statistic* for the case of GLCE is -4.4915 which exceeds the upper bound value of corresponding *t-statistic* (-4.38). Similarly, the value of observed *t-statistic* for the case of each other measure of global liquidity (GLDIV, GLSUM and GLPCA) also exceeds the upper bound value of the corresponding *t-statistic*.

Table 6.2: ARDL Bounds Test Results

	LGLCE	**LGLDIV**	**LGLGDPW**	**LGLSUM**	**LGLPCA**
F-Statistic	4.6767	51.4958	5.0641	21.7943	33.0077
No. of Estimated Parameters (K)	6	4	5	6	5
Lower F-Statistic	2.45	2.86	2.62	2.45	2.62
Upper F-Statistic	3.61	4.01	3.79	3.61	3.79
t-Statistic	-4.4915	-4.3006	-2.9784	-5.6829	-4.9059
Lower t-Statistic	-2.86	-2.86	-2.86	-2.86	-2.86
Upper t-Statistic	-4.38	-3.99	-4.19	-4.38	-4.19

Notes: As for Tables 3.1 and 6.1.

6.2 Results of Post-Estimation Diagnostic Tests

The investigation about the appropriate functioning and soundness of the model is indispensable for the credible findings. To this end, the analyses executed in this section pass through some diagnostic tests. It is obvious from Table 6.3 that all models fit well as the *F-statistics* reflecting their overall significance are significant as 1% level of significance. The *F-test* of overall significance tests significance of all the coefficients simultaneously with the null hypothesis that all the coefficients are equal to zero simultaneously. Hence, on the basis of these results we can reject the null hypothesis and conclude that all the coefficients are not equal to zero at 1% level of significance in all cases. However, the value of *F-statistic* differs from case to case, as it is 21.7706 with *P-value* (0.000) for GLCE, for GLDIV 258.9838 with *P-value* (0.000), for GLGDPW 6.3714 with *P-value* (0.000), for GLSUM 44.2783 with *P-value* (0.000) and for GLPCA 86.5677 with *P-value* (0.000).

Further, the results of Ramsey's regression specification error test (henceforth RESET) endorses the suitability of functional forms of all models, as its *F-statistic* is insignificant at even up to 10% level of significance for each model (Table 6.3). In this setting, Ramsey's RESET tests the linear functional form of model against quadratic functional form with the null hypothesis that the linear functional form fits well. Hence, the non-rejection of null hypothesis authenticates that the linear functional form is appropriate for each model. Thus, all models pass through functional form specification filter and validate linear functional form for all models.

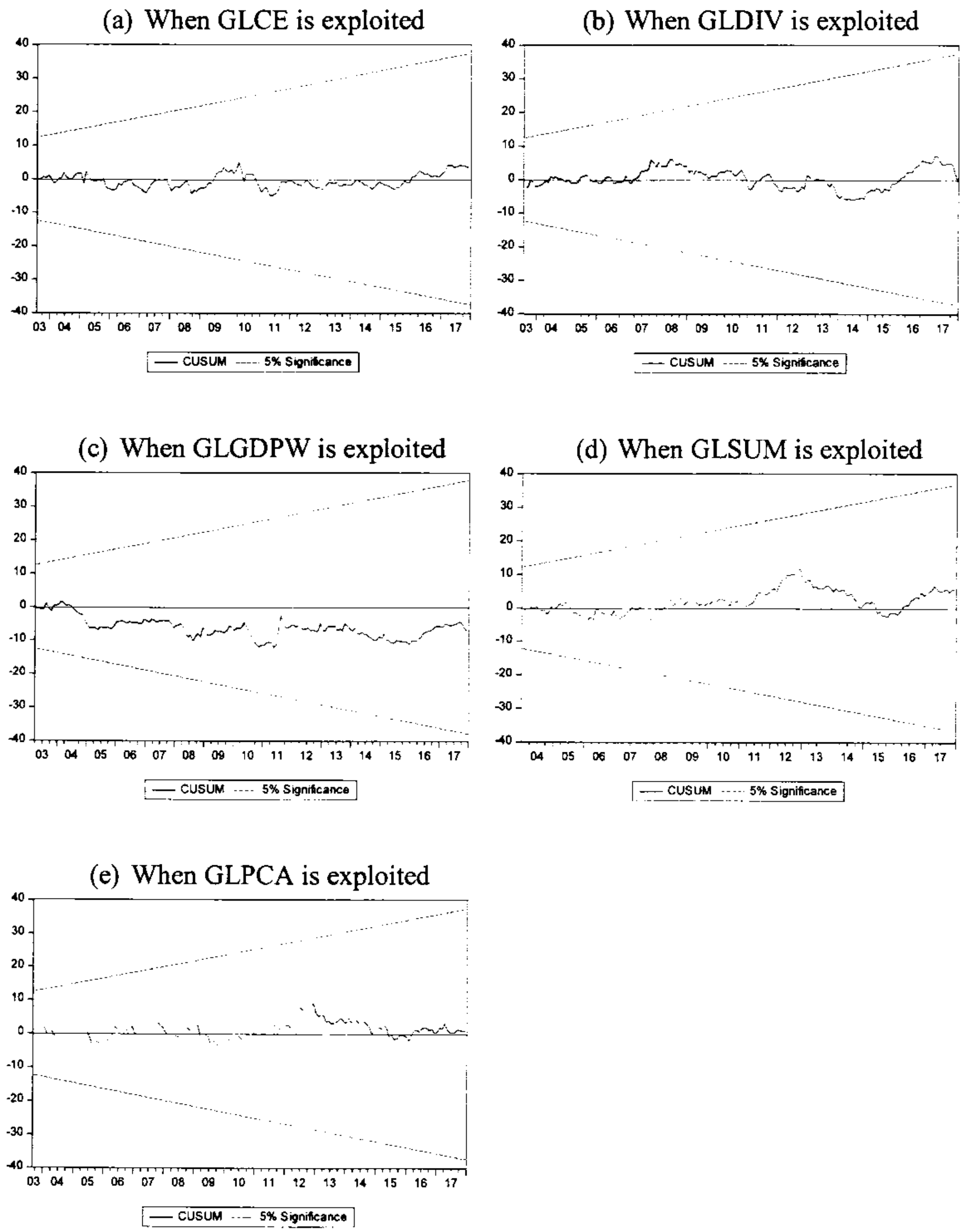
Furthermore, the outcomes of serial correlation LM test dismiss the presence of serial correlation among the residuals of each model up to 12 lags (Table 6.3). The value of serial correlation LM test *F-statistic* is 1.371 with *P-value* (0.1852) for GLCE model, 1.0792 with *P-value* (0.3811) for GLDIV, 1.2248 with *P-value* (0.2702) for GLGDPW, 0.6215 with *P-value* (0.8215) for GLSUM and 1.0855 with *P-value* (0.376) for GLPCA. Further, the value of *F-statistic* along with its *P-value* of each serial correlation LM test demonstrates that we cannot reject the null hypothesis that there is no serial correlation among the residuals up to specified lag length (that is 12), in all these settings. All this substantiates that standard errors of the coefficient estimates of these models are not affected by serial correlation. Hence, the efficiency of parameters estimates of these models is not exacerbated due to serial correlation.

Table 6.3: Post-Estimation Diagnostic Tests Results

		LGLCE	LGLDIV	LGLGDPW	LGLSUM	LGLPCA
Overall Model	***F-Statistic (P-Value)***	21.7706*** (0.000)	258.9838*** (0.000)	6.3714*** (0.000)	44.2783*** (0.000)	86.5677*** (0.000)
Ramsey RESET Test	***F-Statistic (P-Value)***	0.5751 (0.449)	1.9254 (0.167)	0.1283 (0.721)	0.3475 (0.556)	0.50167 (0.479)
Serial Correlation (LM Test)	***F-Statistic (P-Value)***	1.371 (0.1852)	1.0792 (0.3811)	1.2248 (0.2702)	0.6215 (0.8215)	1.0855 (0.376)
Notes: As for Tables 3.1 and 6.1.						

Adding to the ongoing discussion, the plots of cumulative sum (henceforth CUSUM) of recursive residuals and CUSUM of square (henceforth CUSUMSQ) tests validate that the coefficients of almost all models are stable. The plot of CUSUM statistic does not tip out of its 5% critical bands implying that the null hypothesis of stability of residuals (parameters estimates) cannot be rejected at 5% level of significance for the case of each model estimated (Figure 6.1). Since CUSUM test diagnoses the presence of structural break or the stability of residuals (coefficients) over time, it can be derived from these findings presented by this test that there is no structural break or instability of coefficient over time.

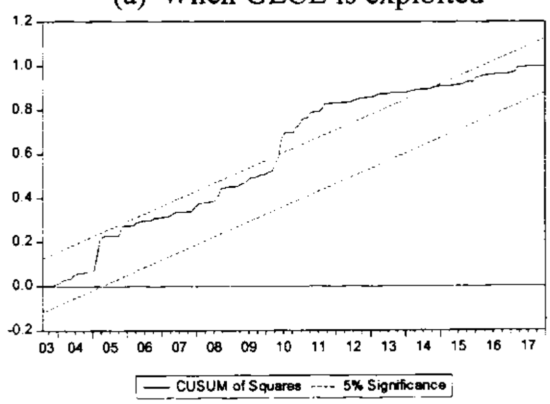
Figure 6.1: Plots of CUSUM Tests



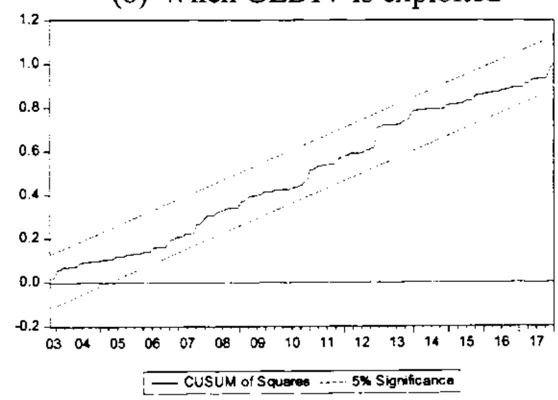
Moreover, the CUSUMSQ test also corroborates the stability of squared residuals (variance of residuals) over the entire sample period for all models, except the cases when GLCE and GLGDPW are investigated (Figure 6.2). For the case of GLCE, the CUSUMSQ statistic crosses its 5% critical band for a short interval of time. It gradually drifts away and then gradually reverts back to its 5% critical band and remains within it over the remaining period. This evidence challenges the constancy of coefficients because the null hypothesis of stability of squared residuals is rejected for some time at 5% significance level.

Figure 6.2: Plots of CUSUMSQ Tests

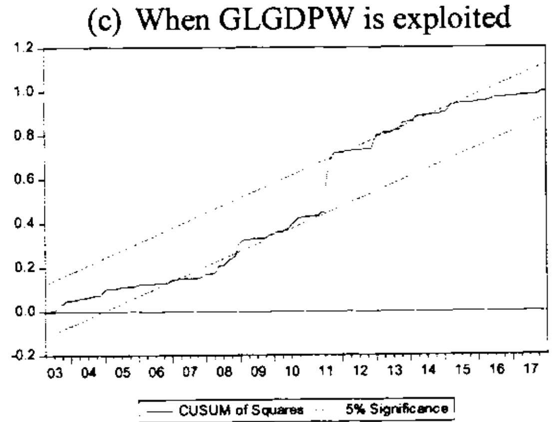
(a) When GLCE is exploited



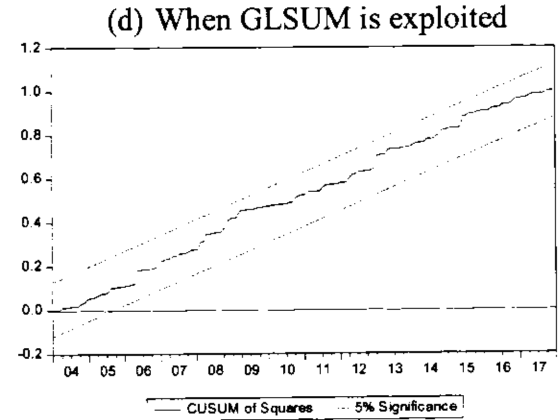
(b) When GLDIV is exploited



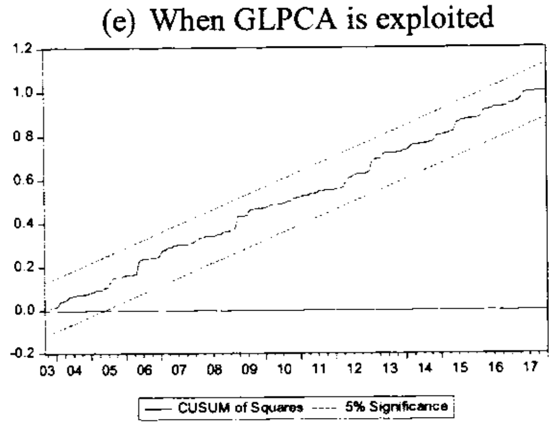
(c) When GLGDPW is exploited



(d) When GLSUM is exploited



(e) When GLPCA is exploited



However, for the case of GLGDPW it tips out of its 5% critical band for a very short interval and then reverts back and remains within the bands, afterwards it though touches the boundaries of band but does not crosses them. Nonetheless, for the case of each other measure of global liquidity (GLDIV, GLSUM and GLPCA), the CUSUMSQ test endorses the stability of coefficients as the null hypothesis of stability of squared residuals is not rejected at 5% significance level over the entire period.

Overall, the results of the post-estimation diagnostic tests do not shatter the very foundation of specifications made rather they endorse the suitability and strong fitness of models for the cases of all measures of global liquidity. However, they identify very weak indications of some problems for the case of one or two measures. Furthermore, these indications are not severe enough that they may challenge the credibility of the conclusions derived from the findings about the short and long run drivers. In this way, both pre- and post-estimation tests' reports confirm the appropriateness of specifications made in the models and the overall fitness of models.

6.3 Results of the Short Run Determinants

It is evident from Table 6.4 that the results of error correction (henceforth ECM) term lends further support to the existence of stable long run equilibrium (cointegration) relationships among the variables for the case of every measure of global liquidity. The coefficients of ECM terms of all the models are highly significant at 1% level of significance with negative sign and their absolute values are also less than one. However, the magnitudes of the coefficients of ECM terms vary across the measures of global liquidity. The magnitude of the coefficient of ECM term for the case of GLCE is -0.091 which implies that the dependent variable (GLCE) reverts back to its long run equilibrium path in case of its any short term deviation from the equilibrium path. Moreover, on average its speed of adjustment to equilibrium path is about 9% per period (month). Further, the value of the coefficient of ECM term for the case of GLDIV is -0.0086 which demonstrates that on average around 0.86% of short run deviation from the equilibrium path is corrected. Furthermore, the value of the coefficient of ECM term for GLGDPW is -0.0053 which implies that around 0.53% of short run deviation is corrected in a month. Nonetheless, it substantiates that GLGDPW possesses the tendency of convergence to its long run equilibrium path though the speed of adjustment is very low.

Similarly, the speed of convergence of GLSUM is about 10% and of GLPCA is around 7.75% per month.

As far as the short run determinants are concerned, it is clear from Table 6.4 that global liquidity is not determined by its own lag values in the short run as shown in the cases of all global liquidity measures except GLDIV. It implies that global liquidity is not influenced by its own inherited behaviour in the short run rather there are some other factors that determine it. It is in agreement with a common understanding that short term changes in the quantity of monetary services do not depend on their previously available quantity. Since the primary source of liquidity is official liquidity and central banks do not create liquidity keeping in view the available liquidity only rather they take into account other economic developments such as inflation, unemployment rate etc.

On the other hand, other institutions that provide private liquidity (monetary) services also make decisions about the creation and destruction of liquidity services considering their demand and supply prospects instead of solely considering their quantity. Owing to this reason, it is likely that global liquidity is not influenced by its own lag values in short run. However, the coefficient of its first lag is statistical significant at 1% level of significance for the case GLDIV which implies that on average global liquidity shrinks by 0.2479% as a result of 1% increase in its first lag, provided that all other factors are constant. This points towards the situation whereby one period rise in global liquidity is offset, though not equally, in subsequent period to ward off the implications emanated by excessive liquidity.

Further, GIPI is one of the significant factors that impact short term developments in global liquidity as substantiated in the cases of all measures of global liquidity. However, the nature of effects and time of effects vary across global liquidity measures. In case of GLCE, GLDIV and GLPCA, it is noted that current value of GIPI has positive and significant impact on global liquidity whist in the case of GLSUM and GLGDPW first and second lag of GIPI negatively impact global liquidity respectively. All this shows that during the periods of positive developments in global business activity, economic agents, particularly investors and depository institutions muster confidence and they demand for and supply of increased quantity of monetary services respectively. Further, the increase in GIPI leads to increased volume of transactions which in turn increases the demand for liquid assets. This is in line with standard demand for money theories, and theoretical and empirical literature (Avdjiev et al., 2020; Cohen et al., 2017; Choi et al., 2017; Cerutti et al., 2017; CGFS, 2011).

However, the negative impact of lags of GIPI indicate that previous periods increase in GIPI squeezes the ability of depository institutions to create liquidity due to their depleting reserves, as individuals and business firms are keeping higher amount of liquid assets with themselves instead of depositing them in financial institutions. However, we document strongest effect of GIPI on global liquidity in case of GLCE where it indicates that on average 1% increase in GIPI leads to 0.1112% increase in global liquidity, given the other factors remain same, whereas the weakest effect is noted in case of GLDIV where it implies that 1% increase in GIPI, on average, causes 0.0428% increase in global liquidity, provided that all other factors are constant.

It is also observed that GBL significantly impacts short term dynamics of global liquidity, as noted in the cases of two measures of global liquidity: GLCE and GLGDPW. Nevertheless, in the cases of GLDIV, GLSUM and GLPCA, it is substantiated that GBL has no statistically significant impact on global liquidity. It is further noted that only current level of GBL impact short term developments of global liquidity. However, the nature of effects differs across global liquidity measures. In case of GLCE it has positive whilst in case of GLGDPW it has, though very feeble, negative impact. It is very clear that financial institutions can potentially increase monetary services by increasing their leverage but it happens only when financial institutions can permissibly increase their leverage. It is also in line with one view of literature (Bruno and Shin, 2013, 2014; CGFS, 2011).

However, the negative impact supports another view that swelling bank balance sheets fuels risk sentiments which ultimately dampens liquidity conditions (Buch and Goldberg, 2015). Anyhow, we document its strongest effect in case of GLCE where it implies that global liquidity, on average, swells by 0.0536% as a result of 1% increase in GBL, provided that all other factors remain constant, while the most fragile effect is in case of GLGDPW here it indicates that on average global liquidity contracts by 0.007% due to 1% rise in GBL, given that all other factors do not alter.

Table 6.4 also demonstrates that GCBBF has statistically significant impact on the short run developments in global liquidity as authenticated by four global liquidity measures: GLCE, GLGDPW, GLSUM and GLPCA. Further, all these four cases of global liquidity measures endorse its positive impact, though the time of effect differ across the measures. The evidence of its positive impact is quite in agreement with the views of theoretical as well empirical literature, and also with economic theory (Cohen et al., 2017; Cerutti et al., 2017; Renata, 2015; CGFS, 2011). It is generally viewed that bank flows fetch capital to capital-deficient areas and capital-deficient areas quickly amplify liquidity on the ground of received capital. Hence, through this phenomenon an increase in the volume of cross-border bank flows serves as an impetus to global liquidity conditions. Anyhow, the highest magnitude of its coefficient, though significant at 10% level of significance, is for the case of GLCE where it shows global liquidity on average expands by 0.6592% as a result of 1% increase in GCBBF, ceteris paribus, whereas the smallest magnitude of its coefficient is for the case of GLGDPW where it implies 0.0622% average increase in global liquidity as a result of 1% increase in it, provided that all other conditions remain same.

Further, it is also apparent from Table 6.4 that GINF is also one of the significant determinants of short term global liquidity conditions, as supported by all the measures of global liquidity. However, the nature of its effect varies across its lags: its level and first lag have positive and significant impact, while fourth and sixth lags have negative and significant impact. The positive impact of its level and first lag implies that when prices of goods increase individuals and business firms have to keep more cash to carry out day-to-day activities, thus demand for liquid assets increases. It is also in concord with the existing literature (Sousa and Zaghini, 2008; Rüffer and Stracca, 2006). On the other hand, the negative effects of its fourth and sixth lags refer to monetary authorities' action of squeezing money supply in face of soaring prices. Additionally, the lagged negative effect further indicates delayed response of monetary authorities. However, the greatest magnitude of its coefficient is in the case of GLDIV and the smallest is in the case of GLGDPW.

Furthermore, it is evident in the case of only one measure of global liquidity (GLCE) that VIX influences the short term developments in global liquidity. Further, it has statistically significant and negative impact on global liquidity which implies that global liquidity shrinks due to increase in the intensity of global risk. These findings are in agreement with the views of theoretical as well as empirical literature (Choi et al., 2017; Bruno and Shin, 2014, 2015; Rey, 2015; CGFS, 2011). Further the magnitude of its coefficient indicates that global liquidity on average contracts by 0.0129% due to 1% increase in VIX, provided that all other factors remain same.

Similarly, all the cases of global liquidity measures, except that of GLGDPW, substantiate that GRINT also drive global liquidity conditions in the short run. However, the nature of its effects varies across its lags. In this regard, its negative effect is recorded at its level in the cases of all the four measures but positive effects of its first, third and fourth lags are witnessed and again negative effect of its fifth lag is documented across the cases of different measures of global liquidity. Its negative impact on global liquidity is in agreement with theoretical and empirical literature that implies the demand for liquid assets declines due to rise in their real opportunity cost (Choi et al., 2017; Cerutti et al., 2017; Renata, 2015; CGFS, 2011).

On the other hand, the positive effects of its lags look strange but this might be due the reason that people prefer to deposit monetary assets in depository corporations in the face of rising opportunity cost of holding them. This act on the part of people increases the ability of depository corporations to amplify liquidity conditions (supply side view). Anyhow, the largest value of its coefficient is in the case of GLCE that implies that one unit increase in GRINT causes, on average, 24.66% (27.96%)[37] fall in global liquidity, given that all other factors are held constant and the smallest value in case of GLDIV indicates on average 0.62% (0.622%) decline in global liquidity as a result of one unit increase in it, provided that all other variables remain constant.

Additionally, it is substantiated in the cases of all measures of global liquidity, except that of GLCE that GINTD is also one of the short run drivers of global liquidity conditions. Further, all the four measures (other than GLCE), except GLDIV, report positive impact of its level and first lag which further lends support to the view maintained in theoretical and empirical literature that interest rate differential triggers cross-border bank and capital flows which in turn leads to increased global liquidity (Cerutti et al., 2017; Renata, 2015; CGFS, 2011). However, the negative impact is documented at its level in case of GLDIV and at its second lag in case of GLGDPW only. It might be due the fact that stringent monetary stance (raised Federal fund rate) in the US curtails the ability of financial institutions

[37] The value in parenthesis adjacent to the other value of coefficient is calculated by using the formula: $(e^{\beta_i} - 1) * 100$ because the dependent variable is in log form while independent variable is not.

Table 6.4: Results of the Short Run Determinants

	D(LGLCE)	D(LGLDIV)	D(LGLGDPW)	D(LGLSUM)	D(LGLPCA)
D(LGLCE(-1))					
D(LGLDIV(-1))		-0.2479*** (0.003)			
D(LGLGDPW (-1))			0.1421 (0.301)		
D(LGLSUM(-1))					
D(LGLPCA(-1))					
D(LGIPI)	0.1112** (0.013)	0.0428*** (0.000)	-0.0161 (0.421)	0.0506 (0.535)	0.0444*** (0.008)
D(LGIPI(-1))			0.022726 (0.4167)	-0.2132** (0.010)	
D(LGIPI(-2))			-0.0682*** (0.000)		
D(LGBL)	0.0537*** (0.000)		-0.007*** (0.000)	0.0021 (0.852)	
D(LGCBBF)	-0.0034 (0.992)		-0.0087 (0.717)	0.2634*** (0.000)	0.2916*** (0.000)
D(LGCBBF(-1))	-1.1742 (0.218)		0.0622** (0.013)		
D(LGCBBF(-2))	0.6592* (0.097)				
D(GINF)	0.0074*** (0.000)	0.0094*** (0.000)	-0.0001 (0.217)	0.0060*** (0.000)	0.0080*** (0.000)
D(GINF(-1))		0.000254 (0.168)	0.0002*** (0.006)	0.0001 (0.961)	-0.0001 (0.563)
D(GINF(-2))		-0.0003 (0.119)		0.0001 (0.969)	0.0005 (0.272)
D(GINF(-3))		-0.0002 (0.192)		-0.0004 (0.273)	-0.0005 (0.215)
D(GINF(-4))				-0.0006** (0.037)	-0.0008*** (0.005)
D(GINF(-5))				-0.0001 (0.632)	-0.0001 (0.931)
D(GINF(-6))				-0.0005* (0.0521)	-0.0007** (0.0278)
D(LVIX)	-0.0129** (0.028)				
D(GRINT)	- 0.2466*** (0.000)	-0.00697** (0.022)		-0.0416*** (0.000)	-0.0312*** (0.000)

Continue…

Table 6.4: Results of the Short Run Determinants (Continued...)

	D(LGLCE)	D(LGLDIV)	D(LGLGDPW)	D(LGLSUM)	D(LGLPCA)
D(GRINT(-1))	0.0445* (0.087)	0.0001 (0.994)		0.0088 (0.426)	0.0136*** (0.006)
D(GRINT(-2))	-0.0033 (0.890)	-0.0081 (0.229)		-0.0108 (0.379)	
D(GRINT(-3))	0.010 (0.663)	-0.0070 (0.180)		0.0114* (0.077)	
D(GRINT(-4))	0.0488** (0.046)	0.0150*** (0.0054)			
D(GRINT(-5))	-0.0522*** (0.000)	-0.0062* (0.0534)			
D(GINTD)		-0.0005** (0.036)	0.0013* (0.053)	0.0009** (0.014)	0.0008* (0.064)
D(GINTD(-1))			0.0021* (0.056)		
D(GINTD(-2))			-0.0014* (0.087)		
ECM(-1)	-0.091*** (0.000)	-0.0086*** (0.000)	-0.0053*** (0.0003)	-0.1001*** (0.000)	-0.0775*** (0.000)

Notes: As for Tables 3.1 and 6.1, except that *P-Value* is given in parentheses. The letter "D" in the start of variables indicates their first difference.

to increase the amount of monetary assets which in turn reduces cross-border quantity of monetary assets because money supply of most of the countries is linked with the availability of foreign exchange in terms of the US dollar to some or greater extent.

6.4 Results of the Long Run Determinants

It is obvious from Table 6.5 that GIPI is a statistically significant driver of global liquidity conditions in the long run. All the cases of global liquidity measures validate that GIPI has positive impact on global liquidity. It might be due to the fact that flourishing real business conditions enhance individuals and business firms, and monetary intermediaries confidence; thus, they demand for and supply of more liquid assets respectively. Further, it becomes more lucrative to invest in real business than to keep the funds with depository corporations during a cosy economic environment. Furthermore, individuals and business firms keep more cash to carry out day-to-day activities, hence demand for liquid assets increases. In addition, volume of transactions inflates due to rise in GIPI, hence more liquid assets are required to carry out these transactions. This evidence is in concord with the standard demand for money theories and also with theoretical as well as empirical literature (Avdjiev et al., 2020; Cohen et al., 2017; Choi et al., 2017; Cerutti et al., 2017).

Further, in the cases of three measures of global liquidity, GBL is found to be significant determinant of global liquidity in the long run. However, the nature of its effects varies across the measures. In case of GLCE it is noted that it has positive impact; whereas in the cases of GLGDPW and GLSUM, it has negative impact on global liquidity. The evidence of its positive impact on global liquidity conditions supports the view that financial institutions can potentially increase monetary services by increasing their leverage (Bruno and Shin, 2013, 2014; CGFS, 2011); however they do so only during good times. On the other hand, the evidence of negative impact strengthens another stance that swelling bank balance sheets fuels risk sentiments, particularly among the financial firms, which ultimately translate into squeezed liquidity conditions (Buch and Goldberg, 2015).

Moreover, it is validated in four cases of global liquidity measures that GCBBF influences the dynamics of global liquidity in the long run. All the four measures document its positive impact on global liquidity. This is in line with the views of theoretical as well empirical literature, and also with economic theory (Cohen et al., 2017; Cerutti et al., 2017; Renata, 2015; CGFS, 2011). It is generally visualized in economic literature that bank flows fetch capital to capital-deficient areas and capital-deficient areas, in turn, quickly amplify liquidity on the ground of received capital. Thus, through this phenomenon, an increase in the volume of cross-border bank flows leads to the creation of liquidity in the areas where there is scarcity of liquid assets. All this leads to overall surge in global liquidity.

In all the cases of five measures of global liquidity GINF is found to be statistically significant determinant of global liquidity in the long run. Further, the cases of four measures of global liquidity report its positive impact while the case of only one measure (GLGDPW) reports its negative impact on global liquidity. The overwhelming evidence in favour of its positive impact might be due to several reasons. First, global economic system possesses historically rising trend in both goods prices and amount of monetary assets. Second, it is also widely documented in the literature that the periods of rising goods prices are closely associated with the periods of surges in global liquidity (Sousa and Zaghini, 2008; Rüffer and Stracca, 2006). Third, when prices of goods increase individuals and business firms have to keep more cash to carry out day-to-day activities, thus demand for liquid assets increases. Fourth, rising goods prices lower real borrowing cost (if monetary authorities do not react) and make investment more lucrative which in turn stimulates business activities. Further, this evidence is also in line with a chunk of empirical literature (Cerutti et al., 2017; Renata, 2015). On the other hand, its negative effect might be due to the monetary authorities' action of squeezing money supply by taking stringent measures, in the face of soaring prices.

Furthermore, only the case of one measure of global liquidity (GLCE) endorses that VIX influences the long-term developments in global liquidity. Thus, the overwhelming evidence, as substantiated by the cases of other four measures, is that VIX does not play any role in the determination of global liquidity conditions in the long run. However, in this case (GLCE), it has statistically significant and negative impact on global liquidity which implies that global liquidity shrinks due to increase in the intensity of global risk. It refers to the situation whereby horizon of future expectations is overcast with uncertainty and consequently economic agents' confidence is eroded. Further, financial institutions are hesitant to lend and the borrowers are very diffident to borrow, in the face of uncertain future. These findings are in agreement with the views of theoretical and empirical literature (Choi et al., 2017; Bruno and Shin, 2014, 2015; Rey, 2015; CGFS, 2011).

Besides, GRINT is also one of the significant long run determinants of global liquidity as validated by the cases of four global liquidity measures: GLCE, GLDIV, GLSUM and GLPCA. Further, majority of the cases of global liquidity measures reports its negative impact on global liquidity. However, the case of only one measure (GLDIV) documents its positive impact. The evidence of its negative impact on global liquidity is in agreement with theoretical and empirical literature that implies the demand for liquid assets declines due to rise in their real opportunity cost – GRINT (Choi et al., 2017; Cerutti et al., 2017; Renata, 2015; CGFS, 2011) . On the other hand, the existence of its positive effect on global liquidity is quite strange and contradicts the views of theoretical as well empirical literature. However, it might be possible if economic agents visualize the future of their investment projects bleak and do not consider investment worthwhile. Hence, they prefer to deposit their financial assets in depository corporations instead of holding them, when faced with rising opportunity cost. All this increases the ability of depository corporations to amplify liquidity conditions (supply side view).

Additionally, it is substantiated in the cases of three measures of global liquidity (GLDIV, GLSUM and GLPCA) that GINTD significantly impact the long run global liquidity conditions. Further, there is no consensus on the nature of its effect as the two measures (GLSUM and GLPCA) report its positive impact whereas one measure (GLDIV) reports its negative impact. Hence, the majority of measures document its positive impact that lends support to the view maintained in theoretical as well as empirical literature that interest rate differential triggers cross-border bank and capital flows which, in turn, leads to increased global liquidity (Cerutti et al., 2017; Renata, 2015; CGFS, 2011). Nevertheless, its negative impact might be due to the reason that the stringent monetary policy (elevated Federal fund rate) pursued by the US monetary authorities may compress global monetary and economic conditions to some extent.

Table 6.5: Results of the Long Run Determinants

	LGLCE	LGLDIV	LGLGDPW	LGLSUM	LGLPCA
LGIPI	1.221734** (0.032)	4.9568*** (0.000)	1.8256*** (0.009)	0.6739*** (0.000)	0.5732*** (0.000)
LGBL	0.5895*** (0.007)		-1.3034*** (0.000)	-0.2107** (0.026)	
LGCBBF	0.3599*** (0.000)		0.3350** (0.015)	0.62388*** (0.000)	0.7365*** (0.000)
GINF	0.0809*** (0.000)	1.3897*** (0.000)	-0.0852** (0.014)	0.0766*** (0.000)	0.1198*** (0.000)
LVIX	-0.1419** (0.027)				
GRINT	-0.261*** (0.000)	0.0823 (0.123)		-0.1109*** (0.000)	-0.0983*** (0.000)
GINTD		-0.0602* (0.055)	0.028358 (0.234)	0.0094** (0.013)	0.0115** (0.033)
C	-8.8477*** (0.000)	-16.487*** (0.000)	-4.7429* (0.0862)	-8.3268*** (0.000)	-10.2956*** (0.000)
Notes: As for Tables 3.1, 6.1 and 6.4.					

In sum, it is obvious from the previous findings that global macroeconomic and financial factors profoundly impact global liquidity conditions both in the short as well as long run. Relying on so called "majority rule" (what majority of the cases of global liquidity support), it can be concluded that GIPI, GCBBF, GINF and GINTD promote global liquidity conditions, whereas GBL and GRINT hamper global liquidity conditions. However, VIX, though documented in the case of only one global liquidity measure, has also negative impact on global liquidity. Further, on the basis of the same principle (majority rule), it can also be argued that the findings derived from the analyses are also in quite agreement with the views of theoretical and empirical literature in the cases of almost all variables.

CHAPTER 7

RESULTS AND DISCUSSION-IV

Global Liquidity Spillovers and Implications for Developing Countries

This chapter sheds light on the findings about the spillover effects of global liquidity on the macroeconomic variables of developing countries. It examines the existence and nature of the effects stemmed from structural (when theoretical restrictions in the light of literature are imposed) and Choleskey decompositions. For the purpose, it proceeds as follows. Its first section examines the order of integration of the variables utilized in this part of the exploration. The second section inspects the impulse responses of variables when theoretical restrictions are enforced and the third section probes into the behaviour of impulse responses when Choleskey decomposition is carried out.

7.1 Unit Root Test Results

Table 7.1 demonstrates that some variables are stationary and some are nonstationary at their level. However, all the developing countries variables, except interest rate of developing countries (henceforth INTD), are nonstationary at their level as we cannot reject the null hypothesis that the variable is unit root processes even at 10% level of significance in the case of each variable. On the other hand, as reported earlier in section 3.4 of the study, some global liquidity measures are stationary and some are nonstationary at their level. Nonetheless, the null hypothesis that the variable is nonstationary can be rejected even at 1% level of significance for all variables exploited in this analysis at their first difference. It can be inferred that the developing countries variables: real economic activity of developing countries (henceforth IPID), CPI of developing countries (henceforth CPID), monetary aggregate of developing countries (henceforth MD) and real effective exchange rate of developing countries (henceforth REERD) are first order integrated. Hence, this altogether gives good reason for the estimation of models at first difference of the variables (where all variables are stationary), ruling out the possibility of spurious results.

Table 7.1: Unit Root Test Results

	Level		**First Difference**	
Variables	***t-Statistic***	***P-Value***	***t-Statistic***	***P-Value***
LGLCE	-1.5472	0.507	-11.1206***	0.000
LGLDIV	-3.3304**	0.014	-9.5015***	0.000
LGLGDPW	-0.6834	0.847	-8.7135***	0.000
LGLSUM	-3.0122**	0.035	-10.9015***	0.000
LGLPCA	-3.4185**	0.011	-10.3259***	0.000
LGIPI	-2.1447	0.227	-4.7882***	0.000
LGCMPI	-2.48445	0.120	-9.3801***	0.000
LIPID	-2.1855	0.212	-6.1272***	0.000
LCPID	-0.88592	0.791	-6.1118***	0.000
LMD	-1.183308	0.390	-4.6794***	0.001
INTD	-2.88352**	0.049	-8.0497***	0.000
LREERD	-0.57696	0.871	-11.5792***	0.000
Notes: As for Tables 3.1 and 4.1.				

7.2 Impulse Responses under Structural Identification Restrictions

The study exploits all the five measures of global liquidity constructed by this study: currency equivalent (henceforth GLCE), Divisia index (henceforth GLDIV), GDP-weighted growth rates (henceforth GLGDPW), simple-sum (henceforth GLSUM) and PCA-based (henceforth GLPCA) in this analysis too. Although the findings in the contexts of all the measures are highly similar, yet there are slight variations across the measures. Thus, it would be simpler and easily comprehendible if we examine the spillover effects of the measures one by one.

GLCE

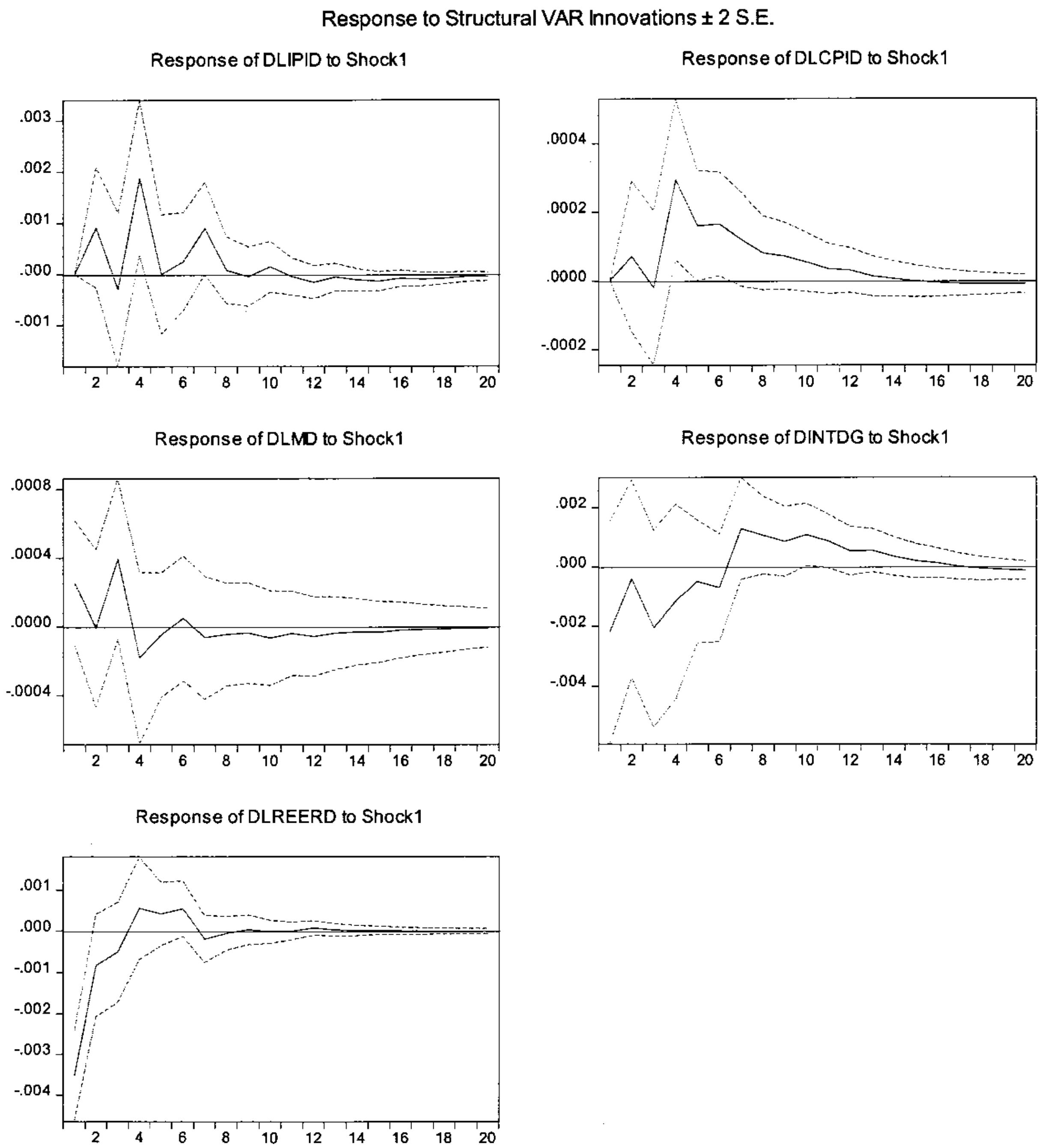
Figure 7.1 exhibits the impulse responses, with 95% confidence bands[38], of macroeconomic variables of developing countries to a one-time one standard deviation positive shock to the log difference of GLCE. It is obvious from the figure that IPID rises in the first two periods and then declines in the third period but its response remains insignificant at 5% level. Again IPID witnesses a surge during the fourth and fifth periods and peaks at the fifth period registering a rise of around 2% in its growth rate, with its response being significant at 5% level in this period. Afterwards, the rise in IPID dies away and also its impulse response tends to be insignificant. This evidence is in concord with the existing literature that expansionary monetary measures yield favourable effects across the borders (Dekle and Hamada, 2015; Choi and Lee, 2010; Sousa and Zaghini, 2008). It might be due the reason that developing countries are mainly deficient of financial resources and expansionary monetary conditions in developed countries lead to financial flows to developing countries, as visualized in the literature that, in turn, stimulate economic activities in developing countries by mitigating the paucity of financial resources.

Analogously, CPID also significantly responds to a one-time innovation in GLCE. In the first three periods of investigation, CPID posts fluctuations but its impulse response is insignificant at 5% level of significance. From the third period, the impulse response function of CPID rises but reaches its peak at fifth period and then gradually declines. Further the impulse response function remains significant from the fourth to eighth periods at 5% level. The hike in CPID is in line with the existing literature (Kang et al., 2016b; Dekle and Hamada, 2015; Choi and Lee,

[38] We use asymptotic standard errors for in construction of confidence bands.

2010; Sousa and Zaghini, 2008). It might be due to some reasons. First, expansionary global liquidity conditions increase foreign demand for the commodities of developing countries and also domestic demand through financial flows to developing countries.

Figure 7.1: Impulse Responses of the Developing Countries Variables to the Innovation in GLCE under Structural Decomposition



Second, easy monetary conditions in advanced economies trigger inflationary pressure in those countries that might stimulate foreign demand for developing countries commodities (substitution effect). Further, price hike in advanced economies is also likely to have spillover effects on CPID.

The impulse response of MD undergoes some fluctuations in the very beginning of investigation period but normalizes very soon. However, the impulse response function of MD remains insignificant at 5% level of significance over the entire period (20 months), which seems very weird. It implies that monetary conditions in developing countries are independent of global liquidity conditions, which seems very strange. It further reflects that monetary authorities in developing countries do not react in terms of monetary aggregates to foreign monetary developments. It might be owing to the fact that liquidity need of domestic agents is fulfilled by foreign financial flows or the monetary authorities in developing countries do not react to foreign liquidity developments.

Besides, the impulse response function of INTD registers rising trend with some oscillations over first eight periods but remains insignificant at 5% level of significance during this period then it gradually declines. However, it becomes significant at 5% level for the 11th and 12th periods, where it posts a rise of around 1% in the growth rate of interest rate. The rise in the interest rate may be accorded to the reaction of monetary authorities in the face of the rising prices and overheating of economy. However, in empirical literature there are mixed findings: domestic interest rate responds positively (Sousa and Zaghini, 2008), negatively (Choi et al., 2017) and does not respond to foreign monetary expansion (Kang et al., 2016b). Hence, our findings strengthen the stance of Sousa and Zaghini (2008).

The impulse response function of log difference of the REERD promptly plunges down and then registers rising trend, peaking at the fourth period and then gradually converges to equilibrium level. However, it remains significant at 5% level of significance for the first two periods only. The consequent abrupt depreciation of the REERD might be due to uncertain conditions engendered by the unexpected liquidity glut and is also consistent with the findings of Kang et al. (2016b). However, the decline in its negative growth rate indicates decrease in the rate of depreciation (in other words appreciation) of REERD. It might be due the fact that financial (capital) inflows appreciate REERD by creating demand for the currencies of developing countries. It is in agreement with the economic theory that exchange rates of countries appreciate due to increased capital inflows and foreign demand for their commodities.

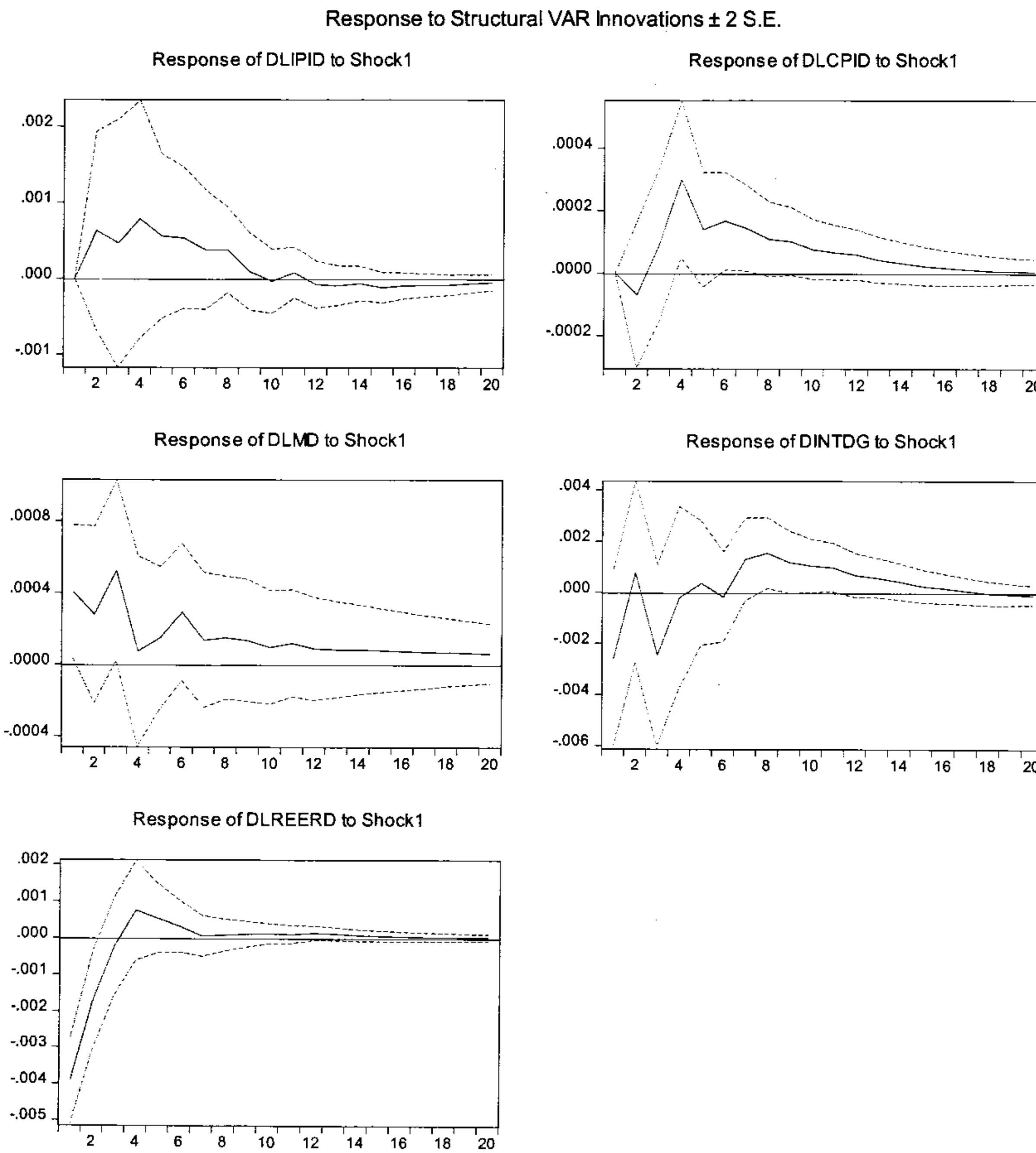
GLDIV

Figure 7.2 presents impulse response functions with 95% confidence bands of the variables of developing countries to a one-time one standard deviation positive innovation in the log difference of GLDIV. It is evident from the figure that impulse response function of IPID soars with some sort of fluctuations in the very start of the period of investigation and then gradually converges to zero-line. Nevertheless, the impulse response function remains insignificant at 5% level of significance over the entire period of investigation. It implies that spillover effects of global liquidity on the economic conditions of developing countries are weak enough that global liquidity fails to influence IPID significantly. Such findings are also documented by few empirical explorations in the literature that monetary developments in one country fails to influence real economic activity of another country (Kang et al., 2016b).

Further, the impulse response function of CPID tends to soar with very few oscillations and reaches its peak at the fourth period, where it also becomes significant at 5% level and then gradually falls. At the fourth period, it documents the rise of around 3% in the growth rate of CPID. It becomes again significant at 5% level for the interval of six to eight periods. Nonetheless, the impulse response function remains insignificant for the first three periods and again for the ninth and onward periods. The rise in the CPID is quite in concord with the views maintained in the existing literature. Further, the CPID hike can be ascribed to a number of reasons as discussed under the previous global liquidity measure (GLCE).

The impulse response function of MD registers some variations but is significant at 5% level of significance only at the first period and between third and fourth period where it also peaks. Additionally, it poses a trend of reverting to the equilibrium path with a very few oscillations after this peak. Although it does not touch the equilibrium path, yet it becomes insignificant at 5% level of significance for the whole remaining period. Further, the significant spike between the third and fourth period corroborates expansionary effect of global liquidity on MD. The resultant spurt in MD is in line with the views expressed in the literature that excess liquidity in one financial centre transmits to others and domestic liquidity swells in response to foreign liquidity gush (Sousa and Zaghini, 2008; Baks and Kramer, 1999). However, this evidence contradicts the results of Kang et al. (2016b) where they document negative response of the US monetary aggregate to the surge in Chinese liquidity.

Figure 7.2: Impulse Responses of the Developing Countries Variables to the Innovation in GLDIV under Structural Decomposition

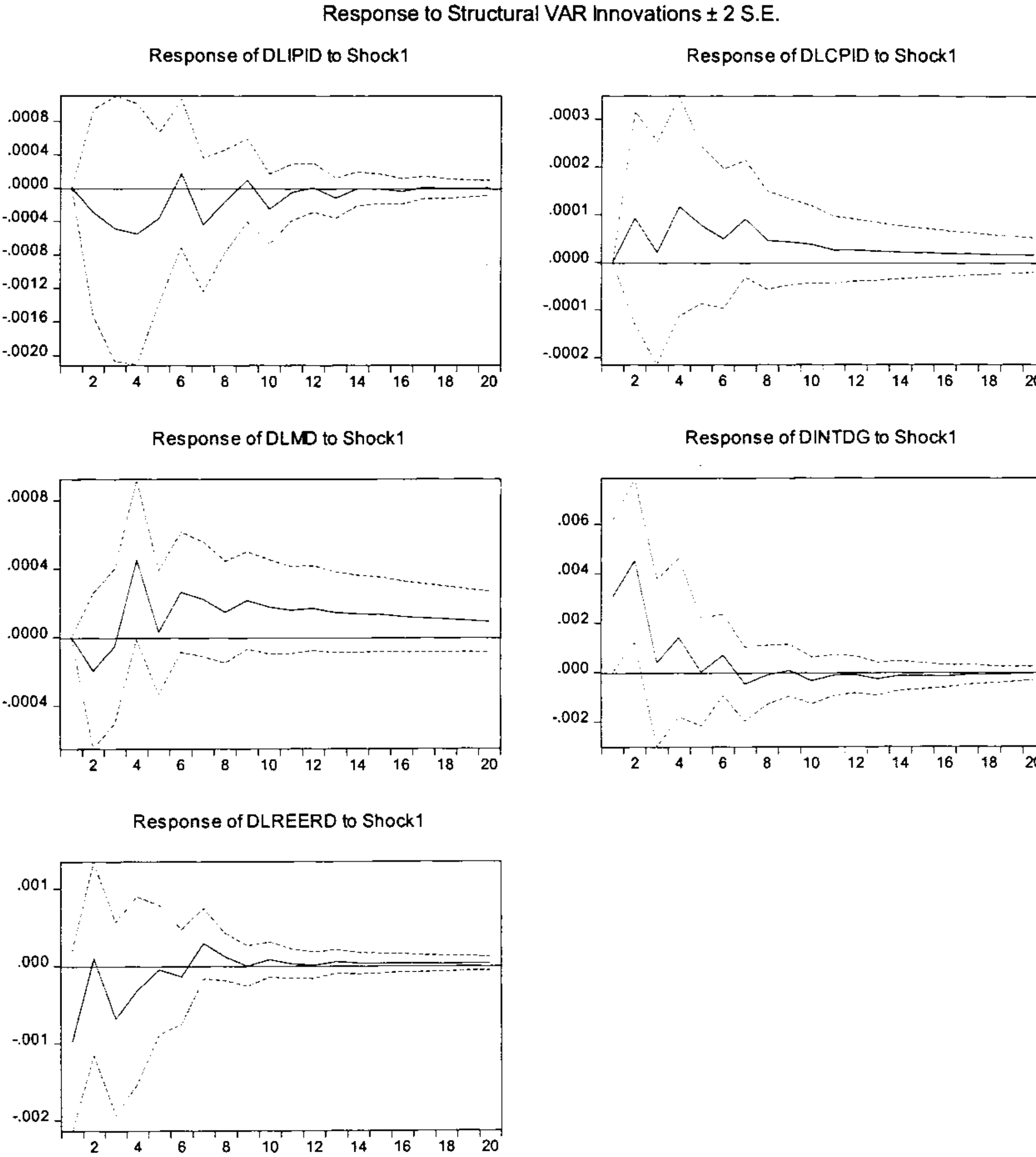


Similarly the impulse response of INTD also fluctuates but remains insignificant at 5% level of significance for the first seven periods of exploration. However, it starts soaring from the sixth period and peaks at the eighth period, and also becomes significant at 5% level of significance for the interval of four periods (from eighth to twelfth period). All this indicates somewhat delayed reaction of monetary authorities of developing countries to global liquidity developments. Moreover, it also seconds the findings of empirical literature as mentioned earlier under GLCE. Besides, the impulse response function of REERD dives down at the very first period and then starts rising, registering a shift in growth rate from negative to positive. However, it is significant at 5% level of significance for the first two periods only. The spontaneous plunge indicates depreciation of REERD. However, the decline in negative growth rate designate reduction in the depreciation of REERD which can be attributed the reasons elaborated under GLCE and is also in agreement with the existing literature.

GLGDPW

The impulse responses of the variables of developing countries to a one-time one standard deviation positive innovation in the log difference of GLGDPW are portrayed in Figure 7.3. It is evident from the figure that impulse response functions of IPID, CPID, MD and REERD register some variations but remain insignificant at 5% level of significance over the entire period (20 months). However, the impulse response function of INTD soars, peaks at the second period and then gradually converges to equilibrium path. Further, it is also significant at 5% level of significance for the first three periods which underlines quick response of the monetary authorities of the developing countries to a surge in global liquidity. This rise in INTD is well in line with the existing literature as mentioned earlier under GLCE. Additionally, the insignificant responses of the variables other than INTD visualize that global liquidity developments do not have spillover effects on the economic conditions of the developing countries, which appears to be very strange in this era of globalization. Nonetheless, this evidence might be due to the fact that GLGDPW is the poorest measure of global liquidity among the class of five measures under investigation, as highlighted in chapters 4 and 5.

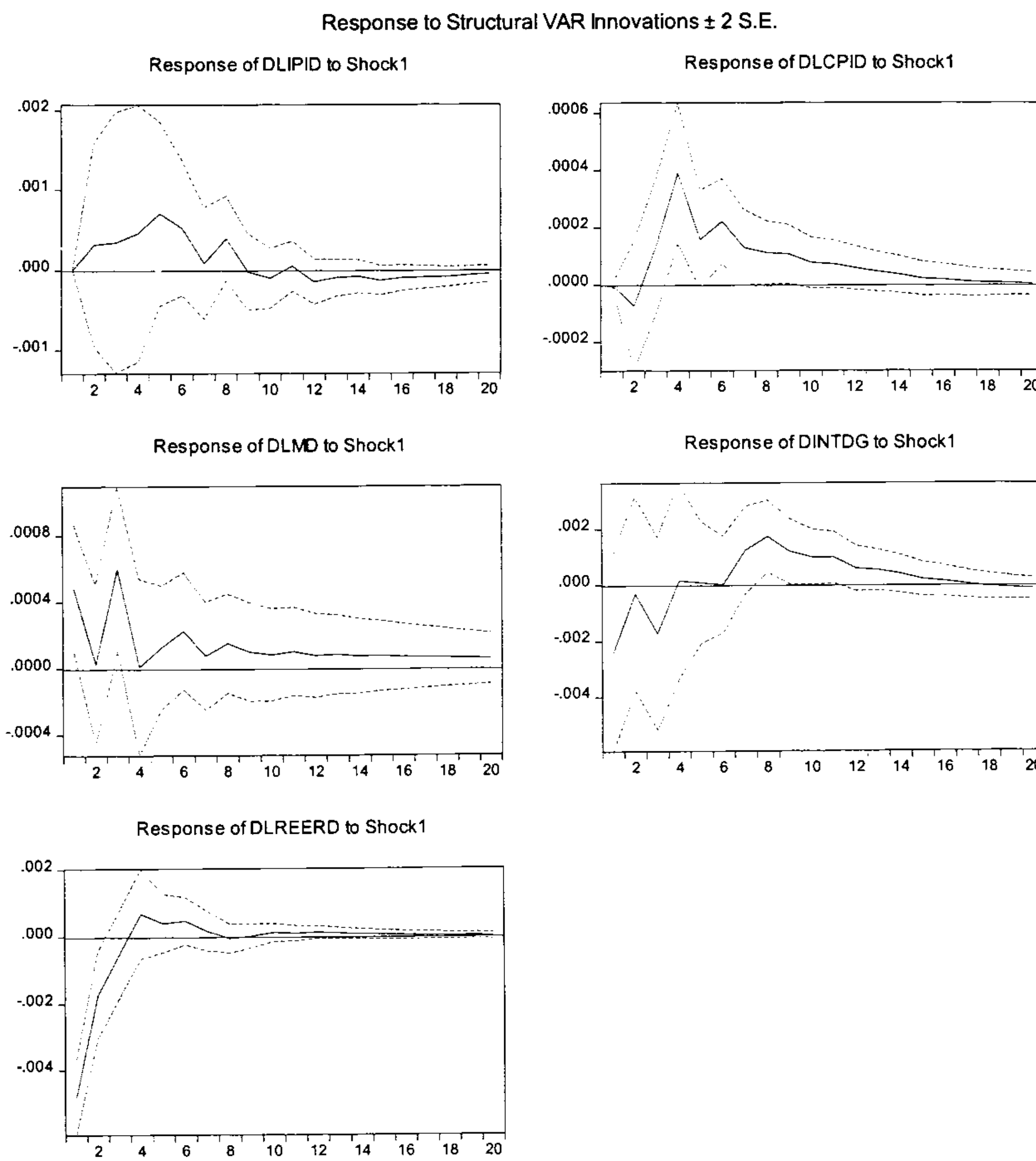
Figure 7.3: Impulse Responses of the Developing Countries Variables to the Innovation in GLGDPW under Structural Decomposition



GLSUM

Figure 7.4 portrays the responses of the developing countries variables to a one-time one standard deviation positive shock to the log difference of GLSUM. It is evident from the figure that impulse response function of IPID rises in the beginning and then gradually converges to zero-line with some oscillations. However, it remains insignificant at 5% level of significance over the entire period, which substantiates that global liquidity developments have no significant spillover effects on IPID. It further strengthens the stance maintained by a sort of literature (as mentioned earlier under GLDIV measure of global liquidity) that cross-border monetary developments sometimes fail to influence domestic real economic activity.

Figure 7.4: Impulse Responses of the Developing Countries Variables to the Innovation in GLSUM under Structural Decomposition



The impulse response function of CPID slightly dips down in the first period and then registers a sharp rise peaking at the fifth period, where it indicates an increase of around 4% in the growth rate of CPID. Further, the impulse response function of CPID remains insignificant at 5% level of significance for about first four periods, then it becomes significant and remains so till the tenth period. The significant rise in CPID in response to a positive global liquidity shock contends that global liquidity leads to the build-up of inflationary pressures in the developing countries. This evidence is quite in line with the existing theoretical as well as empirical literature, as discussed before under GLCE.

The impulse response of function of MD oscillates with larger amplitude in the very start of the investigation period. It swings up in the first period and is also significant at 5% level of significance. In the second period it plunges and turns to be insignificant and again soars and spikes between the third and fourth period, representing a surge of around 6% in the growth rate of MD. Further, the spike between the third and fourth period is significant at 5% level of significance. Nonetheless, this evidence is consistent with the findings derived by earlier explorations and can be ascribed to the reasons mentioned before under GLDIV.

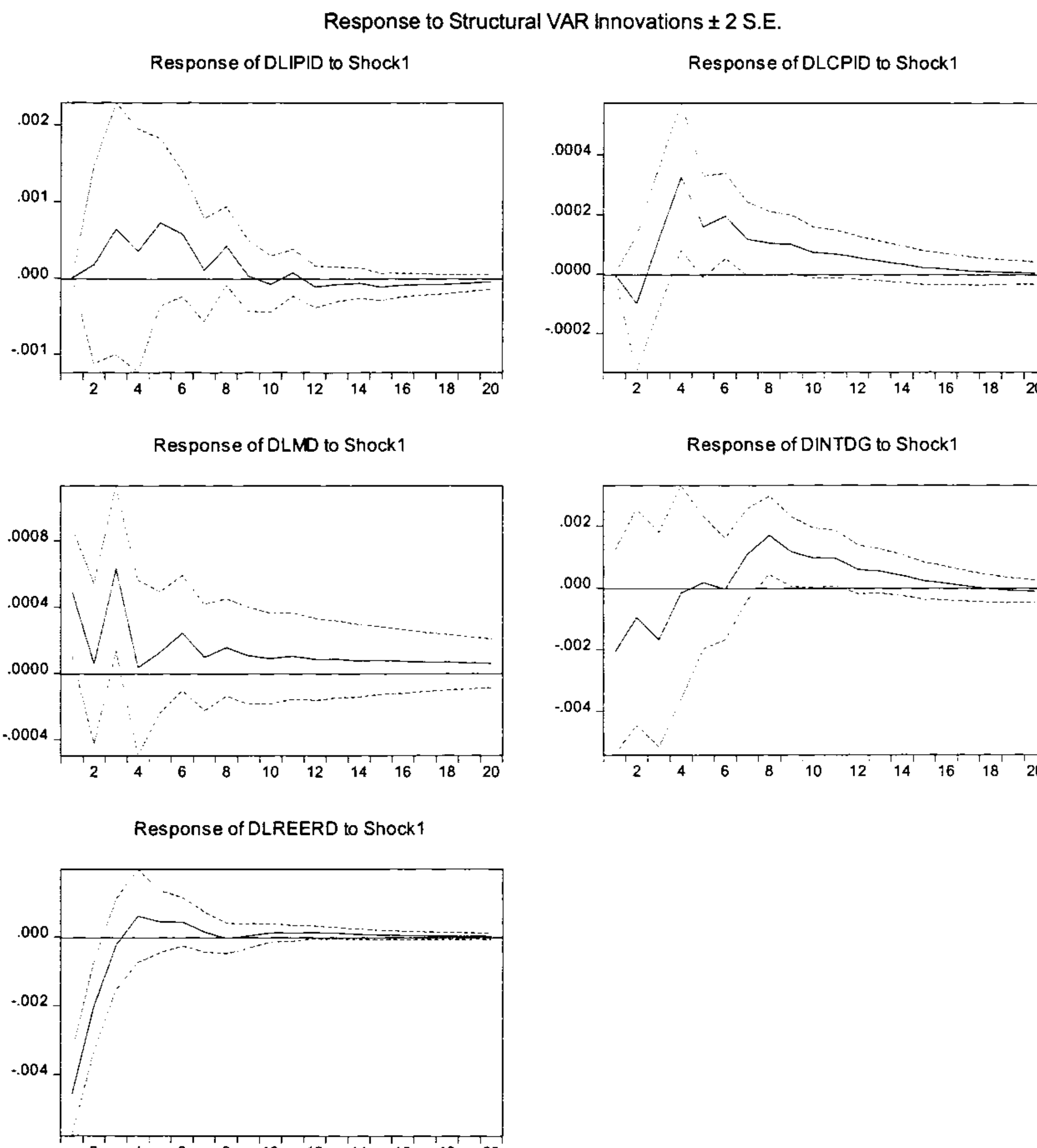
It is also reflected in the figure that the impulse response function of INTD poses rising trend till the eighth period with some variations and then gradually converges to steady path. However, it remains insignificant at 5% level of significance over the first seven periods which points to delayed response of the monetary authorities of the developing countries. Yet, it turns to be significant at eighth period, where it also peaks, and remains so till the twelfth period. The consequent augment in INTD lends additional support to the theoretical as well as empirical literature and can be ascribed to a number of reasons presented earlier under GLCE. Further, the impulse response function of REERD shows similar dynamics as posted under other measures of global liquidity. It registers a very quick reaction. Its impulse response function plunges down and then posts a sharp rise in the start of investigation period, and is also significant at 5% level of significance for the first three periods in this case too.

GLPCA

The impulse responses of the developing countries variables to a one-time one standard deviation positive shock in the log difference of GLPCA are exhibited in

Figure 7.5. The dynamics of impulse response functions in the case of this measure of global liquidity (GLPCA) are quite similar to those in the case of GLSUM. Analogously, the impulse response function of IPID remains insignificant at 5% level of significance, though it yields some vacillations. The growth rate of CPID significantly spikes at the fourth period and then converges to equilibrium path at the tenth period, as substantiated by the dynamics of its impulse response function.

Figure 7.5: Impulse Responses of the Developing Countries Variables to the Innovation in GLPCA under Structural Decomposition



The impulse response function of MD exhibits significant increase in the growth rate of MD in the first and third period. Further, the growth rate of INTD significantly soars in the seventh and eighth periods and then gradually declines till the twelfth period. Moreover, the impulse response function of MD remains significant at 5% level of significance from the seventh to twelfth period. Besides, the impulse response function of REERD plunges at the first period and then significantly rises in the first three periods. The underlying reasons of such dynamics of impulse response functions have been discussed in earlier passages. However, the high similarities among the impulse responses yielded in the cases of GLSUM and GLPCA might be due to the fact that these both measures of global liquidity have almost similar dynamics that has also been corroborated under the chapter of the relative performance of the measures (chapter 5) where both have registered nearly similar performance.

7.3 Impulse Responses under Cholesky Decomposition

The dynamics of impulse response functions of the variables of developing countries are almost same under both structural identification restrictions and Cholesky decompositions for each measure of global liquidity, except for the cases of GLDIV, GLGDPW, GLSUM and GLPCA where very minute variations in the impulse response functions of MD and INTD, regarding their significance, are witnessed (Figures A7.1 through A7.5 given in the Appendix). The variations in the impulse response function of MD are noted as follows. It is found to be significant at 5% level of significance at the first and between third and fourth periods under theoretical identification restrictions but remains insignificant for the entire period of inspection under Cholesky decomposition, when GLDIV is exploited. For the case of GLGDPW, it remains insignificant for the whole period under theoretical identification restrictions but posts positive and significant growth rate under Cholesky decomposition between the third and fourth periods. Further, when GLSUM and GLPCA are utilized, it is significant at the first period and between third and fourth period under theoretical identification restrictions, whereas under Cholesky decomposition it is also significant at the first but not between the third and fourth periods. Besides, there is only one variation in the impulse response function of INTD that it is insignificant under theoretical identification restrictions but is significant under Cholesky decomposition at the first period for the cases of GLDIV, GLSUM and GLPCA.

In sum, it can be maintained that global liquidity has significant spillover effects, though ephemeral in nature, on the macroeconomic variables of developing countries. The surges in global liquidity serve as an impetus to IPID, although this evidence is documented in the case of only one measure of global liquidity that has appeared to be relatively the most efficient measure of global liquidity in this investigation – GLCE. Further, gushes in global liquidity build on inflationary pressure in the developing countries as validated by all the measures of global liquidity under inspection and in both identification schemes. Similarly, it is also authenticated by all the measures except GLCE that monetary services in the developing countries spring up as a result of an increase in global liquidity. Furthermore, it is also noted that monetary authorities in the developing countries react to the consequent inflationary pressure and loose monetary conditions by increasing policy rate, though it is characterized by a delayed response. This evidence is supported by all measures and both identification schemes. Furthermore, in the cases of all the measures except GLGDPW, it is observed that a surge in global liquidity leads to prompt depreciation and then a decline in depreciation (appreciation) of REERD.

CHAPTER 8

CONCLUSION AND RECOMMENDATIONS

It can be deduced from the literature discussed in the preceding chapters that global liquidity has remained central to the discussion on the international financial system. It is generally held that both economic and financial developments are deeply influenced by liquidity conditions. Global liquidity is particularly viewed as one of the chief drivers of commodity and consumer price inflation and has strong association with the asset price booms and busts. Additionally, its spillovers cause significant international implications in the current state of increasingly integrated world. But despite being a focal point of recent research, global liquidity remains an elusive concept, having no agreed measure. Besides, there is lack of rigorous attempts that empirically explore its drivers and investigate its spillover effects on the developing economies in the existing literature.

8.1 Conclusion

This study constructs and examines the dynamics of five different measures of global liquidity over the time by utilizing monthly data spanning from 2001M12 to 2017M12 for 21 high income countries. It also appraises the relative performance of these measures through two approaches: forecasting performance and correlation between the lags of cyclical components of the measures and the cyclical components of global macroeconomic and financial variables. Further, it attempts to explore the short and long run determinants of global liquidity by exploiting all the five measures one by one. Furthermore, it also investigates spillover effects of global liquidity on macroeconomic variables of developing countries. For the spillover analysis we exploit monthly data ranging from 2001M12 to 2017M2017 for 40 developing countries, conforming to the data range of global liquidity measures.

Global liquidity, despite being highly focused in empirical literature emerged in the aftermath of the global financial crisis, lacks comprehensive measure(s) and definition, while remaining an elusive concept. The growing literature on the issue suggests an array of different aspects of global liquidity and a variety of their respective measures. However, most of empirical studies exploit its monetary measures for their investigations and mostly use of atheoretical measures. But the investigations that utilize theoretical measures are very scarce.

Acquiring insight from the use of monetary measures of global liquidity in the overwhelming part of the existing literature, we also construct its two theoretical and three atheoretical monetary measures, using a relatively broader dataset. Our atheoretical measures comprise of the simple-sum, GDP-weighted growth rates and PCA based aggregation methods. And the theoretical measures include currency equivalent and Divisia index techniques of monetary aggregation. The currency equivalent technique is a stock measure and the Divisia index is a flow measure. In this way, this study constructs and investigates both stock and flow measures of monetary aggregates supported by the microeconomic theory.

Further, we inspect the dynamics of monetary aggregates constructed at regional and global levels over time. To this end, we group the high income countries, as classified by the World Bank, into five regional blocks: East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean, the Middle East and North Africa, and North America. We employ a graphical approach for this part of investigation so that trends and dynamics of the aggregates can be distinguished over time. A keen inspection of the developments in monetary aggregates reveal that theoretical measures outperform the atheoretical ones in effective depiction of the financial and liquidity conditions, and policy stance.

Despite the high correlation (greater than 86%) between the global liquidity measures, they register discernable trends and dynamics. The currency equivalent aggregate in almost all the cases remains the most variant while the GDP-weighted growth rates aggregate remains the least variant. Nonetheless, the currency equivalent aggregate is highly sensitive to the changes in the quantities of monetary assets and their returns. The larger fluctuations presented by it can be imputed to the couplet effect of change in monetary quantities and their user costs. After the currency equivalent, the Divisia aggregate posts larger variations than other aggregates. Moreover, the currency equivalent and Divisia aggregate appropriately identify the global financial crisis and its repercussions through presenting eccentric fluctuations in this period.

Apart from the investigation of the dynamics of regional and global monetary aggregates, we also examine the dynamics of regional and global Divisia user costs. The regional Divisia user costs of monetary assets accurately delineate the financial conditions and policy stance of each region. They reflect the uncertainty and fragility of financial conditions in almost every economic and financial distress such as the 9/11 incident, the Uruguay banking crisis of 2002 and the global financial crisis of 2007-2008. It subtly distinguishes the periods of tranquility and turbulence. Analogously, the global Divisia user cost also delineates economic events of high intensity with a substantial amount of exactness. It registers variations of larger amplitude which indicates atmosphere of uncertainty caused by the Asian financial crisis of 1997, Uruguay crisis of 2002, and the last but not the least, 9/11 incident and consequent war against terrorism. For this reason, it supports the stance of some researchers that the Divisia user cost can act as a good indicator of financial and liquidity conditions.

Further, we evaluate relative forecasting performance of the measures by exploiting vector autoregression (VAR) approach. In this direction, before moving over to the forecasting performance of the measures we investigate the order of integration and the existence of cointegration relationships among the variables under investigation in this part of the exploration. The results of these diagnostic tests substantiate that all variables are first order integrated and there exists long run cointegrating relationships among the variables. Furthermore, both the Johansen cointegration rank tests (trace and maximum eigenvalue criteria) validate the existence of cointegartion relationships in each case with one cointegrating vector. Hence, all this supports the use of VAR technique and also rules out the possibility of spurious results.

For the forecasting purpose, we estimate VARs using data for the period of 2001M12 to 2015M6 and generate forecasts for the remaining period of 30 months which accounts for almost 15% of the total sample period. Then, we evaluate the forecasts obtained from these experiments for each variable on the criteria of root mean squared error (RMSE) and mean absolute error (MAE), and also through visual inspection. The results of RMSE and MAE establish the supremacy of currency equivalent measure of global liquidity (GLCE) over all other measures in accurately forecasting all the four variables: global real activity (GIPI), global consumer price index (GCPI), global commodity price index (GCMPI) and global equity price index (MSCI). However, the relatively worst performance is noted in the case of GDP-weighted growth rates measure of global liquidity (GLGDPW).

Adding to the ongoing concluding argument, the best predictor of GIPI is GLCE with the lowest RMSE (4.182) and MAE (3.796), whereas the relatively worst predictor is GLGDPW with highest RMSE (7.821) and MAE (7.059). Further, though the difference among RMSEs and MAEs of indicators is not sizeable, yet both theoretical measures, GLCE and Divisia index of global liquidity (GLDIV), outperform other atheoretical measures in precisely forecasting GIPI. Similarly, the smallest RMSEs and MAEs for all other variables are produced by the VARs exploiting GLCE and the largest by the VARs utilizing GLGDPW, except for the case of GCMPI where the largest RMSE and MAE are generated by the VAR incorporating PCA-based measure of global liquidity (GLPCA). However, the GLDIV fails to yield smaller RMSEs and MAEs than those produced by simple-sum measure of global liquidity (GLSUM) and GLPCA in forecasting GCPI and MSCI.

The visual inspection of the forecasts generated by the global liquidity measures for the variables also seconds the conclusions derived from the RMSE and MAE results. It is observed that all the forecast lines rapidly rise and diverge away from the actual line of GIPI, GCPI, GCMPI and MSCI, except those produced by GLCE which converge to the original lines of GCPI and GCMPI right from the start of forecast horizon. Moreover, the forecast lines generated by the VAR exploiting GLCE remain closer to the actual lines as compared to the other forecast lines for all forecasted variables. However, the most divergent forecasts for GIPI, GCPI and MSCI are yielded by GLGDPW, but for GCMPI by GLPCA. Notably, the forecasts yielded by GLDIV for all variables are very close to those produced by atheoretical measures, failing to make any visible difference. Nonetheless, a tendency of converges to original contours in almost all the forecast contours is witnessed. However, the speed of convergences varies across global liquidity measures and is also observed to be very slow.

Further, the evaluation of forecasting performance of the measures with 95% confidence bands exhibits that GLSUM and GLGDPW badly fails to forecast GIPI as the original line does not lie within the confidence bands constructed by using these two measures over the entire forecast horizon. However, it lies within the confidence band built by exploiting GLCE for the whole period. Further, actual GCPI lies within 95% confidence bands allied to all the measures most of the time. However, it tips out of the confidence band allied to GLDIV for a very short time but it transgresses the confidence band constructed through GLGDPW for noticeable period, indicating poor performance of GLGDPW. Analogously, original GCMPI lies within the confidence bands associated with all the measures over the entire forecast period. However, in case of GLSUM and GLPCA, the actual GCMPI touches the boundaries of confidence bands at least once. Contrarily, it is observed that overall the power of global liquidity measures to forecast MSCI is not remarkable. However, GLCE succeeds to predict MSCI in a somewhat better way than all other measures, as the actual MSCI falls within the confidence band established by utilizing this measure most of the time. But all other measures, particularly GLDIV and GLGDPW badly fail to predict MSCI.

On the other hand, the strength of association between the secular components of global macroeconomic and financial variables and the lags of the secular components of global liquidity measures substantiates that GLCE has relatively strongest association with GIPI, GLDIV has with GCPI and MSCI and GLPCA has with GCMPI. Hence, collectively both theoretical measures outperform the atheoretical ones on the basis of strength of association between the cyclical components in all cases, except that of GCMPI. Overall, it is noted that the lags of the secular components of global liquidity are highly correlated with the secular components of inspected global variables. All this substantiates that global liquidity might play critical role in the long run developments in the global economic and financial conditions.

Besides, we explore the short and long run determinants of global liquidity by exploiting autoregressive distribute lag (ARDL) model and using bounds testing approach to examine the existence of long run cointegration relationships among the variables. The variables investigated in this analysis are not integrated of same order: some are stationary at level and some are first order integrated. Therefore, we resort to ARDL bounds testing approach. Further, since it is deemed that it would be more appropriate to investigate overall global developments as the drivers of global liquidity, we attempt to explore the global determinants (not country-specific) of global liquidity.

The results of both *F-* and *t-statistics* meant for ARDL bounds test validate the existence of cointegration relationships among the variables for the case of each measure of global liquidity. However, the magnitude of t-statistic for the model utilizing GLGDPW does not exceed upper bound limit that indicates the possibility of degenerated relationships. Further, the coefficients of error correction term (ECM), though their magnitudes vary across global liquidity measures, carry negative sign and have magnitude less than one in every case. This evidence further confirms that any short run deviation from the long run path will be corrected over time; hence there exists stable long run relationships among the variables considered in each model.

Additionally, we also employ post-estimation diagnostics to examine the appropriateness and soundness of the models. For the purpose, we investigate overall significance, appropriate functional forms, presence of serial correlation among the residuals and parameter stability of the models. The outcomes of *F-test* of overall significance of models validate the overall significance of all models. Similarly, the results of Ramsey's RESET support linear forms of models against quadratic forms. Further, the outcomes of serial correlation LM test dismiss the presence of serial correlation among the residuals of each model up to 12 lags. Moreover, the plots of cumulative sum (CUSUM) of recursive residuals and CUSUM of square (CUSUMSQ) tests contend that the coefficients of almost all models are stable.

Further, it is evident from the analysis that GIPI is one of the significant factors that impact the short term developments in global liquidity. This evidence is supported by all the measures of global liquidity. However, the nature of effects and time of effects vary across the measures. In the cases of GLCE, GLDIV and GLPCA, it is noted that current value of GIPI has positive and significant impact on global liquidity whilst in the case of GLSUM and GLGDPW first and second lag of GIPI negatively impact global liquidity respectively. Moreover, global bank leverage (GBL) also significantly impacts the short term dynamics of global liquidity. However, it is substantiated by only two measures of global liquidity: GLCE and GLGDPW. It is further observed that current level of GBL impacts the short term developments of global liquidity. But the nature of effects varies across global liquidity measures. For the case of GLCE it has positive whilst in case of GLGDPW it has, though negligibly very small, negative impact on global liquidity.

Moreover, global cross-border bank flows (GCBBF) have statistically significant impact on the short run developments in global liquidity as authenticated by four global liquidity measures: GLCE, GLGDPW, GLSUM and GLPCA. Further, all these four cases of global liquidity measures endorse its positive impact, though the time of effect differ across the measures. On the other hand, it is validated by all the five measures that global inflation (GINF) is also a statistically significant determinant of the short term global liquidity conditions. However, the nature of its effect varies across its lags: its level and first lag have positive and significant impact whilst fourth and sixth lags have negative and significant impact. The positive impact of its level and first lag implies that when prices of goods increase individuals and business firms have to keep more cash to carry out day-to-day activities, thus demand for liquid assets increases.

Furthermore, it is also documented, though in the case of only one indicator of global liquidity, GLCE, that global risk (VIX) influences the short term developments of global liquidity. Nonetheless, it has statistically significant and negative impact on global liquidity which implies that global liquidity shrinks due to increase in the intensity of global risk. Apart from this, all the cases of global liquidity measures, except that of GLGDPW, substantiate that global real interest rate (GRINT) also drive global liquidity conditions in the short run. However, the nature of its effects varies across its lags. In this regard, its negative effect is recorded at its level in the cases of all the four measures. But it is further detected that its first, third and fifth lags augment whilst the sixth lag dampens global liquidity conditions. Moreover, the nature of the effects of its lags also varies across global liquidity measures.

Additionally, it is also substantiated in the cases of all measures of global liquidity except that of GLCE that GINTD is also one of the short run drivers of global liquidity conditions. Further, all the four measures, except GLDIV, report positive impact of its level and first lag which further lends support to the view maintained in theoretical and empirical literature that interest rate differential triggers cross-border bank and capital flows which, in turn, lead to increased global liquidity. However, the negative impact is documented at its level in case of GLDIV and at its second lag in case of GLGDPW only.

The findings of the study about the long run determinants of global liquidity endorse that GIPI is a statistically significant driver of global liquidity conditions in the long run. All the cases of global liquidity measures validate that GIPI has positive impact on global liquidity. It might be due to the fact that flourishing business conditions enhance individuals and business firms, and monetary intermediaries confidence thus they demand for and supply of more liquid assets respectively. Further, in the cases of three measures of global liquidity, GBL is found to be significant determinant of global liquidity in the long run. However, the nature of its effects varies across the measures. In case of GLCE, it has positive impact whilst in the cases of GLGDPW and GLSUM, it has negative impact on global liquidity.

Moreover, it is validated in the four cases of global liquidity measures that GCBBF influences the dynamics of global liquidity in the long run. All measures, except DLDIV, document its positive impact on global liquidity. On the other hand, in all the cases of five measures of global liquidity, GINF is found to be statistically significant determinant of global liquidity in the long run. Further, four global liquidity measures report its positive impact while the case of only one measure (GLGDPW) reports its negative impact on global liquidity. Besides, only the case of one measure of global liquidity (GLCE) endorses that VIX influences the long-term developments in global liquidity. Thus, the overwhelming evidence, as substantiated by the cases of other four measures, is that VIX does not play any role in the determination of global liquidity conditions in the long run.

Further, GRINT is also one of the significant long run determinants of global liquidity as validated by the cases of four global liquidity measures: GLCE, GLDIV, GLSUM and GLPCA. Further, majority of the cases of global liquidity measures report its negative impact on global liquidity. However, the case of only one measure (GLDIV) documents its positive impact. Additionally, it is substantiated in the cases of three measures of global liquidity (GLDIV, GLSUM and GLPCA) that GINTD significantly impact long run global liquidity conditions. Further, there is no consensus on the nature of its effect as the two measures (GLSUM and GLPCA) report its positive impact whilst one measure (GLDIV) reports its negative impact.

Taken together, it is obvious from the ongoing discussion that global macroeconomic and financial factors profoundly impact global liquidity conditions both in the short as well as long run. Relying on so called "majority rule" (what majority of the cases of global liquidity support), it can be concluded that GIPI, GCBBF, GINF and GINTD foster, whereas GBL and GRINT hamper global liquidity conditions. However, VIX, though documented in the case of only one global liquidity measure, has also negative impact on global liquidity. Further, on the basis of the same principle (majority rule), it can also be argued that the findings derived from the analyses are also in quite agreement with the views of theoretical and empirical literature in cases of almost all the variables.

Lastly, we also investigate spillover effects of global liquidity on some macroeconomic and financial variables of developing countries by exploiting structural VAR (SVAR) model. We examine the short term spillover effects as we impose non-recursive identification restrictions in the contemporaneous setting and estimate the models at first difference instead of at level of the variables. Further, we employ two schemes of identification restrictions: structural identification restrictions and Cholesky decomposition to derive impulse response functions of the developing countries variables. We examine impulse responses of the developing countries variables to a one-time one standard deviation positive innovation in each measure of global liquidity. Nonetheless, we reckon the significance of each impulse response function at 5% level of significance.

The findings of the analysis carried out in this part of the investigation maintain that global liquidity has significant spillover effects, though ephemeral in nature, on the macroeconomic variables of developing countries. The surges in global liquidity serve as an impetus to industrial production index of developing countries (IPID), though this evidence is documented in the case of only one measure of global liquidity that has appeared to be relatively most efficient in this investigation – GLCE. Further, gushes in global liquidity build on inflationary pressure in the developing countries as validated by all the measures of global liquidity under inspection and in both identification schemes.

Similarly, it is also validated by all the measures except GLCE that monetary services in the developing countries spring up as a result of an increase in global liquidity. Furthermore, it is also noted that monetary authorities in the developing countries react to the consequent inflationary pressure and loose monetary conditions by increasing policy rate; however it is characterized by a delayed response. This evidence is supported by all measures and both identification schemes. Furthermore, in case of all the measures except GLGDPW, it is observed that a surge in global liquidity leads to prompt depreciation and then a decline in depreciation (appreciation) of real effective exchange rate of developing countries (REERD). Moreover, both the identification schemes have yielded somewhat similar results.

8.2 Policy Recommendations

Based on our findings, we recommend that central banks of the world should collect and issue data on the components of monetary aggregates and their respective interest rates as these datasets are desperately needed for the construction of well-behaved theoretical monetary aggregates and consequent exploratory attempts. They should also incorporate theoretical measures, such as currency equivalent and Divisia monetary aggregates, among intermediate targets of monetary policy because this study presents evidence of relatively better performance of theoretical monetary aggregates on global scale. Further, they must utilize, for immaculate information, an array of monetary indicators instead of a single one. This practice may help them effectively cope with economic and financial problems.

Moreover, we also recommend the world-wide policymakers to keep a vigilant eye on the developments and dynamics of global liquidity as it has reasonably good predicting ability of global financial and economic conditions. The dynamics of global liquidity can potentially signal future financial and real economic developments, hence these can provide vital information, in advance, to the people at the helm of affairs to take appropriate steps to prevent financial and economic debacles. Owing to this reason, we also suggest the authorities to make use of both theoretical as well as atheoretical global liquidity measures along with other key variables to chalk out future policy strategies.

Besides, the monetary and other economic authorities across the globe should be wary of abnormal behaviour of the determinants of global liquidity and try to rectify their unusual developments timely. In this regard, they should try to curb overheating or retardation of economic activity, abnormal acceleration or deceleration of global financial flows, swelling or contracting leverage of monetary intermediaries, severe price-hikes, anomalous trends in global interest rates, and irregularities in interest rate differential. All these conditions are the chief drivers of global liquidity, hence are strong indications of global liquidity gluts or shortages. For this reason, policymakers are advised to foresee global liquidity conditions through the lens of these indicators and formulate future policy plans accordingly.

In the light of the findings derived from the analysis of spillover effects of global liquidity, we recommend the monetary and other economic authorities of the developing countries to keep a careful glance on the developments of global liquidity whilst devising and executing domestic policy measures, as global liquidity has significant impact on the economic and financial conditions prevalent in the developing countries. Global liquidity can potentially attenuate or amplify the effects of domestic policy actions in the developing countries. For instance, the effect of contractionary monetary policy pursued in the developing countries can be offset by monetary expansion in the developed countries. Conversely, monetary contraction in the developed countries may further intensify the effect of contractionary monetary policy in the developing countries. In the same line, serious implications may also be encountered in the pursuance of other policy measures in the developing countries. Hence, policymakers in the developing countries have to be very careful in recommending the dose of medicine for economic cure. Considering these implications, it is recommended that the authorities in the developing countries must devise and exercise the policies, well-coordinated with that of the developed countries.

8.3 Recommendations for Future Research

This study attempts to attract the attention of researchers to utilize theoretical measures of global liquidity to better understand and explore its role in global financial stability, and its nexus with macroeconomic and financial variables. Researchers may also use the suggested measures in their future endeavours to investigate the role of global liquidity in business cycles, particularly, to underline the monetary stance that would potentially prevent fluctuations in business activities. This work also lends ground to the future research efforts for the construction of some modified, theory-based indicators of monetary as well as financial conditions. Furthermore, we suggest that researchers should examine the relationships of monetary variables constructed through theory-based aggregation procedures with macroeconomic and financial variables at country, regional and global level for their future explorations.

Moreover, this study attempts to motivate the investigators to dig out some other determinants of global liquidity by exploiting different datasets and econometric tools. In this direction, we suggest models with non-linear functional forms and threshold analyses. Nonetheless, the explorations focused on the determinants of global liquidity, using its monetary measures are very scant; this study tries to draw researchers' attention to this avenue of research. Besides, we also attempt to inspire investigators to examine the spillover effects of global liquidity on different regions and countries. In this field, investigators may examine the spillover effects by considering some other variables of developing countries, such as trade variables. They may conduct comparative studies about the spillover effects of global liquidity, formulating different regional blocks of the countries.

8.4 Limitations of the Study

The limitations of the study are as follows. First, the central banks across the world do not follow a single standard definition in the construction of monetary aggregates and interest rates. We attempt to overcome this limitation by following the definitions suggested by the IMF. Second, the data on the components of monetary aggregates and their respective interest rates is not available for a substantial period. We have to resort to their proxies. Third, we have not investigated the possibility of structural breaks in the data. Last, we have investigated the impulse responses of developing countries variables in SVAR setting and have not considered generalized impulse responses.

REFERENCES

Adalid, R., & Detken, C. (2007). Liquidity shocks and asset price boom/bust cycles. *ECBWorking Paper 732.* European Central Bank, Frankfurt, Germany.

Ait-Sahalia, Y., Andritzky, J., Jobst, A., Nowak, S., & Tamirisa, N. (2012). Market response to policy initiatives during the global financial crisis. *Journal of International Economics*, *87*(1), 162-177.

Albrizio, S., Choi, S., Furceri, D., & Yoon, C. (2020). International bank lending channel of monetary policy. *Journal of International Money and Finance*, *102*, 102124.(https://www.sciencedirect.com/science/article/pii/S0261560619305595)

Aldasoro, I., & Ehlers, T. (2018). Global liquidity: changing instrument and currency patterns. *BIS Quarterly Review September*. Bank for International Settlement, Basel, Switzerland.

Alessi, L., & Detken, C. (2011). Quasi real time early warning indicators for costly asset price boom/bust cycles: A role for global liquidity. *European Journal of Political Economy*, *27*(3), 520-533.

Alkhareif, R. M., & Barnett, W. A. (2012). Divisia monetary aggregates for the GCC countries. In: Barnett, W. A., & Jawadi, F. (Eds.). (2012). Recent Developments in Alternative Finance: Empirical Assessments and Economic Implications. West Yorkshire, Emerald Press, pp 1–37.

Ammer, J., Vega, C., & Wongswan, J. (2010). International transmission of US monetary policy shocks: Evidence from stock prices. *Journal of Money, Credit and Banking*, *42*, 179-198.

Andersen, T. G., & Bollerslev, T. (1998). Deutsche mark–dollar volatility: intraday activity patterns, macroeconomic announcements, and longer run dependencies. *the Journal of Finance*, *53*(1), 219-265.

Andrés, J., López-Salido, J. D., & Nelson, E. (2009). Money and the natural rate of interest: Structural estimates for the United States and the euro area. *Journal of Economic Dynamics and Control*, *33*(3), 758-776.

Apostolakis, G. (2016). Spreading crisis: Evidence of financial stress spillovers in the Asian financial markets. *International Review of Economics & Finance*, *43*, 542-551.

Arltová, M., & Fedorová, D. (2016). Selection of unit root test on the basis of length of the time series and value of AR (1) parameter. *Statistika*, *96*(3), 47-64.

Arndt, S. W., & Richardson, J. D. (1987). Real-financial linkages among open economies. *NBER Working Paper No.* 2230. National Bureau of Economic Research.

Avdjiev, S., & Hale, G. (2019). US monetary policy and fluctuations of international bank lending. Journal *of International Money and Finance*, *95*, 251-268.

Avdjiev, S., Gambacorta, L., Goldberg, L. S., & Schiaffi, S. (2020). The shifting drivers of global liquidity. *Journal of International Economics*, *125,* 103324. (https://www.sciencedirect.com/science/article/abs/pii/S0022199618301946)

Baele, L., Ferrando, A., Hördahl, P., Krylova, E., & Monnet, C. (2004). Measuring European financial integration. *Oxford Review of Economic Policy*, *20*(4), 509-530.

Bagliano, F. C., & Favero, C. A. (1998). Measuring monetary policy with VAR models: An evaluation. *European Economic Review*, *42*(6), 1069-1112.

Bai, J., & Ng, S. (2004). A panic attack on unit roots and cointegration. *Econometrica*, *72*(4), 1127-1177.

Bai, M., & Qin, Y. (2015). Commonality in liquidity in emerging markets: Another supply-side explanation. *International Review of Economics & Finance*, *39*, 90-106.

Baks, K., & Kramer, M. C. F. (1999). Global liquidity and asset prices: Measurement, implications, and spillovers. *IMF Working Paper No.* 99/168. International Monetary Fund, Washington, D.C.

Barnett, W. A. (1978). The user cost of money. *Economics letters*, *1*(2), 145-149.

Barnett, W. A. (1980). Economic monetary aggregates an application of index number and *aggregation* theory. *Journal of econometrics*, *14*(1), 11-48.

Barnett, W. A. (1984). Recent monetary policy and the Divisia monetary aggregates. *The American Statistician*, *38*(3), 165-172.

Barnett, W. A. (1987). The microeconomic theory of monetary aggregation. In: Barnett WA, *Singleton*, K (Eds.), New approaches to monetary economics, Cambridge University Press, New York.

Barnett, W. A. (2003). Aggregation-theoretic monetary aggregation over the euro area, when countries are heterogeneous. *ECB Working Paper No.* 260. European Central Bank, Frankfurt, Germany.

Barnett, W. A. (2007). Multilateral aggregation-theoretic monetary aggregation over heterogeneous countries. *Journal of Econometrics*, *136*(2), 457-482.

Barnett, W. A., & Gaekwad, N. B. (2018). The demand for money for EMU: A flexible functional form approach. *Open Economies Review*, *29*(2), 353-371.

Barnett, W. A., Offenbacher, E. K., &Spindt, P. A. (1984). The new Divisia monetary aggregates. *Journal of Political Economy*, *92*(6), 1049-1085.

Barnett, W. A., & Su, L. (2017). Data sources for the credit-card augmented Divisia monetary aggregates. *Research in International Business and Finance*, *39*, 899-910.

Bauer, M. D., & Neely, C. J. (2014). International channels of the Fed's unconventional monetary policy. *Journal of International Money and Finance*, *44*, 24-46.

Beckmann, J., Belke, A., & Czudaj, R. (2014). Does global liquidity drive commodity prices?. *Journal of Banking & Finance*, *48*, 224-234.

Beirne, J., Caporale, G. M., Schulze-Ghattas, M., & Spagnolo, N. (2013). Volatility spillovers and contagion from mature to emerging stock markets. *Review of International Economics*, *21*(5), 1060-1075.

Belke, A. H., Bordon, I. G., & Hendricks, T. W. (2014). Monetary policy, global liquidity and commodity price dynamics. *The North American Journal of Economics and Finance*, *28*, 1-16.

Belke, A., & Keil, J. (2016). Financial integration, global liquidity and global macroeconomic linkages. *Journal of Economic Studies*, *43*(1), 16-26.

Belke, A., & Rees, A. (2014). Globalisation and monetary policy—A FAVAR analysis for the G7 and the eurozone. *The North American Journal of Economics and Finance*, *29*, 306-321.

Belke, A., & Verheyen, F. (2014). The low-interest-rate environment, global liquidity spillovers and challenges for monetary policy ahead. *Comparative Economic Studies*, *56*(2), 313-334.

Belke, A., & Volz, U. (2019). Flows to emerging market and developing economies–Global liquidity and uncertainty versus country-specific pull factors. *Review of Development Finance*, *9*(1), 32-50.

Belke, A., Bordon, I. G., & Hendricks, T. W. (2010a). Global liquidity and commodity prices–A cointegrated VAR approach for OECD countries. *Applied Financial Economics*, *20*(3), 227-242.

Belke, A., Bordon, I. G., & Volz, U. (2013). Effects of global liquidity on commodity and food prices. *World Development*, *44*, 31-43.

Belke, A., Dubova, I., & Volz, U. (2018). Bond yield spillovers from major advanced economies to emerging Asia. *Pacific Economic Review*, *23*(1), 109-126.

Belke, A., Orth, W., & Setzer, R. (2010b). Liquidity and the dynamic pattern of asset price adjustment: A global view. *Journal of Banking & Finance*, *34*(8), 1933-1945.

Belloumi, M. (2014). The relationship between trade, FDI and economic growth in Tunisia: An application of the autoregressive distributed lag model. *Economic systems*, *38*(2), 269-287.

Belongia, M. T., & Ireland, P. N. (2017). Circumventing the zero lower bound with monetary policy rules based on money. *Journal of Macroeconomics*, *54*, 42-58.

Berger, H., & Harjes, T. (2009). Does global liquidity matter for monetary policy in the Euro Area?. *International Finance*, *12*(1), 33-55.

Bernanke, B. S. (1986, September). Alternative explanations of the money-income correlation. In: *Carnegie-Rochester conference series on public policy*. North-Holland. Vol. 25, pp. 49-99).

Bernanke, B. S., Gertler, M., Watson, M., Sims, C. A., & Friedman, B. M. (1997). Systematic monetary policy and the effects of oil price shocks. *Brookings papers on economic activity*, *1997*(1), 91-157.

Beyer, A., Doornik, J. A., & Hendry, D. F. (2001). Constructing Historical Euro-zone Data. *The Economic Journal*, *111*(469), 102-121.

Bianchi, J., Liu, C., & Mendoza, E. G. (2016). Fundamentals news, global liquidity and macroprudential policy. *Journal of International Economics*, *99*, S2-S15.

Bierut, B. (2013). *Global liquidity as an early warning indicator of asset price booms: G5 versus broader measures*. DNB Working Paper, 377/ May 2013. Netherlands Central Bank, Netherlands.

Binner, J. M., Bissoondeeal, R. K., Elger, C. T., Jones, B. E., & Mullineux, A. W. (2009). Admissible monetary aggregates for the euro area. *Journal of International Money and Finance*, *28*(1), 99-114.

Bonizzi, B., Laskaridis, C., & Toporowski, J. (2019). Global Liquidity, the Private Sector and Debt Sustainability in Sub-Saharan Africa. *Development and Change*, *50*(5), 1430-1454.

Borio, C. (2008). The financial turmoil of 2007? A preliminary assessment and some policy considerations. *Estabilidad financiera*, (14), 23-54.

Borio, C. (2010). Ten propositions about liquidity crises. *CESifo Economic Studies*, *56*(1), 70-95.

Borio, C. E., & Filardo, A. J. (2007). Globalisation and inflation: New cross-country evidence on the global determinants of domestic inflation. *BIS Working Paper No.* 277, Bank for International Settlement, Basel, Switzerland.

Borio, C., & Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?. *Journal of Financial stability*, *8*(4), 236-251.

Bose, S., & Chattopadhyay, S. (2019). Global Liquidity–A Review of Concepts, Measurement, and Effect on Asset Prices: An Empirical Analysis of the Impact on the Indian Stock Market. In: *The Impacts of Monetary Policy in the 21st Century: Perspectives from Emerging Economies*. Emerald Publishing Limited. Bingley, United Kingdom.

Bowman, D., Londono, J. M., & Sapriza, H. (2015). US unconventional monetary policy and transmission to emerging market economies. *Journal of International Money and Finance*, *55*, 27-59.

Brana, S., & Prat, S. (2016). The effects of global excess liquidity on emerging stock market returns: Evidence from a panel threshold model. *Economic Modelling*, *52*, 26-34.

Brana, S., Djigbenou, M. L., & Prat, S. (2012). Global excess liquidity and asset prices in emerging countries: A PVAR approach. *Emerging Markets Review*, *13*(3), 256-267.

Brockman, P., Chung, D. Y., & Pérignon, C. (2009). Commonality in liquidity: A global perspective. *Journal of Financial and Quantitative Analysis*, *44*(4), 851-882.

Browne, F., & Cronin, D. (2010). Commodity prices, money and inflation. *Journal of Economics and Business*, *62*(4), 331-345.

Bruno, V., & Shin, H. S. (2014). Cross-border banking and global liquidity. *The Review of Economic Studies*, *82*(2), 535-564.

Bruno, V., & Shin, H. S. (2013). Capital flows, cross-border banking and global liquidity. *NBER Working Paper No.* 19038. National Bureau of Economic Research.

Bruno, V., & Shin, H. S. (2015). Capital flows and the risk-taking channel of monetary policy. *Journal of Monetary Economics*, *71*, 119-132.

Buch, C. M., & Goldberg, L. S. (2015). International banking and liquidity risk transmission: Lessons from across countries. *IMF Economic Review*, *63*(3), 377-410. International Monetary Fund, Washington, D. C.

Burger, J. D., Sengupta, R., Warnock, F. E., & Warnock, V. C. (2015). US investment in global bonds: As the Fed pushes, some EMEs pull. *Economic Policy*, *30*(84), 729-766.

Bussière, M., Cao, J., de Haan, J., Hills, R., Lloyd, S., Meunier, B., & Styrin, K. (2020). The interaction between macroprudential policy and monetary policy: Overview. *Review of International Economics*. (https://onlinelibrary.wiley.com/doi/abs/10.1111/roie.12505)

Calvo, G. A., Leiderman, L., & Reinhart, C. M. (1993). Capital inflows and real exchange rate appreciation in Latin America: the role of external factors. *Staff Papers*, *40*(1), 108-151.

Canova, F. (2005). The transmission of US shocks to Latin America. *Journal of Applied econometrics*, *20*(2), 229-251.

Canova, F., Ciccarelli, M., & Ortega, E. (2007). Similarities and convergence in G-7 cycles. *Journal of Monetary economics*, *54*(3), 850-878.

Caramazza, F., Ricci, L., & Salgado, R. (2004). International financial contagion in currency crises. *Journal of International Money and Finance*, *23*(1), 51-70.

Cerutti, E. (2015). Drivers of cross-border banking exposures during the crisis. *Journal of Banking & Finance*, *55*, 340-357.

Cerutti, E., Claessens, S., & Ratnovski, L. (2014). *Global liquidity and drivers of cross-border bank flows. IMF Working Paper No.* 14/69. International Monetary Fund, Washington, D. C.

Cerutti, E., Claessens, S., & Ratnovski, L. (2017). Global liquidity and cross-border bank flows. *Economic Policy*, *32*(89), 81-125.

Cesa-Bianchi, A., Cespedes, L. F., & Rebucci, A. (2015). Global liquidity, house prices, and the macroeconomy: Evidence from advanced and emerging economies. *Journal of Money, Credit and Banking*, *47*(S1), 301-335.

Cetorelli, N., & Goldberg, L. S. (2012). Banking globalization and monetary transmission. *The Journal of Finance*, *67*(5), 1811-1843.

Chakraborty, A. B., & Bordoloi, S. (2012). International commodity prices–volatility and global liquidity. *IFC Bulletin*, *28*, 239. International Finance Corporation, Washington, D. C.

Chandrasekhar, C. P. (2008). *Global liquidity and financial flows to developing countries: new trends in emerging markets and their implications*. G-24 Discussion Paper Series Vol. 52. UNCTAD.

Chandrasekhar, C. P., & Ghosh, J. (2009). The global Liquidity Paradox. *mimeo*. New York.

Chen, Q., Filardo, A., He, D., & Zhu, F. (2016). Financial crisis, US unconventional monetary policy and international spillovers. *Journal of International Money and Finance*, *67*, 62-81.

Chen, S., Liu, P., Maechler, A., Marsh, C., Saksonovs, S., & Shin, H. (2012). Exploring the Dynamics of Global Liquidity. *IMF Working PaperNo*. 12/246. International Monetary Fund, Washington, D. C.

Cheung, Y. L., Cheung, Y. W., & Ng, C. C. (2007). East Asian equity markets, financial crises, and the Japanese currency. *Journal of the Japanese and International Economies*, *21*(1), 138-152.

Chinn, M., & Ito, H. (2003). A new measure of capital account openness. *Journal of Comparative Policy Analysis*, *10*(3), 309-322.

Chinn, M. D., & Ito, H. (2008). A new measure of financial openness. *Journal of comparative policy analysis*, *10*(3), 309-322.

Cho, S., Hyde, S., & Nguyen, N. (2015). Time-varying regional and global integration and contagion: Evidence from style portfolios. *International Review of Financial Analysis*, *42*, 109-131.

Choi, W. G., Kang, T., Kim, G. Y., & Lee, B. (2017). Global liquidity transmission to emerging market economies, and their policy responses. *Journal of International Economics*, *109*, 153-166.

Chuhan, P., Claessens, S., & Mamingi, N. (1998). Equity and bond flows to Latin America and Asia: the role of global and country factors. *Journal of Development Economics*, *55*(2), 439-463.

Chung, K., Lee, J. E., Loukoianova, E., Park, M. H., & Shin, M. H. S. (2014). Global liquidity through the lens of monetary aggregates. *IMF Working Paper No.* 14/19. International Monetary Fund, Washington, D.C.

Ciccarelli, M., & Mojon, B. (2010). Global inflation. *The Review of Economics and Statistics*, *92*(3), 524-535.

Clark, J., Converse, N., Coulibaly, B., & Kamin, S. B. (2020). Emerging market capital flows and US monetary policy. *International Finance*, *23*(1), 2-17.

Committee on the Global Financial System (CGFS) (2011). Global liquidity—concept, measurement and policy implications. *CGFS papers, No.* 45. Bank for International Settlement, Basel, Switzerland.

Cohen, B. H., Domanski, D., Fender, I., & Shin, H. S. (2017). Global Liquidity: A Selective Review. *Annual Review of Economics*, *9*, 587-612.

D'Agostino, A. & Surico, P. (2009). Does global liquidity help to forecast US inflation?. *Journal of Money, Credit and Banking*, *41*(2-3), 479-489.

Darius, R., & Radde, S. (2010). Can global liquidity forecast asset prices? *IMF Working Paper No.* 10/196. International Monetary Fund, Washington, D.C.

Darvas, Z. (2015). Does money matter in the euro area? Evidence from a new Divisia index. *Economics Letters*, *133*, 123-126.

Darvas, Z., & Szapáry, G. (2000). Financial contagion in five small open economies: does the exchange rate regime really matter?. *International Finance*, *3*(1), 25-51.

Day, T. E. (1984). Real stock returns and inflation. *The Journal of Finance*, *39*(2), 493-502.

De Santis, R. A., Favero, C. A., & Roffia, B. (2014). Euro area money demand and *international* portfolio allocation: A contribution to assessing risks to price stability. *In:* Winkler, B., Van Riet, A., Bull, P., & van Riet, A. (Eds.). (2013). *A Flow-of-Funds Perspective on the Financial Crisis Volume I: Money, Credit and Sectoral Balance Sheets*. Springer.

Dekle, R., & Hamada, K. (2015). Japanese monetary policy and international spillovers. *Journal of International Money and Finance*, *52*, 175-199.

Detken, C., Gerdesmeier, D., &Roffia, B. (2010). Interlinkages between money, credit and asset prices and their implications for consumer price inflation. In: Papademos, L., & Stark, J. (Eds.). (2010). *Enhancing monetary analysis*. Frankfurt am Main: European Central Bank, Frankfurt, Germany. 307-353.

Devereux, M. B., & Sutherland, A. (2011). Evaluating international financial integration under leverage constraints. *European Economic Review*, *55*(3), 427-442.

Diamond, D. W., Hu, Y., & Rajan, R. G. (2020). The Spillovers from Easy Liquidity and the Implications for Multilateralism. *IMF Economic Review*, *68*(1), 4-34.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, *74*(366a), 427-431.

Diewert, W. E. (1976). Exact and superlative index numbers. *Journal of econometrics*, *4*(2), 115-145.

Diewert, W. E. (1978). Superlative index numbers and consistency in aggregation. *Econometrica*, 46(4), 883-900.

Djigbenou-Kre, M. L., & Park, H. (2016). The effects of global liquidity on global imbalances. *International Review of Economics & Finance*, *42*, 1-12.

Domanski, D., Fender, I., & McGuire, P. (2011). Assessing global liquidity. *BIS Quarterly Review*, 57. Bank for International Settlement, Basel, Switzerland.

Drake, L., Chrystal, K. A., & Binner, J. M. (2000). Weighted monetary aggregates for the UK. In: *Divisia monetary aggregates*. Palgrave Macmillan, London. pp. 47-78.

Dreger, C., & Wolters, J. (2011). Liquidity and Asset Prices: How Strong Are the Linkages?. *Review of Economics and Finance*, *1*, 43-52.

Drehmann, M., Borio, C., &Tsatsaronis, K. (2011). Anchoring Countercyclical Capital Buffers: The Role of Credit Aggregates. *International Journal of Central Banking*, 7(4), 189-240

Ehrmann, M., & Fratzscher, M. (2005). Equal size, equal role? Interest rate interdependence between the euro area and the United States. *The Economic Journal*, *115*(506), 928-948.

Ehrmann, M., & Fratzscher, M. (2009). Global financial transmission of monetary policy shocks. *Oxford Bulletin of Economics and Statistics*, *71*(6), 739-759.

Ehrmann, M., Fratzscher, M., & Rigobon, R. (2011). Stocks, bonds, money markets and exchange rates: measuring international financial transmission. *Journal of Applied Econometrics*, *26*(6), 948-974.

Eickmeier, S., Gambacorta, L., & Hofmann, B. (2014). Understanding global liquidity. *European Economic Review*, *68*, 1-18.

Engle, R. F., Ito, T., & Lin, W. L. (1990). Meteor showers or heat waves - *Heteroskedastic intra daily volatility in the foreign exchange markets, Econometrica 58 (3), 525-542.*

Engle, R., & Granger, C. (1991). *Long-run economic relationships: Readings in cointegration*. Oxford University Press. Oxford, United Kingdom.

European Central Bank (2011). Global liquidity: measurement and stability. *Financial Stability Review* (December, 2011). European Central Bank, Frankfurt, Germany

Everett, M. (2016). Drivers of global liquidity and global bank flows: A view from the euro area. *FIW Working Paper No.* 168. Vienna, Austria.

Favero, C. A. (2001). Applied Macroeconometrics. Oxford University Press, New York.

Fleming, J. M. (1962). Domestic financial policies under fixed and under floating exchange rates. *IMF Staff Papers*, *9*(3). International Monetary Fund, Washington, D. C. pp. 369-380.

Forbes, K. J., & Chinn, M. D. (2004). A decomposition of global linkages in financial markets over time. *Review of economics and statistics*, *86*(3), 705-722.

Forbes, K. J., & Warnock, F. E. (2012). Capital flow waves: Surges, stops, flight, and retrenchment. *Journal of International Economics*, *88*(2), 235-251.

Forbes, K., Fratzscher, M., & Straub, R. (2015). Capital-flow management measures: What are they good for?. *Journal of International Economics*, *96*, S76-S97.

Fornari, F., & Levy, A. (2000). Global liquidity in the 1990s: geographical allocation and long-run determinants. In: *International financial markets and the implications for monetary and financial stability. BIS Conference Papers*, Vol. 8 (March 2000), pp. 1-36.

Frankel, J. A. (1986). Expectations and commodity price dynamics: The overshooting model. *American Journal of Agricultural Economics*, *68*(2), 344-348

Frankel, J. A., & Hardouvelis, G. A. (1985). Commodity prices, money surprises and fed credibilit. *Journal of Money, Credit and Banking*, *17*(4), 425-438..

Fratzscher, M. (2012). Capital flows, push versus pull factors and the global financial crisis. *Journal of International Economics*, *88*(2), 341-356.

Fratzscher, M., Lo Duca, M., & Straub, R. (2017). On the international spillovers of US quantitative easing. *The Economic Journal*, *128*(608), 330-377.

Friedman, M. (1968). The Role of Monetary Policy. *The American Economic Review*, *58*(1), 1-17.

Friedman, M. (1988). Money and the stock market. *Journal of Political Economy*, *96*(2), 221-245.

Gamba-Santamaria, S., Gomez-Gonzalez, J. E., Hurtado-Guarin, J. L., & Melo-Velandia, L. F. (2017). Stock market volatility spillovers: Evidence for Latin America. *Finance Research Letters*, *20*(C), 207-216.

Georgiadis, G. (2016). Determinants of global spillovers from US monetary policy. *Journal of International Money and Finance*, *67*, 41-61.

Gerlach, H. S. (1988). World business cycles under fixed and flexible exchange rates. *Journal of Money, Credit and Banking*, 621-632.

Ghosh, A. R., & Ostry, J. D. (1994). Export instability and the external balance in developing countries. *Staff Papers*, *41*(2), 214-235.

Giese, J. V., & Tuxen, C. K. (2007). Global liquidity and asset prices in a cointegrated VAR. *Nuffield College, University of Oxford, and Department of Economics, Copenhagen University*, 1-28.

Glick, R., & Rose, A. K. (1999). Contagion and trade: Why are currency crises regional?. *Journal of international Money and Finance*, *18*(4), 603-617.

Goldberg, L., & Leonard, D. (2003). What moves sovereign bond markets? The effects of economic news on US and German yields. *Current Issues in Economics and Finance*, *9*(9).

Goldstein, M. (1998). *The Asian financial crisis: Causes, cures, and systemic implications*. Vol. 55. Peterson Institute, Washington, D.C.

Greiber, C., & Setzer, R. (2007). *Money and housing: evidence for the euro area and the US*. Deutsche Bundesbank, Research Centre (No. 2007, 12). Frankfurt, Germany.

Guerello, C., & Tronzano, M. (2020). Global factors, international spillovers, and the term structure of interest rates: New evidence for Asian Countries. *The North American Journal of Economics and Finance*, *51*, 101073. (https://www.sciencedirect.com/science/article/abs/pii/S1062940819300166)

Hamao, Y., Masulis, R. W., & Ng, V. (1990). Correlations in price changes and volatility across international stock markets. *Review of Financial studies*, *3*(2), 281-307.

Hamilton, J. D. (2018b).Measuring global economic activity. manuscript, University of California at San Diego.

Hamilton, J. D. (2018a). Why you should never use the Hodrick-Prescott filter. *Review of Economics and Statistics*, *100*(5), 831-843.

Hancock, M. (2005). Divisia money. *Bank of England. Quarterly Bulletin*, *45*(1), 39.

Hashmi, I. A. S., & Bhatti, A. A. (2019). On the monetary measures of global liquidity. *Financial Innovation*, *5*(1), 1-23.

He, D., & McCauley, R. N. (2013). Transmitting Global Liquidity to East Asia: Policy Rates. Bond Yields, Currencies and Dollar Credit, *BIS Working Paper No.*431, Bank for International Settlements, Basel, Switzerland.

Helbling, T., &Terrones, M. (2003). Real and financial effects of bursting asset price bubbles. *IMF World Economic Outlook*, *61*, 94.

Hendry, D. F. (2001). Modelling UK inflation, 1875-1991. Journal of Applied Econometrics 16, 255–275.

Hjertstrand, P., Swofford, J. L., & Whitney, G. A. (2018). Index numbers and revealed preference rankings. *Macroeconomic Dynamics*, 1-19.

Howell, M. J. (2020). Measuring Liquidity: The Global Liquidity Indexes (GLI). In: *Capital Wars* (pp. 259-265). Palgrave Macmillan, London, United Kingdom.

Huang, X., & Xia, S. (2015). Currency-Equivalent Vs. Divisia Monetary Aggregates: Theoretical Evaluation and Empirical Evidence from the United States And China. *Journal for Economic Forecasting*, (3), 60-80.

Hutt, W. H., & Keynes, J. M. (1963). *Keynesianism-retrospect and Prospect. A Critical Restatement of Basic Economic Principles*. Chicago.

Inekwe, J. N. (2020). Liquidity connectedness and output synchronisation. *Journal of International Financial Markets, Institutions and Money*, *66*, 101208. (https://www.sciencedirect.com/science/article/abs/pii/S1042443120300925)

Ivanov, V., & Kilian, L. (2005). A practitioner's guide to lag order selection for VAR impulse response analysis. *Studies in Nonlinear Dynamics & Econometrics*, *9*(1).

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, *12*(2-3), 231-254.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, *59*, 1551-1580.

Joint Research Centre-European Commission. (2008). *Handbook on constructing composite indicators: Methodology and User guide*. OECD publishing. Paris, France.

Juselius, K. (2007). The Cointegrated VAR Model: Econometric Methodology and Macroeconomic Applications. Oxford: Oxford University Press. Oxford, United Kingdom.

Kamber, G., & Thoenissen, C. (2013). Financial exposure and the international transmission of financial shocks. *Journal of Money, Credit and Banking*, *45*(s2), 127-158.

Kaminsky, G. L., & Reinhart, C. M. (2000). On crises, contagion, and confusion. *Journal of international Economics*, *51*(1), 145-168.

Kang, H., Yu, B. K., & Yu, J. (2016a). Global liquidity and commodity prices. *Review of International Economics*, *24*(1), 20-36.

Kang, W., Ratti, R. A., & Vespignani, J. L. (2016b). Chinese liquidity increases and the US economy. *Economic Modelling*, *52*, 764-771.

Kilian, L. (2009). Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market. *American Economic Review*, *99*(3), 1053-69.

Kilian, L. (2011). Structural Vector Autoregressions. *CEPR Discussion Papers No.* 8515. The Center for Economic and Policy Research, Washington, D. C.

Kim, S. (2001). International transmission of US monetary policy shocks: Evidence from VAR's. *Journal of Monetary Economics*, *48*(2), 339-372.

Kim, S., & Roubini, N. (2000). Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach. *Journal of Monetary Economics*, *45*(3), 561-586.

King, M. A., & Wadhwani, S. (1990). Transmission of volatility between stock markets. *Review of Financial studies*, *3*(1), 5-33.

King, M., Sentana, E., & Wadhwani, S. (1994). Volatility and links between national stock markets. *Econometrica*, 62, 901-933.

Kodres, L. E., & Pritsker, M. (2002). A rational expectations model of financial contagion. *The journal of finance*, *57*(2), 769-799.

Kokeyne, A., Nowak, S., Psalida, E., & Sun, T. (2010). Global liquidity expansion: effects on receiving economies and policy response options. *IMF Global Financial Stability Report*. International Monetary Fund, Washington, D. C.

Kolasa, M., Makarski, K., & Brzoza-Brzezina, M. (2015). Crisis, contagion and international policy spillovers under foreign ownership of banks. In *2015 Meeting Papers* (No. 595). Society for Economic Dynamics.

Kollmann, R. (2001). The exchange rate in a dynamic-optimizing business cycle model with nominal rigidities: a quantitative investigation. *Journal of International Economics*, *55*(2), 243-262.

Kollmann, R. (2013). Global banks, financial shocks, and international business cycles: Evidence from an estimated model. *Journal of Money, Credit and Banking*, *45*(s2), 159-195.

Krzak, M. (1998). Contagion effects of the Russian financial crisis on Central and Eastern Europe: The case of Poland. *Oesterreichische Nationalbank: Vienna. Focus on Transition*, 22.

Kwiatkowski, D., Phillips, P. C., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root?. *Journal of econometrics*, *54*(1-3), 159-178.

Kyle, A. S., & Xiong, W. (2001). Contagion as a wealth effect. *The Journal of Finance*, *56*(4), 1401-1440.

Laeven, L., & Tong, H. (2012). US monetary shocks and global stock prices. *Journal of Financial Intermediation*, *21*(3), 530-547.

Landau, J. P. (2011). Global liquidity-concept, measurement and policy implications. *CGFS Papers*, *45*. Bank for International Settlements, Basel, Switzerland.

Landau, J. P. (2013). Global liquidity: public and private. In: *Proceedings-Economic Policy Symposium-Jackson Hole*. Federal Reserve Bank of Kansas City, pp. 223-259.

Lane, P. R., & Milesi-Ferretti, G. M. (2007). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004. *Journal of international Economics*, *73*(2), 223-250.

Lee, B. S. (1992). Causal relations among stock returns, interest rates, real activity, and inflation. *The Journal of Finance*, *47*(4), 1591-1603.

Lin, W. L., Engle, R. F., & Ito, T. (1994). Do bulls and bears move across borders? International transmission of stock returns and volatility. *Review of financial studies*, *7*(3), 507-538.

Macaulay, F. R. (1931). The smoothing of time series. *NBER Books*. National Bureau of Economic Research.

Maćkowiak, B. (2007). External shocks, US monetary policy and macroeconomic fluctuations in emerging markets. *Journal of monetary economics*, *54*(8), 2512-2520.

Marshall, D. A. (1992). Inflation and asset returns in a monetary economy. *The Journal of Finance*, *47*(4), 1315-1342.

Masson, P. (1999). Contagion:: macroeconomic models with multiple equilibria. *Journal of International Money and Finance*, *18*(4), 587-602.

Matsumoto, A., & Schindler, M. (2006). Global Monetary Conditions and Liquidity: Measurement and Implications. *IMF Research Note*. International Monetary Fund, Washington, D. C..

Mayordomo, S., Rodriguez-Moreno, M., & Peña, J. I. (2014). Liquidity commonalities in the corporate CDS market around the 2007–2012 financial crisis. *International Review of Economics & Finance*, *31*, 171-192.

McCauley, R. (2012). Risk-on/risk-off, capital flows, leverage and safe assets. *Public Policy Review*, *8*(3), 281-298.

McCauley, R. N., McGuire, P., and Sushko, V. (2015). US monetary policy, leverage and offshore dollar credit. *Economic Policy*, 82, 187-229.

McCoy, D. (1997). *How useful is Structural VAR Analysis for Irish economics?* (No. 2/RT/97). Central Bank of Ireland.

McGuire, P., & Sushko, V. (2015). The BIS Global liquidity indicators. *IFC Bulletins chapters*, *39*. Bank for International Settlements, Basel, Switzerland.

Mundell, R. A. (1960). The monetary dynamics of international adjustment under fixed and flexible exchange rates. *The Quarterly Journal of Economics*, *74*(2), 227-257.

Miranda-Agrippino, S., & Rey, H. (2015). World asset markets and the global financial cycle. *NBER working paperNo.* 21722. National Bureau of Economic Research.

Miranda-Agrippino, S., & Rey, H. (2012, February). World asset markets and global liquidity. In: *Frankfurt ECB BIS Conference, London Business School, mimeo, February*.

Nelson, E. (2003). The future of monetary aggregates in monetary policy analysis. *Journal of Monetary Economics*, *50*(5), 1029-1059.

Newbold, P., & Granger, C. W. J. (1974). Spurious regressions in econometrics. *Journal of Econometrics*, *2*(2), 111-120.

Newey, W., & West, K. (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, *55*(3), 703-708.

Obstfeld, M., & Rogoff, K. (1995). Exchange rate dynamics redux. *Journal of political economy*, *103*(3), 624-660.

OECD Economic Outlook: Methods and Sources (2018): (http://www.oecd.org/eco/outlook/sources-and-methods.htm). 24/09/2018.

Osina, N. (2019). Global liquidity, market sentiment, and financial stability indices. Journal *of Multinational Financial Management*, *52*, 100606. (https://www.sciencedirect.com/science/article/pii/S1042444X19301872)

Osina, N. (2020). Global liquidity and capital flow regulations. *Journal of Banking Regulation*, 1-21. (https://link.springer.com/article/10.1057/s41261-020-00128-y)

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Peseran, M. H., & Peseran, B. (1997). *Working with Microfit 4: Interactive Econometric Analysis*. Oxford University Press, Oxford, UK.

Pfaff, B. (2008). VAR, SVAR and SVEC models: Implementation within R package vars. *Journal of Statistical Software*, *27*(4), 1-32.

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335-346.

Pritsker, M. (2001). The channels for financial contagion. In: *International financial contagion*. Springer US. pp. 67-95

Ratti, R. A., &Vespignani, J. L. (2015). Commodity prices and BRIC and G3 liquidity: A SFAVEC approach. *Journal of Banking & Finance*, *53*, 18-33.

Reinhardt, D., & Riddiough, S. J. (2015). The two faces of cross-border banking flows. *IMF Economic Review*, *63*(4), 751-791.

Reinhart, C. M., & Rogoff, K. S. (2014). Recovery from financial crises: Evidence from 100 episodes. *American Economic Review*, *104*(5), 50-55.

Renata, K. (2015). Global Liquidity Determinants Across Emerging and Advanced Countries. *Journal of Banking and Financial Economics*, (1 (3)), 152-170.

Rey, H. (2015). Dilemma not trilemma: the global financial cycle and monetary policy independence. *NBER working paperNo.* 21162. National Bureau of Economic Research.

Rijckeghem, C. V., & Weder, B. (2003). Spillovers through banking centers: a panel data analysis of bank flows. *Journal of International Money and Finance*, *22*(4), 483-509.

Roffia, B., &Zaghini, A. (2007). Excess money growth and inflation dynamics. *International Finance*, *10*(3), 241-280.

Rose, A. K., & Wieladek, T. (2011). Financial protectionism: the first tests. *NBER working paperNo.* 17073. National Bureau of Economic Research.

Rotemberg, J. J., Driscoll, J. C., & Poterba, J. M. (1995). Money, output, and prices: Evidence from a new monetary aggregate. *Journal of Business & Economic Statistics*, *13*(1), 67-83.

Rüffer, R., &Stracca, L. (2006). What is global excess liquidity, and does it matter? ECB Working Paper No.696. European Central Bank, Frankfurt, Germany.

Sahoo, S., Shankar, S., & Anthony, J. M. (2020, November). US Monetary Policy and Spillovers to Select EMEs: An Episodic Analysis. In: *Financial Issues in Emerging Economies: Special Issue Including Selected Papers from II International Conference on Economics and Finance, 2019, Bengaluru, India*. Emerald Publishing Limited.

Salgado, M. R., Aziz, M. J., & Caramazza, M. F. (2000). Currency crises: in search of common elements. *IMF Working Paper No.* 0/67. International Monetary Fund, Washington, D. C..

Sbracia, M., & Zaghini, A. (2003). The role of the banking system in the international transmission of shocks. *World Economy*, *26*(5), 727-754.

Schnabl, P. (2012). The international transmission of bank liquidity shocks: Evidence from an emerging market. *The Journal of Finance*, *67*(3), 897-932.

Schunk, D. L. (2001). The relative forecasting performance of the Divisia and simple sum monetary aggregates. *Journal of Money, Credit and Banking*, 33(2), 272-283.

Serletis, A., &Molik, T. E. (2000). Monetary aggregates and monetary policy. In: Money, monetary policy, and transmission mechanisms, Bank of Canada, Ontario pp. 161–169.

Shin, H. S. (2014). The second phase of global liquidity and its impact on emerging economies. In:*Volatile capital flows in Korea*. Palgrave Macmillan, New York. pp. 247-257.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, 48, 1-48.

Sims, C. A., & Zha, T. (1995). Does monetary policy generate recessions? Using less aggregate price data to identify monetary policy. *Paper, Yale University*, 782.

Sims, C. A., & Zha, T. (2006). Does monetary policy generate recessions?. *Macroeconomic Dynamics*, *10*(2), 231-272.

Śmiech, S., Papież, M., & Dąbrowski, M. A. (2015). Does the euro area macroeconomy affect global commodity prices? Evidence from a SVAR approach. *International Review of Economics & Finance*, *39*, 485-503.

Sousa, J. M., & Zaghini, A. (2007). Global monetary policy shocks in the G5: A SVAR approach. *Journal of International Financial Markets, Institutions and Money*, *17*(5), 403-419.

Sousa, J., & Zaghini, A. (2008). Monetary policy shocks in the Euro Area and global liquidity spillovers. *International journal of finance & Economics*, *13*(3), 205-218.

Stracca, L. (2004). Does liquidity matter? Properties of a Divisia monetary aggregate in the Euro area. *Oxford Bulletin of Economics and Statistics*, *66*(3), 309-331.

Stulz, R. M. (1986). Asset pricing and expected inflation. *The Journal of Finance*, *41*(1), 209-223.

Svensson, L. E. (2000). Does the P* model provide any rationale for monetary targeting?. *German Economic Review*, *1*(1), 69-81.

Takáts, E., & Temesvary, J. (2020). The currency dimension of the bank lending channel in international monetary transmission. *Journal of International Economics*, *125*, 103309. (https://www.sciencedirect.com/science/article/abs/pii/S0022199618301818)

Taylor, J. B. (2007). Housing and monetary policy. *NBER working paperNo.* 13682. National Bureau of Economic Research.

Taylor, M. P., & Sarno, L. (1997). Capital flows to developing countries: long-and short-term determinants. *The World Bank Economic Review*, *11*(3), 451-470.

Theil, H. (1967). Economics and information theory. North-Holland, Amsterdam.

Thornton, D. L., & Yue, P. (1992). An extended series of Divisia monetary aggregates. *Federal Reserve Bank of St. Louis Review*, *74*(November/December 1992), 35-52.

Törnqvist, L. (1936). The Bank of Finland's consumption price index. *Bank of Finland Bulletin* 10, 1-8.

Tule, K. M., Odonye, O. J., Afangideh, U. J., Ebuh, G. U., Udoh, E. A. P., & Ujunwa, A. (2019). Assessing the spillover effects of US monetary policy normalization on Nigeria sovereign bond yield. *Financial Innovation*, *5*(1), 32.

Türkay, M. (2018). Does International Liquidity Matter For G-7 Countries? A PVAR Approach. *International Econometric Review*, *10*(1), 1-13.

Woodford, M. (2008). How important is money in the conduct of monetary policy?. *Journal of Money, credit and Banking*, *40*(8), 1561-1598.

Woodford, M. (2011). *Interest and prices: Foundations of a theory of monetary policy*. Princeton University Press. Princeton.

Wyplosz, C. (1996). Contagious Currency Crises: First Tests. *Scand. J. of Economics*, *98*(4), 463-484.

Yiu, M. S., Ho, W. Y. A., & Jin, L. (2010). Dynamic correlation analysis of financial spillover to Asian and Latin American markets in global financial turmoil. Hong Kong Monetary Authority *working paper No.* 01/2010.

APPENDIX

Sampled Countries

Table A3.1: List of Sampled Countries

High Income (Developed) Countries			
Australia	Canada	Chile	Czech Republic
Denmark	The Euro Area (EU_{19})[39]	Hong Kong	Hungary
Iceland	Israel	Japan	Korea Republic
New Zealand	Norway	Poland	Singapore
Sweden	Switzerland	United Kingdom	United States
Uruguay			
Developing Countries			
Albania	Algeria	Angola	Bangladesh
Bosnia and Herzegovina	Botswana	Brazil	Bulgaria
China, Mainland	Colombia	Costa Rica	Côte d'Ivoire
Ecuador	El Salvador	Georgia	Guatemala
Honduras	India	Indonesia	Kazakhstan
Macedonia, FYR	Malaysia	Mexico	Morocco
Nicaragua	Nigeria	Pakistan	Peru
Philippines	Romania	Russian Federation	Senegal
Serbia	South Africa	Tunisia	Turkey
Uganda	Ukraine	Venezuela, RB	Zambia

[39]We treat EU_{19} as a single unit because these countries use euro while other members of the European Union do not use euro as their national currency (the European Commission).

Table A4.1: PCA Results for East Asia and Pacific

No. of Observations	193	No. of Comp	6	No. of Traces	6
Number of Comp	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion**
1	5.3802	4.8518	0.8967	5.3802	0.8967
2	0.5284	0.4747	0.0881	5.9087	0.9848
3	0.0537	0.0275	0.009	5.9624	0.9937
4	0.0262	0.0176	0.0044	5.9886	0.9981
5	0.0085	0.0057	0.0014	5.9972	0.9995
6	0.0027	---	0.0005	6	1

Table A4.1: PCA Results for East Asia and Pacific (Continued...)
Principal Components (Eigenvectors/Loadings)

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6
BMAUS	0.4267	0.1297	-0.3387	-0.3392	-0.3210	-0.6842
BMHONG	0.4081	-0.3775	0.7129	-0.0297	0.3046	-0.2981
BMJAP	0.3362	0.8543	0.2700	0.2722	0.0709	0.0697
BMKOR	0.4172	-0.3096	-0.0570	0.6111	-0.5629	0.1908
BMNZ	0.4249	-0.1198	-0.5466	0.1914	0.6779	0.0998
BMSING	0.4285	-0.0196	0.0438	-0.6322	-0.1503	0.6258

Notes: BMAUS is broad money for Australia; BMHONG is broad money for Hong Kong; BMJAP is broad money for Japan; BMKOR is broad money for Korea Republic; BMNZ is broad money for New Zealand; BMSING is for Singapore.

Table A4.2: PCA Results for Europe and Central Asia

No. of Observations	193	No. of Comp	10	No. of Traces	10
Number of Comp	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion**
1	8.7887	8.0909	0.8789	8.7887	0.8789
2	0.6977	0.3944	0.0698	9.4864	0.9486
3	0.3032	0.2122	0.0303	9.7897	0.979
4	0.0910	0.0304	0.0091	9.8808	0.9881
5	0.0605	0.0387	0.0061	9.9413	0.9941
6	0.0217	0.0044	0.0022	9.9631	0.9963
7	0.0173	0.0080	0.0017	9.9805	0.9981
8	0.0093	0.0030	0.0009	9.9898	0.999
9	0.0062	0.0023	0.0006	9.9961	0.9996
10	0.0038	---	0.0004	10	1

Continue…

Table A4.2: PCA Results for Europe and Central Asia (Continued...)

Principal Components (Eigenvectors/Loadings)

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10
BMCZ	0.3315	-0.1061	-0.0399	-0.3816	-0.3960	0.1255	-0.1260	-0.0888	0.2616	-0.6831
BMDEN	0.3204	0.1507	-0.3929	-0.3498	0.5525	0.4593	-0.0916	0.0679	0.17868	0.1911
BMEUA	0.3327	0.0955	-0.187	-0.1633	-0.1001	-0.0007	0.4199	-0.2353	-0.7588	-0.0307
BMHUNG	0.3214	0.2530	-0.3272	0.0102	-0.3382	-0.4241	0.3462	0.2201	0.4070	0.3115
BMICE	0.2503	0.6725	0.6616	0.0313	0.0249	0.1677	0.0665	0.1044	0.0271	-0.0383
BMNOR	0.3242	-0.1073	-0.1958	0.7572	-0.0682	0.3615	0.0021	0.3060	-0.0632	-0.196
BMPOL	0.3246	-0.2588	0.1908	-0.2243	-0.2482	-0.0590	-0.5114	0.4383	-0.2902	0.3712
BMSWE	0.3305	-0.1714	0.1519	0.2015	-0.1639	0.1493	-0.1367	-0.7352	0.2007	0.3858
BMSWT	0.2855	-0.5628	0.4020	-0.0680	0.3584	-0.1189	0.4958	0.1479	0.1529	-0.0412
BMUK	0.3306	0.1259	-0.0681	0.1873	0.4372	-0.6281	-0.3858	-0.1563	-0.0740	-0.2656

Notes: BMCZ is broad money for Czech Republic; BMDEN is broad money for Denmark; BMEUA is broad money for the Euro Area; BMHUNG is broad money Hungary; BMICE is broad money for Iceland; BMNOR is broad money for Norway; BMPOL is broad money for Poland; BMSWE is broad for Sweden; BMSWT is broad money for Switzerland; BMUK is broad money for the United Kingdom.

Table A4.3: PCA Results for Latin America and Caribbean

No. of Observations	193	No. of Comp	2	No. of Traces	2
Number of Comp	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion**
1	1.9532	1.9064	0.9766	1.9532	0.9766
2	0.0467	---	0.0234	2	1

Table A4.3: PCA Results for Latin America and Caribbean (Continued…)
Principal Components (Eigenvectors/Loadings)

Variable	PC 1	PC 2
BMCHL	0.7071	-0.7071
BMURUG	0.7071	0.7071
Notes: BMCHL is broad money for Chile and BMURUG is broad money for Uruguay.		

Table A4.4: PCA Results for North America

No. of Observations	193	No. of Comp	2	No. of Traces	2
Number of Comp	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion**
1	1.9271	1.8542	0.9636	1.9271	0.9636
2	0.0728	---	0.0364	2	1

Table A4.4: PCA Results for North America (Continued…)
Principal Components (Eigenvectors/Loadings)

Variable	PC 1	PC 2
BMCAN	0.7071	-0.7071
BMUS	0.7071	0.7071
Notes: BMCAN is broad money for Canada and BMUS is the broad money for the United States.		

Table A4.5: PCA Results for Global Monetary Aggregate

No. of Observations	193	No. of Comp	21	No. of Traces	21
Number of Comp	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion**
1	17.8451	16.0036	0.8498	17.8451	0.8498
2	1.8415	1.0538	0.0877	19.6867	0.9375
3	0.7876	0.6132	0.0375	20.4744	0.975
4	0.1744	0.0283	0.0083	20.6488	0.9833
5	0.1461	0.0787	0.007	20.7949	0.9902
6	0.0673	0.0265	0.0032	20.8622	0.9934
7	0.0407	0.0180	0.0019	20.9030	0.9954
8	0.0227	0.0065	0.0011	20.9257	0.9965
9	0.0161	0.0030	0.0008	20.9419	0.9972
10	0.0131	0.0020	0.0006	20.9551	0.9979
11	0.0111	0.0029	0.0005	20.9662	0.9984
12	0.0082	0.0016	0.0004	20.9744	0.9988
13	0.0065	0.0020	0.0003	20.9810	0.9991
14	0.0044	0.0001	0.0002	20.9855	0.9993
15	0.0043	0.0016	0.0002	20.9898	0.9995
16	0.0026	0.0004	0.0001	20.9924	0.9996
17	0.0022	0.0004	0.0001	20.9946	0.9997
18	0.0017	0.0004	0.0001	20.9964	0.9998
19	0.0013	0.0001	0.0001	20.9978	0.9999
20	0.0012	0.0002	0.0001	20.9990	1
21	0.0009	---	0	21	1

Continue…

Table A4.5: PCA Results for Global Monetary Aggregate (Continued…)
Principal Components (Eigenvectors/Loadings)

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10
BMAUS	0.2323	-0.0607	-0.1618	0.1742	-0.0328	0.0371	-0.0779	-0.1135	-0.0956	0.2000
BMCAN	0.2356	-0.0373	-0.0276	0.0835	-0.0148	0.0466	-0.0735	-0.2327	-0.1999	-0.0959
BMCHL	0.2306	-0.1081	-0.0063	0.3196	-0.1240	0.0628	-0.2490	0.0445	-0.1023	-0.4554
BMCZ	0.2292	0.1317	-0.0276	-0.3284	0.0481	-0.3155	-0.2491	-0.0503	0.0475	-0.0707
BMDEN	0.2054	0.3195	-0.0884	-0.3530	0.0551	0.6299	-0.0735	0.1828	-0.2939	0.0762
BMEUA	0.2177	0.2696	-0.0002	-0.2656	-0.0711	-0.0677	0.0973	0.3909	0.0175	-0.1435
BMHONG	0.2161	-0.2680	0.1675	-0.1902	0.1237	0.0437	-0.1230	0.0683	-0.1056	0.0231
BMHUNG	0.2003	0.3775	-0.0165	-0.2088	-0.0729	-0.2940	0.2017	-0.1948	0.0858	0.2044
BMICE	0.1495	0.3617	0.6155	0.3742	0.4896	-0.0370	-0.1194	0.1351	0.1549	0.1032
BMISR	0.2125	-0.2869	0.1422	-0.2294	0.1013	-0.2409	0.4157	0.0415	0.0406	-0.2140
BMJAP	0.1799	0.0692	-0.6632	0.1534	0.6504	-0.0791	0.0880	-0.0528	0.0637	-0.0418
BMKOR	0.2265	-0.1527	0.1894	0.0331	0.0755	0.0197	0.2447	-0.4642	-0.3526	0.1453
BMNOR	0.2196	0.1936	-0.1742	0.3271	-0.3677	-0.1878	-0.0264	0.2623	-0.1567	0.1955

Continue…

Table A4.5: PCA Results for Global Monetary Aggregate (Continued…)
Principal Components (Eigenvectors/Loadings)

Variable	PC 11	PC 12	PC 13	PC 14	PC 15	PC 16	PC 17	PC 18	PC 19	PC 20	PC 21
BMAUS	0.1113	0.2445	-0.1299	-0.5789	0.1056	-0.1892	0.1547	0.0804	-0.4272	0.0511	-0.3582
BMCAN	-0.1450	0.1506	0.0894	-0.0782	-0.0718	0.7916	-0.0640	-0.2973	-0.1499	-0.1073	0.0893
BMCHL	-0.3459	0.3217	-0.1215	0.3829	0.1942	-0.2202	-0.0712	0.1946	-0.0912	-0.0940	-0.0236
BMCZ	0.0236	-0.0055	-0.0633	-0.1185	0.0662	-0.1704	-0.3063	-0.2885	0.2301	-0.5449	-0.2617
BMDEN	0.2786	0.2181	-0.1328	0.0979	0.1088	0.0107	-0.0371	0.0552	0.1221	0.0155	0.0914
BMEUA	-0.2853	-0.1782	0.1672	0.0669	-0.0876	-0.0865	0.4798	-0.2625	-0.3941	-0.0313	-0.0094
BMHONG	-0.0426	-0.3942	0.1531	-0.1767	0.0577	0.0373	-0.1596	0.5338	-0.2536	-0.278	0.3156
BMHUNG	-0.4479	0.1968	-0.1583	-0.1320	0.1974	0.0581	-0.0358	0.30592	0.1774	0.2294	0.2248
BMICE	0.1006	0.0783	0.0093	-0.0074	0.0159	0.0422	0.0182	-0.0135	-0.0165	-0.0114	-0.011
BMISR	0.3416	0.5330	0.2574	0.0237	-0.1147	-0.0786	0.0034	0.0337	-0.0332	0.0207	0.1398
BMJAP	0.0185	-0.1111	0.0459	0.1539	-0.0815	-0.0122	0.0260	0.0798	0.0084	-0.0005	0.0346
BMKOR	0.0381	-0.2555	0.0386	0.2333	0.4085	-0.1928	0.2720	-0.2266	0.0923	-0.0243	-0.0107
BMNOR	0.2089	-0.0620	0.5661	0.0507	0.1486	0.0671	-0.0638	0.1366	0.2186	-0.0004	-0.0787

Continue…

Table A4.5: PCA Results for Global Monetary Aggregate (Continued...)
Principal Components (Eigenvectors/Loadings)

Variable	PC 11	PC 12	PC 13	PC 14	PC 15	PC 16	PC 17	PC 18	PC 19	PC 20	PC 21
BMNZ	-0.2490	-0.0227	-0.1965	-0.03	-0.5637	-0.2080	-0.2218	-0.1239	0.1156	-0.1442	0.0802
BMPOL	0.2373	-0.0502	-0.1758	0.5273	-0.2810	0.0599	-0.1017	0.1054	-0.3315	0.1990	-0.1487
BMSING	0.0149	-0.0200	0.0983	-0.1279	0.1236	-0.2514	-0.2146	-0.4463	-0.0517	0.3128	0.5339
BMSWE	0.3638	-0.2986	-0.4713	-0.1876	-0.0778	0.0828	0.1387	0.0383	0.1738	0.1990	0.1537
BMSWT	0.0453	-0.1088	-0.2958	0.1003	0.3695	0.2410	-0.1089	-0.0344	-0.0266	-0.1469	-0.1612
BMUK	0.0366	-0.1723	0.2445	-0.0806	-0.2664	-0.1160	-0.0825	0.1109	0.0129	-0.0243	-0.1273
BMURUG	-0.0566	0.1175	-0.0071	-0.0246	-0.2107	0.0700	0.5980	0.1222	0.4461	-0.1508	0.0365
BMUS	-0.2343	-0.1437	0.1513	-0.0783	-0.0225	0.0654	-0.1851	-0.0052	0.2316	0.5521	-0.4773

Notes: As for Tables A4.1 through A4.4. However, BMISR is broad money for Israel.

Relative Performance of the Measures of Global Liquidity

Correlation between Cyclical Components

Table A5.1: Correlation between the Cyclical Components of GIPI and the Lags of the Cyclical Components of Global Liquidity Measures

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L0.	-0.8471	0.0926	-0.2556	0.0016	0.0649
L1.	-0.8228	0.0574	-0.3262	-0.0184	0.0488
L2.	-0.7872	0.012	-0.3857	-0.0455	0.0232
L3.	-0.7423	-0.0452	-0.4354	-0.0801	-0.0123
L4.	-0.6986	-0.1209	-0.4765	-0.131	-0.0654
L5.	-0.6582	-0.2058	-0.5124	-0.193	-0.1298
L6.	-0.6137	-0.2912	-0.5412	-0.2587	-0.1992
L7.	-0.5599	-0.3711	-0.5638	-0.3224	-0.2666
L8.	-0.5002	-0.4435	-0.5787	-0.38	-0.3297
L9.	-0.4363	-0.5081	-0.587	-0.4317	-0.3882
L10.	-0.3697	-0.5672	-0.589	-0.4785	-0.4421
L11.	-0.2986	-0.6141	-0.5758	-0.5127	-0.4864
L12.	-0.2238	-0.6502	-0.5587	-0.5373	-0.5217
L13.	-0.1427	-0.6782	-0.5348	-0.5528	-0.5498
L14.	-0.0594	-0.6964	-0.5057	-0.5593	-0.5696
L15.	0.0222	-0.7055	-0.4702	-0.5555	-0.5794
L16.	0.098	-0.7101	-0.4281	-0.5483	-0.5854
L17.	0.1672	-0.7092	-0.3797	-0.5352	-0.5865
L18.	0.2299	-0.7007	-0.3245	-0.5134	-0.5791
L19.	0.2884	-0.6865	-0.2671	-0.4846	-0.5644
L20.	0.3382	-0.6678	-0.2071	-0.4555	-0.5485
L21.	0.3782	-0.6486	-0.1488	-0.4252	-0.5311
L22.	0.412	-0.626	-0.0891	-0.39	-0.5086
L23.	0.4362	-0.5958	-0.0298	-0.3489	-0.4792
L24.	0.4529	-0.5604	0.0254	-0.3045	-0.4447

Continue…

Table A5.1: Correlation between the Cyclical Components of GIPI and the Lags of the Cyclical Components of Global Liquidity Measures (Continued…)

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L25.	0.4629	-0.5198	0.0751	-0.2595	-0.4072
L26.	0.4684	-0.4732	0.1193	-0.2118	-0.3646
L27.	0.4691	-0.4181	0.1592	-0.1587	-0.3142
L28.	0.4678	-0.3519	0.1897	-0.0977	-0.2533
L29.	0.4674	-0.2826	0.2189	-0.0317	-0.1871
L30.	0.464	-0.2161	0.2477	0.0321	-0.1216
L31.	0.4571	-0.1512	0.2717	0.0946	-0.057
L32.	0.446	-0.0886	0.2915	0.1528	0.0056
L33.	0.4353	-0.0237	0.309	0.2138	0.071
L34.	0.4234	0.0419	0.3221	0.276	0.1377
L35.	0.4082	0.1012	0.3285	0.3287	0.1969
L36.	0.3901	0.1551	0.3369	0.379	0.253
L37.	0.3689	0.2003	0.3454	0.4252	0.3035
L38.	0.3394	0.2292	0.3533	0.4546	0.3383
L39.	0.3076	0.2471	0.3616	0.4668	0.357
L40.	0.2753	0.256	0.3678	0.4678	0.3649
L41.	0.2409	0.2542	0.3731	0.4504	0.3569
L42.	0.2081	0.2439	0.3771	0.4231	0.3388
L43.	0.1755	0.2292	0.3796	0.3884	0.3134
L44.	0.1403	0.2049	0.3787	0.3473	0.2808
L45.	0.1051	0.1752	0.3759	0.301	0.2433
L46.	0.0721	0.1454	0.3708	0.2536	0.2046
L47.	0.0433	0.1128	0.362	0.2059	0.1643
L48.	0.0162	0.0729	0.3526	0.1531	0.1178

Notes: As for Table 3.1, however L(.) shows lag number of global liquidity measures

Table A5.2: Correlation between the Cyclical Components of GCPI and the Lags of the Cyclical Components of Global Liquidity Measures

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L0.	0.0911	0.9191	-0.127	0.7657	0.841
L1.	0.0764	0.8825	-0.1324	0.7641	0.832
L2.	0.0421	0.8187	-0.1294	0.7353	0.7953
L3.	0.0036	0.7451	-0.1251	0.6949	0.7479
L4.	-0.0398	0.6583	-0.1201	0.64	0.6868
L5.	-0.0846	0.5717	-0.115	0.5796	0.6208
L6.	-0.1334	0.4869	-0.1152	0.5145	0.553
L7.	-0.1912	0.4013	-0.1209	0.4488	0.4845
L8.	-0.2441	0.3322	-0.1277	0.3981	0.43
L9.	-0.2824	0.2797	-0.1397	0.3594	0.3886
L10.	-0.3052	0.2364	-0.1605	0.3264	0.3542
L11.	-0.3192	0.2009	-0.183	0.3011	0.3268
L12.	-0.3154	0.1799	-0.2047	0.29	0.3134
L13.	-0.2986	0.1722	-0.2266	0.2898	0.3113
L14.	-0.2725	0.1708	-0.247	0.2965	0.316
L15.	-0.2334	0.1739	-0.2614	0.3106	0.3267
L16.	-0.1955	0.1741	-0.2704	0.3237	0.3354
L17.	-0.1629	0.1615	-0.2731	0.329	0.3357
L18.	-0.1333	0.1388	-0.271	0.3292	0.3298
L19.	-0.1136	0.1045	-0.2701	0.3204	0.3144
L20.	-0.1151	0.0492	-0.2657	0.2927	0.2807
L21.	-0.126	-0.0146	-0.2638	0.2535	0.2362
L22.	-0.1394	-0.0754	-0.2657	0.2071	0.1866
L23.	-0.1668	-0.1412	-0.2707	0.1509	0.1306
L24.	-0.1973	-0.1951	-0.2762	0.1004	0.081
L25.	-0.2113	-0.2129	-0.2875	0.0765	0.0592
L26.	-0.2193	-0.2128	-0.3006	0.0668	0.053
L27.	-0.219	-0.2002	-0.3137	0.0684	0.0579
L28.	-0.2106	-0.1748	-0.3344	0.0795	0.0748

Continue...

Table A5.2: Correlation between the Cyclical Components of GCPI and the Lags of the Cyclical Components of Global Liquidity Measures (Continued…)

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L29.	-0.1997	-0.1432	-0.3565	0.0963	0.0983
L30.	-0.1815	-0.1004	-0.3821	0.1257	0.1342
L31.	-0.146	-0.0383	-0.4082	0.1682	0.1861
L32.	-0.0989	0.0334	-0.4301	0.2125	0.2418
L33.	-0.0474	0.1055	-0.4457	0.2622	0.3006
L34.	0.0086	0.1761	-0.4557	0.3167	0.3616
L35.	0.0713	0.2424	-0.46	0.3645	0.4155
L36.	0.126	0.2986	-0.4562	0.405	0.461
L37.	0.1713	0.3324	-0.4447	0.4247	0.4839
L38.	0.2092	0.3472	-0.424	0.4213	0.4834
L39.	0.2377	0.352	-0.3962	0.4032	0.4688
L40.	0.2592	0.3415	-0.3677	0.3646	0.4342
L41.	0.2707	0.3117	-0.3375	0.2932	0.3693
L42.	0.2782	0.2772	-0.302	0.2158	0.2972
L43.	0.2901	0.253	-0.2607	0.1526	0.2379
L44.	0.3138	0.2401	-0.2179	0.1058	0.1923
L45.	0.3335	0.2316	-0.1759	0.0659	0.1531
L46.	0.347	0.2236	-0.1385	0.0338	0.1203
L47.	0.3675	0.2273	-0.1062	0.0211	0.1044
L48.	0.3892	0.2427	-0.0776	0.0199	0.0998

Notes: As for Tables 3.1 and A5.1.

Table A5.3: Correlation between the Cyclical Components of GCMPI and the Lags of the Cyclical Components of Global Liquidity Measures

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L0.	-0.2188	0.6729	-0.3032	0.8631	0.8883
L1.	-0.2166	0.6525	-0.3324	0.869	0.8897
L2.	-0.2252	0.6092	-0.3569	0.8524	0.8697
L3.	-0.2381	0.5507	-0.3796	0.8181	0.8333
L4.	-0.258	0.4831	-0.4003	0.7703	0.7846
L5.	-0.2771	0.4131	-0.4213	0.7145	0.7282
L6.	-0.2922	0.3404	-0.4413	0.6525	0.6676
L7.	-0.3075	0.2666	-0.4631	0.5825	0.601
L8.	-0.3143	0.2038	-0.4815	0.5211	0.5416
L9.	-0.3113	0.1513	-0.4976	0.4678	0.4903
L10.	-0.2882	0.1133	-0.5067	0.4269	0.4496
L11.	-0.2534	0.0844	-0.5112	0.393	0.4159
L12.	-0.2134	0.0612	-0.5138	0.3643	0.3863
L13.	-0.1666	0.0464	-0.515	0.3424	0.3637
L14.	-0.1104	0.0406	-0.5123	0.3288	0.3489
L15.	-0.0463	0.0455	-0.5013	0.3247	0.343
L16.	0.0189	0.0475	-0.4837	0.3194	0.335
L17.	0.0785	0.0414	-0.4571	0.3087	0.3216
L18.	0.1321	0.0292	-0.4266	0.2939	0.3031
L19.	0.1796	0.0099	-0.3928	0.273	0.2779
L20.	0.2166	-0.0152	-0.3508	0.2459	0.2455
L21.	0.2486	-0.0367	-0.3039	0.222	0.2154
L22.	0.2714	-0.0574	-0.258	0.1943	0.183
L23.	0.2813	-0.0792	-0.2133	0.1624	0.1476
L24.	0.2777	-0.0938	-0.1729	0.132	0.1153
L25.	0.2709	-0.0901	-0.1372	0.1128	0.0969
L26.	0.2642	-0.0738	-0.1039	0.1036	0.0892
L27.	0.2602	-0.0412	-0.0753	0.106	0.0949
L28.	0.2605	0.0042	-0.0531	0.1216	0.1153

Continue…

Table A5.3: Correlation between the Cyclical Components of GCMPI and the Lags of the Cyclical Components of Global Liquidity Measures (Continued…)

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L29.	0.2604	0.058	-0.0326	0.1464	0.1461
L30.	0.2631	0.1236	-0.0182	0.1838	0.19
L31.	0.2732	0.2012	-0.0089	0.2341	0.2473
L32.	0.2893	0.2873	-0.0028	0.2907	0.3121
L33.	0.3087	0.3777	0.0023	0.3518	0.3817
L34.	0.3209	0.4602	0.0033	0.4068	0.446
L35.	0.3302	0.5348	0.0059	0.4527	0.5014
L36.	0.3357	0.6028	0.0118	0.4975	0.5554
L37.	0.3352	0.6554	0.0217	0.53	0.5958
L38.	0.326	0.6891	0.0347	0.5412	0.6154
L39.	0.3105	0.707	0.0496	0.5352	0.6179
L40.	0.2913	0.7152	0.0651	0.5163	0.6075
L41.	0.2668	0.7088	0.0802	0.4789	0.5782
L42.	0.2378	0.6938	0.0994	0.4328	0.5394
L43.	0.2062	0.6759	0.1172	0.387	0.4996
L44.	0.1763	0.6537	0.1289	0.3404	0.4584
L45.	0.1404	0.6284	0.1342	0.2914	0.4158
L46.	0.1057	0.6084	0.1321	0.2505	0.3812
L47.	0.0744	0.5952	0.1217	0.2197	0.3565
L48.	0.0521	0.5928	0.1076	0.2018	0.3445

Notes: As for Tables 3.1 and A5.1.

Table A5.4: Correlation between the Cyclical Components of MSCI and the Lags of the Cyclical Components of Global Liquidity Measures

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L0.	-0.5565	0.142	-0.3264	-0.0902	0.0035
L1.	-0.5103	0.081	-0.3524	-0.1215	-0.0345
L2.	-0.4634	0.0093	-0.364	-0.1656	-0.0857
L3.	-0.4195	-0.0736	-0.3706	-0.2204	-0.1484
L4.	-0.3851	-0.1679	-0.371	-0.2875	-0.2246
L5.	-0.3474	-0.2549	-0.3667	-0.3503	-0.2953
L6.	-0.3168	-0.3374	-0.3589	-0.4102	-0.3629
L7.	-0.2907	-0.4115	-0.3531	-0.4645	-0.4266
L8.	-0.26	-0.4712	-0.3405	-0.5027	-0.4748
L9.	-0.2224	-0.5209	-0.325	-0.5316	-0.5143
L10.	-0.1768	-0.5582	-0.309	-0.5497	-0.5441
L11.	-0.1235	-0.5799	-0.2863	-0.5528	-0.5608
L12.	-0.0614	-0.5887	-0.2615	-0.5399	-0.5629
L13.	0.0045	-0.5877	-0.236	-0.5191	-0.5564
L14.	0.0702	-0.5766	-0.2063	-0.4888	-0.5404
L15.	0.1307	-0.5615	-0.1759	-0.4547	-0.52
L16.	0.1765	-0.5473	-0.1367	-0.4215	-0.4988
L17.	0.2135	-0.5402	-0.0931	-0.3904	-0.4803
L18.	0.2401	-0.5391	-0.0526	-0.3675	-0.4696
L19.	0.2572	-0.5414	-0.0105	-0.3419	-0.4567
L20.	0.2668	-0.5455	0.0387	-0.3135	-0.4418
L21.	0.265	-0.5488	0.077	-0.2909	-0.4297
L22.	0.2549	-0.5533	0.1099	-0.2716	-0.4201
L23.	0.2331	-0.5524	0.1404	-0.2462	-0.4028
L24.	0.2096	-0.5303	0.1607	-0.2073	-0.3689
L25.	0.1864	-0.4959	0.171	-0.1653	-0.3283
L26.	0.1652	-0.4516	0.1725	-0.1175	-0.2801
L27.	0.1478	-0.3982	0.1693	-0.0602	-0.2209
L28.	0.135	-0.3385	0.1609	0.0014	-0.1541

Continue…

Table A5.4: Correlation between the Cyclical Components of MSCI and the Lags of the Cyclical Components of Global Liquidity Measures (Continued...)

	GLCE	GLDIV	GLGDPW	GLSUM	GLPCA
L29.	0.124	-0.278	0.1515	0.0599	-0.089
L30.	0.1219	-0.2162	0.1367	0.1199	-0.0221
L31.	0.1284	-0.1527	0.1249	0.1792	0.0457
L32.	0.1392	-0.0919	0.1132	0.232	0.1077
L33.	0.1539	-0.0336	0.1038	0.2846	0.1672
L34.	0.1696	0.0164	0.099	0.334	0.2218
L35.	0.1834	0.0502	0.0929	0.369	0.2617
L36.	0.1829	0.0706	0.091	0.3902	0.2885
L37.	0.1735	0.0737	0.0954	0.3954	0.2971
L38.	0.159	0.0569	0.0992	0.3771	0.2834
L39.	0.1445	0.0397	0.1073	0.3491	0.2619
L40.	0.1302	0.0114	0.1113	0.3023	0.2228
L41.	0.1158	-0.0278	0.1162	0.2363	0.1657
L42.	0.1055	-0.058	0.1286	0.1836	0.1193
L43.	0.1041	-0.0825	0.1412	0.1324	0.075
L44.	0.1043	-0.1137	0.1513	0.0749	0.0236
L45.	0.1013	-0.1439	0.164	0.0209	-0.0254
L46.	0.1036	-0.1698	0.1757	-0.0262	-0.0685
L47.	0.1125	-0.1917	0.1845	-0.0683	-0.1072
L48.	0.122	-0.2141	0.1963	-0.1113	-0.1479

Notes: As for Tables 3.1 and A5.1.

Table A6.1: PCA Results for Global Bank Leverage

No. of Observations	174	No. of Comp	20	No. of Traces	20
Number of Comp	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion**
1	11.1043	7.9223	0.5552	11.1043	0.5552
2	3.1819	1.1599	0.1591	14.2863	0.7143
3	2.0220	1.0511	0.1011	16.3083	0.8154
4	0.9708	0.3321	0.0485	17.2791	0.864
5	0.6387	0.0612	0.0319	17.9178	0.8959
6	0.5774	0.1017	0.0289	18.4953	0.9248
7	0.4757	0.2680	0.0238	18.9710	0.9486
8	0.2076	0.0392	0.0104	19.1786	0.9589
9	0.1684	0.0250	0.0084	19.3470	0.9674
10	0.1433	0.0309	0.0072	19.4904	0.9745
11	0.1123	0.0344	0.0056	19.6027	0.9801
12	0.0778	0.0085	0.0039	19.6806	0.984
13	0.0693	0.0132	0.0035	19.7499	0.9875
14	0.0561	0.0026	0.0028	19.8061	0.9903
15	0.0535	0.0111	0.0027	19.8596	0.993
16	0.0423	0.0062	0.0021	19.902	0.9951
17	0.0361	0.0092	0.0018	19.9381	0.9969
18	0.0269	0.0032	0.0013	19.9650	0.9983
19	0.0236	0.0123	0.0012	19.9887	0.9994
20	0.0112	---	0.0006	20	1

Continue…

Table A6.1: PCA Results for Global Bank Leverage (Continued…)

Principal Components (Eigenvectors/Loadings)

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10
AUSBL	0.1262	0.4762	0.0695	0.0074	0.2109	-0.0411	-0.1358	-0.2635	-0.1365	0.0515
CHLBL	0.2077	0.0488	-0.3037	0.1704	0.0240	-0.3907	0.5718	0.4381	-0.1844	0.1437
CZBL	0.2799	-0.0911	-0.0142	-0.1381	-0.0924	0.0691	-0.0235	-0.2184	-0.0428	-0.0241
DENBL	-0.1096	-0.2950	0.2660	0.0810	0.6814	0.4456	0.1765	0.1391	-0.0921	0.1390
EUABL	0.2864	-0.0146	-0.0442	0.0150	0.0356	0.1891	0.1760	-0.1402	-0.1942	-0.0518
HONGBL	-0.0462	-0.2205	-0.5484	0.3296	0.2033	-0.0074	-0.1835	-0.0909	0.4964	-0.3235
HUNGBL	0.2305	0.0723	0.2158	0.1621	-0.4159	0.4066	-0.2147	0.3461	0.1181	0.0752
ICEBL	0.2475	-0.2454	0.1153	-0.0713	-0.0684	0.0260	0.0435	0.2379	0.4428	0.1604
ISRBL	0.1082	0.0237	0.3819	0.7309	-0.1175	-0.0174	0.1849	-0.1372	-0.0362	-0.3536
JAPBL	0.1944	-0.2963	0.2356	0.1639	0.0615	-0.3772	-0.0916	-0.3796	0.0834	0.4185
KORBL	0.2481	-0.0250	0.2417	-0.2921	0.2225	-0.2523	-0.0532	0.0671	0.1407	-0.2798
NORBL	0.2808	-0.1404	-0.0777	0.0239	-0.0153	0.1265	0.0262	0.1203	-0.0322	0.0974
NZBL	0.2199	-0.3269	0.0841	-0.2156	-0.1095	-0.0636	0.1837	-0.1916	0.1256	-0.0258

Continue…

Table A6.1: PCA Results for Global Bank Leverage (Continued…)

Principal Components (Eigenvectors/Loadings)

Variable	PC 11	PC 12	PC 13	PC 14	PC 15	PC 16	PC 17	PC 18	PC 19	PC 20
AUSBL	-0.2028	-0.2112	0.2957	0.3698	-0.3650	0.3792	0.0591	0.0535	0.0129	0.0569
CHLBL	0.1090	0.0619	0.0349	0.1608	-0.0584	0.1708	-0.1729	-0.0047	0.0250	-0.0138
CZBL	0.6173	-0.2056	-0.2200	0.2218	0.3152	0.3801	0.1438	-0.0399	-0.2059	-0.0173
DENBL	0.1510	-0.0372	0.1204	0.1427	-0.0058	-0.0118	-0.1332	-0.0699	-0.0061	-0.0152
EUABL	0.0947	-0.0822	0.1201	-0.6727	-0.1513	0.2250	0.1735	0.0465	0.4302	-0.1171
HONGBL	0.1498	0.0353	0.1688	0.0432	-0.1595	0.1359	-0.0449	0.0435	0.0561	0.0125
HUNGBL	0.2072	0.1970	0.0667	0.0981	-0.2348	0.0993	-0.3121	0.2380	0.1125	0.1309
ICEBL	-0.3883	-0.5234	-0.1717	-0.0221	-0.0950	0.1792	0.0266	-0.0902	-0.0829	-0.2502
ISRBL	-0.1617	-0.0236	-0.0046	0.0432	0.2452	0.0241	0.0814	-0.1147	-0.0691	-0.0104
JAPBL	0.1138	0.2569	-0.1567	-0.1134	-0.3621	-0.0218	-0.1370	-0.1538	-0.0789	0.1205
KORBL	-0.1195	0.2090	0.2856	-0.2511	0.2854	0.2316	-0.3067	0.2483	-0.2677	0.1003

Continue…

Table A6.1: PCA Results for Global Bank Leverage (Continued…)

Principal Components (Eigenvectors/Loadings)

Variable	PC 11	PC 12	PC 13	PC 14	PC 15	PC 16	PC 17	PC 18	PC 19	PC 20
NORBL	-0.0635	0.2810	0.2632	0.0405	-0.1308	-0.1623	0.6498	0.1890	-0.4370	-0.0796
NZBL	-0.1233	0.0552	0.2231	0.4103	0.1788	-0.1605	0.1198	0.1131	0.5703	0.2037
POLBL	-0.0452	0.3113	0.1649	0.1215	0.1650	-0.1031	-0.2201	-0.4260	0.0698	-0.6570
SINGBL	0.0013	-0.2077	-0.0138	-0.0618	0.4049	-0.2028	0.0329	0.2766	0.1798	0.0177
SWEBL	-0.0575	0.2313	-0.6509	0.1383	-0.2084	-0.0789	0.1266	0.1342	0.1782	-0.0918
SWTBL	-0.0839	-0.0118	-0.1862	-0.0563	0.0912	-0.2532	-0.2122	0.2855	-0.1834	0.1295
UKBLF	-0.2009	0.4434	-0.1862	-0.0086	0.2791	0.5483	0.2372	0.0372	0.1641	0.0103
URUGBL	0.4326	-0.0550	0.1601	-0.0686	-0.0416	-0.1995	0.2543	-0.0486	0.1420	-0.1185
USBLF	-0.0721	0.0346	0.0025	-0.0980	0.0831	-0.0414	0.1006	-0.6429	-0.0121	0.5987

Notes: AUSBL is bank leverage for Australia; CHLBL is is bank leverage for Chile; CZBL is bank leverage for Czech Republic; DENBL is bank leverage for Denmark; EUABL is bank leverage for the Euro Area; HONGBL is bank leverage for Hong Kong; HUNGBL is bank leverage for Hungary; ICEBL is bank leverage for Iceland; ISRBL is bank leverage for Israel; JAPBL is bank leverage for Japan; KORBL is bank leverage for Korea Republic; NORBL is bank leverage for Norway; NZBL is bank leverage for New Zealand; POLBL is bank leverage for Poland; SINGBL is bank leverage for Singapore; SWEBL is bank leverage for Sweden; SWTBL is bank leverage for Switzerland; UKBL is bank leverage for the United Kingdom; URUGBL is bank leverage for Uruguay; USBL is bank leverage for the United States.

Spillover Effects of Global Liquidity

Impulse Responses of the Developing Countries Variables to the Innovation in Global Liquidity under Cholesky Decomposition

Figure A7.1: Impulse Responses of the Developing Countries Variables to the Innovation in GLCE under Cholesky Decomposition

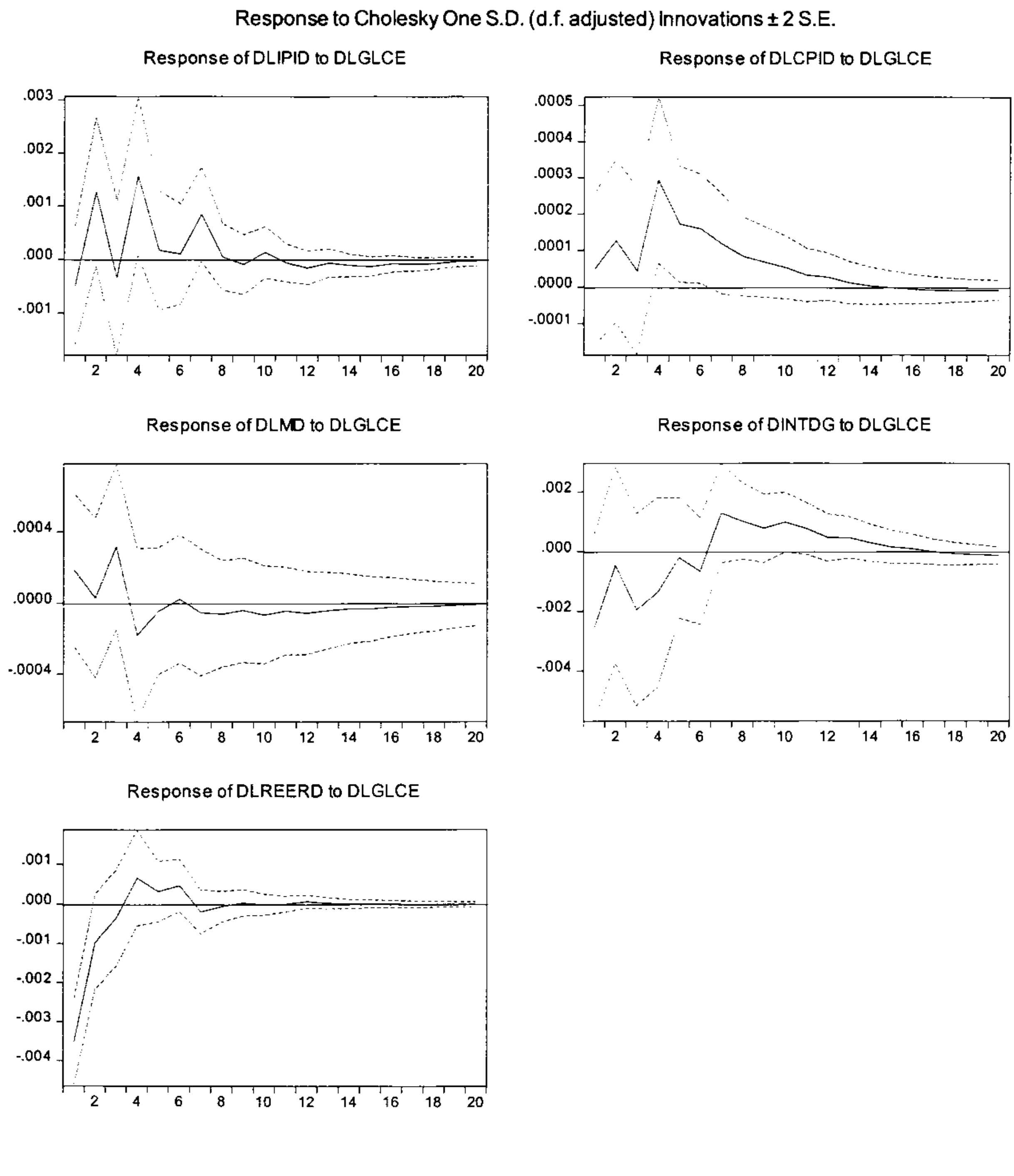


Figure A7.2: Impulse Responses of the Developing Countries Variables to the Innovation in GLDIV under Cholesky Decomposition

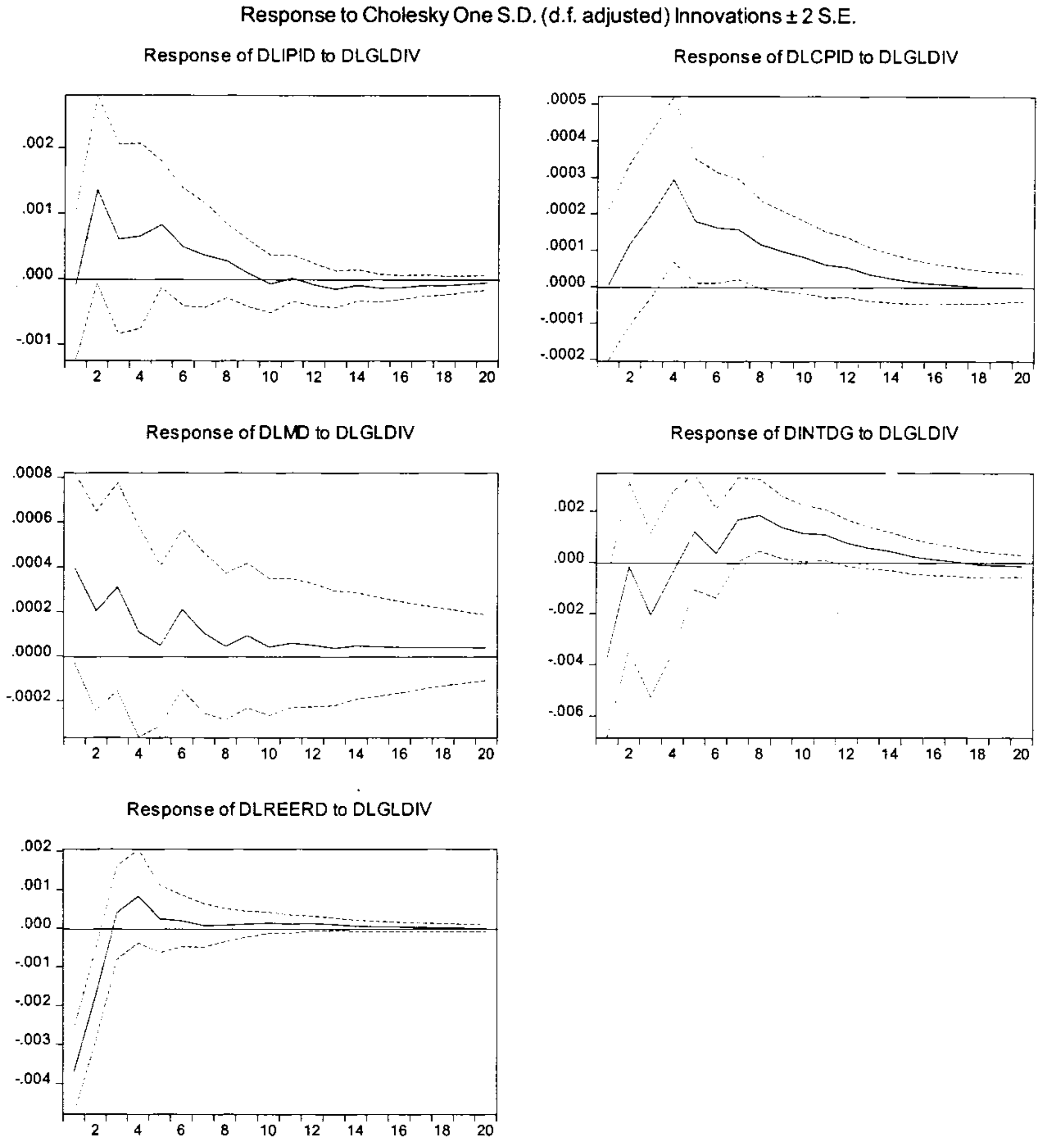


Figure A7.3: Impulse Responses of the Developing Countries Variables to the Innovation in GLGDPW under Cholesky Decomposition

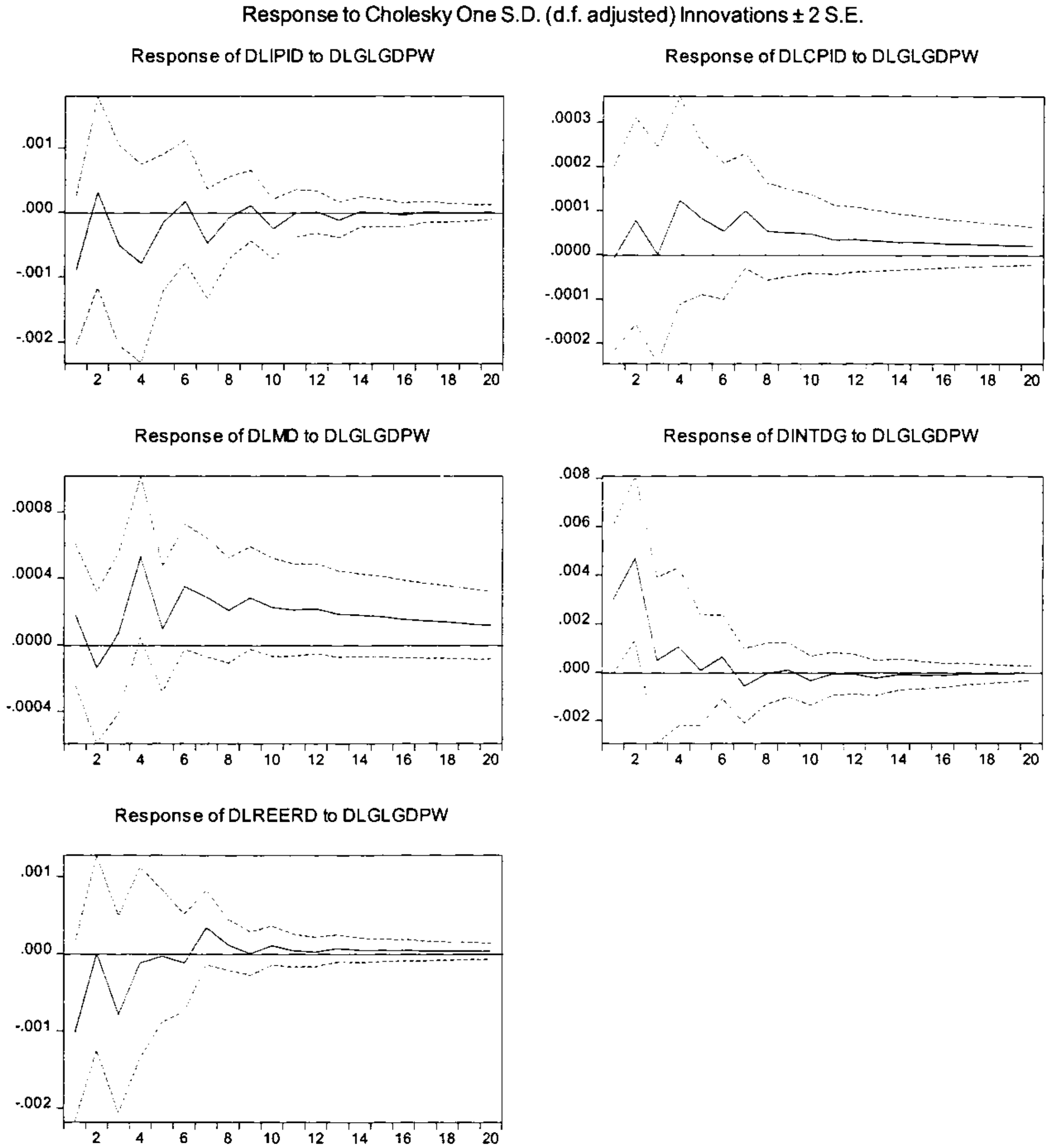


Figure A7.4: Impulse Responses of the Developing Countries Variables to the Innovation in GLSUM under Cholesky Decomposition

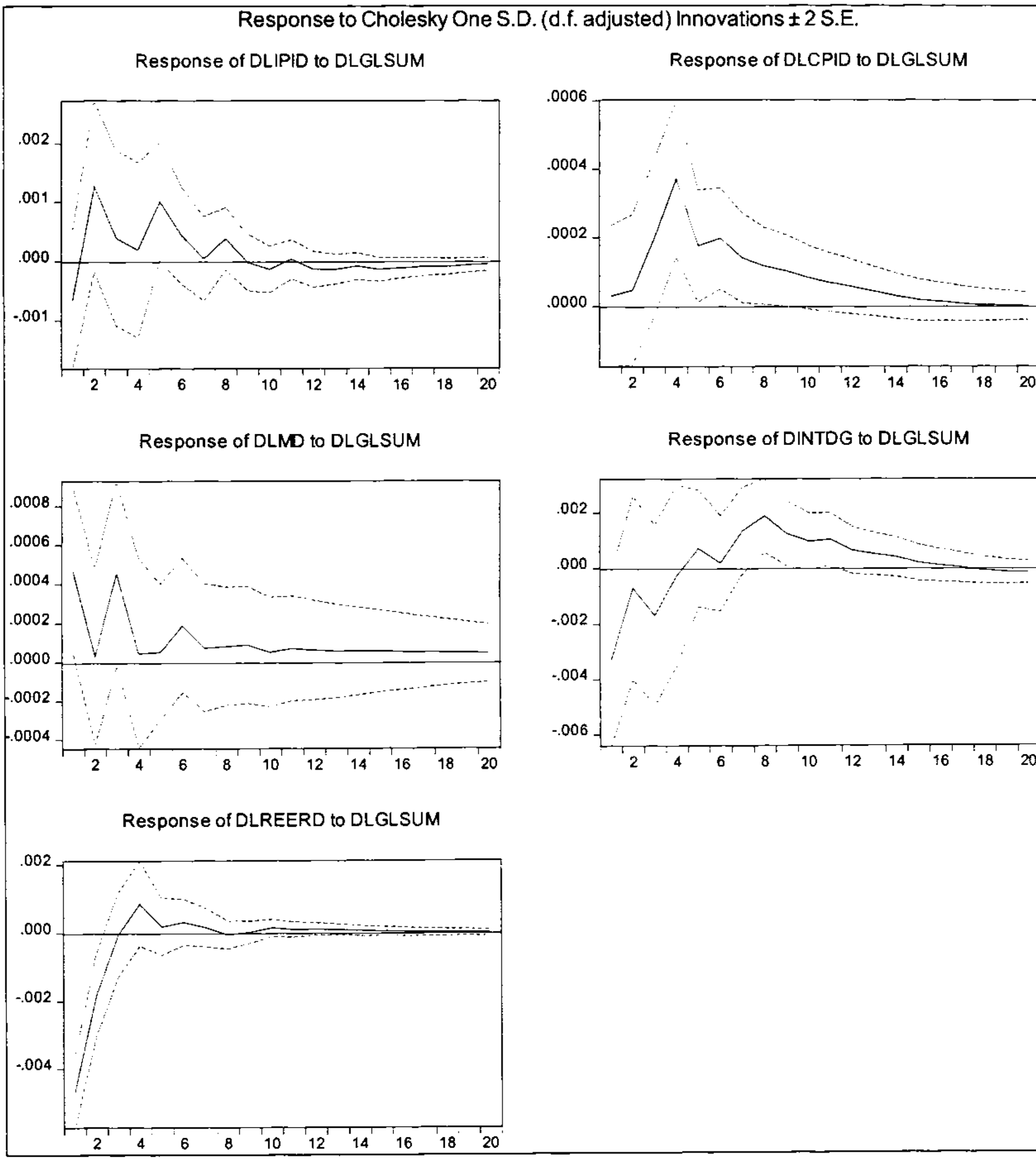


Figure A7.5: Impulse Responses of the Developing Countries Variables to the Innovation in GLPCA under Cholesky Decomposition