1. Introduction

With increasing financial globalization, conditions in global financial markets might impact individual economies. For emerging market economies (EMEs) facing capital shortages, sustainable capital inflows play an important role in economic growth and development. Following the 2008/09 global financial crisis (GFC), advanced countries have implemented large-scale unconventional monetary policy. For example, the U.S. Federal Reserve, the Bank of Japan and European Central Bank adopted strong monetary easing policies at the zero lower bound. As a result, the increased liquidity has spilled into EMEs.

However, capital flows from advanced economies into emerging and developing economies may contribute to the build-up of vulnerabilities and macroeconomic and financial imbalances, which could result in financial crisis in the individual EMEs (Borio, 2008). For instance, the Asian financial crisis, dotcom crisis, and the GFC have been associated with economic booms supported by capital inflows. The IMF (2010a) has also highlighted the spillover effects of monetary easing on other nations following a financial crisis in an advanced economy. The surge in global liquidity can lead to a boom in the economy through the appreciation pressure of the domestic currency, increase in asset prices, and easing of domestic monetary policy. On the other hand, a sudden halt in global liquidity due to investors’ risk aversion or monetary policy tightening in advanced economies may damage recipient economies through the creation of a bust cycle.

Acknowledgements: The author is grateful to the Bank of Mongolia for providing an opportunity to work on this collaborated research project, “Global Liquidity and the Impact on SEACEN Economies,” organized by the SEACEN. I would also like to thank Dr. Peter Tillman, project leader, Gan-Ochir Doojav (PhD), Director General of Research and Statistics Department of the Bank of Mongolia, and Davaajargal Luvsannyam (PhD) and Byambatsogt Tserendejid, Senior Economists at the Bank of Mongolia for their useful comments and discussions.

Disclaimer: The views expressed in this Working Paper are those of the author and do not necessarily represent those of SEACEN or the Bank of Mongolia.
There are three phases to the recent episode of global liquidity. The first phase covers the period leading to the GFC, roughly from 2003 to 2008, when the global banking system expanded, generated by looser financial conditions across borders through the acceleration of banking sector capital flows. The second phase of global liquidity began around 2010 when central banks of major advanced economies started implementing quantitative easing (QE) monetary policy. During this phase, the bond market (e.g., market for emerging market debt securities) played key roles (Shin, 2012; Azis and Shin, 2013). The third phase of global liquidity started when the U.S. Federal Reserve announced the tapering of its QE in 2013, which led the capital flows to retrench from EMEs.

The macroeconomic impacts and transmission mechanism of global liquidity on regional economies differ from country to country, depending on the nature and unique characteristics of their economy. The regional macroeconomic spillover of global financial conditions generally pass through international capital flows into the local economy. However, owing to the underdevelopment of bond and equity markets, capital flows into Mongolia can be mainly traced to foreign direct investments (FDI) rather than bond and equity flows. Mongolia’s FDI inflows are highly associated with the changes in commodity prices as most of the inflows are directed to the mining sector. Therefore, the regional impact of the liquidity conditions in global financial markets and inflows is conveyed through commodity prices into Mongolia’s economy.

This paper examines the nature of the macroeconomic impact of shifts in global liquidity conditions and its transmission mechanism on the Mongolian economy using a structural vector autoregression (VAR) approach for quarterly data from January 2001 to June 2016. In particular, we argue that global financial conditions highly affect the Mongolian economy, which is small and poorly integrated into the world financial market. The impact is mainly through the commodity price channel, confirming the ‘overshooting theory of commodity prices” (Frankel, 1986).

The rest of the paper is organized as follows. Section 2 briefly discusses the measurement of global liquidity, while Section 3 reviews the literature on the transmission mechanism of global liquidity on individual economies focusing on the commodity price channel. Section 4 presents the identification of the structural VAR approach with non-recursive contemporaneous shocks and describes the data set used in the empirical analysis. Section 5 reports the key findings on the impulse responses of the economy to global liquidity shocks. Finally, Section 6 concludes the paper and discusses policy implications.

---

2. See Sukhee and Byambasuren (2016).
2. Understanding Global Liquidity

2.1 Concept

Recently, global liquidity has been widely discussed in debates about spillovers from monetary policy shocks of advanced economies into emerging market economies. Specifically, after the GFC, issues regarding global liquidity are considered as important factors in the development of vulnerabilities prior to the financial crisis (Borio, 2008; IMF, 2010b). Although the concept of global liquidity is increasingly used in both academic and policymaking circles, there is still no agreed definition. It usually referred to as the availability of funds for purchases of goods or assets from a global perspective. For instance, the Committee on the Global Financial System (CGFS) (2011) defines global liquidity in broad terms as global financing conditions, or “ease of financing” in the international financial system.

This overall “ease of financing” depends on the actions of both private investors and financial institutions as well as the public sector. From a global perspective, an essential distinction is between official liquidity – which is created by the public sector – and private sector liquidity (CGFS, 2011). Understanding the difference between liquidity created by private and public sector market participants is essential to insights for the source of global liquidity and its dynamics.

Official liquidity, on the other hand, is defined as the funding provided by the central bank as part of its monetary policy. Monetary authorities create official liquidity in their domestic currency through their regular monetary operations (e.g., supplying the means of payment in the form of base money) and emergency liquidity support (CGFS, 2011; Domanski et al., 2011). The terms and conditions for which they do so, in turn, affect funding and market liquidity in private markets (Domanski, Fender, & McGuire, 2011). While central banks play a critical role in the generation of global liquidity, global liquidity in turn reflects the ability and willingness of market participants to provide funding or to trade in securities markets.

In the light of capital mobility and international financial integration, the concept of global liquidity has come to cover also private liquidity. Private liquidity is created by private sector market participants such as international banks, institutional investors, and non-banking financial institutions. In many instances, these financial intermediaries give credit and thus provide liquidity. Movements in private liquidity are transmitted internationally through the behavior of the financial sector, and its willingness to provide cross-border and/or cross-currency funding. The availability and willingness are determined by private perceptions of risk, and risk appetite, as well as by broader financial and economic conditions. Financial institutions provide market liquidity to securities markets, for example, through market-making activity, or provide funding liquidity through, for instance, interbank lending.
2.2 Indicators

The literature suggests that global liquidity conditions cannot be captured by a single indicator (e.g., Eickmeier et al., 2014; IMF, 2014), which means that there is no clear definition of how to measure global liquidity. However, several proxy indicators relating to different characteristics of liquidity have been developed over time by the Bank for International Settlements (BIS), considered to be effective in capturing vulnerabilities, such as price measures, quantity measures, and measures of investors’ risk appetite.

2.2.1 Quantity-based Measures

The quantity-based measures are credit aggregates, which are the key indicators and the focus of global liquidity measures estimated by the BIS. The term “international bank claims” is used in the BIS Global Liquidity Indicators corresponding to its definition in the BIS locational banking statistics. International bank claims capture banks’ cross-border claims in all currencies and their local claims in foreign currencies, wherein local claims refer to credit extended by banks’ affiliates located in the same country as the borrower. The strong relationship between risk and liquidity is shown in Figure 1, which shows the indicators of cross-border credit extension across BIS reporting countries and the VIX index as a measure of risk appetite.

Figure 1
International Bank Claims
As at May 2016 (Quarterly)

Source: BIS Quarterly Review, September 2016.
The growth of international bank credit exhibits boom-bust cycles that correspond closely to episodes of financial exuberance and distress. In addition, periods of strong growth in cross-border credit often coincide with episodes of elevated risk appetite and compressed risk premium, while periods of contracting cross-border credit seem to coincide with downward shifts in risk appetite. International claims (cross-border bank claims plus local claims in foreign currencies) on non-banks tended to increase since the GFC, while international claims on banks hardly rose until the second quarter of 2016. Thus, global credit has generally remained weak for the last few years (Figure 1).

### 2.2.2 Price-Based Measures

Besides these quantitative indicators, the literature also considers price-based indicators of global liquidity, which are basically interest rates. Specifically, global aggregates of the level of the short-term money market and long-term capital market interest rates (long-term U.S. government bond yields such as the 10-year constant maturity rate) are regarded as important indicators of global funding liquidity conditions.

**Figure 2**

**Shadow Short Rate (SSR)**
As at September 2016 (Monthly)

Source: Reserve Bank of New Zealand.
While the Federal Funds rate has remained almost unchanged for the last 9 years, a useful alternative is the “shadow Federal Funds rate”. This shadow rate is the Federal Funds rate that would have been observed in the absence of the zero lower bound. The alternative measure of the shadow interest rate was calculated by Leo Krippner (Reserve Bank of New Zealand), and the shadow short rate (SSR) is the shortest maturity rate from the estimated shadow yield curve. The SSR has become a popular and intuitive indicator of the stance of conventional and unconventional monetary policy (see Krippner, 2011, 2012a, 2012b, 2013, 2015; Wu and Xia, 2013, 2014, 2016).

2.2.3 Risk-Based Measures

A third category of indicators reflects investors’ shifts in risk-taking preferences. Even though risk-aversion or risk-appetite are hard to measure, the VIX index of implied stock market volatility in the USA is a widely-used or a prime proxy variable for investor risk appetite (see e.g. CGFS, 2011; Agrippino and Rey, 2012). Hence, the VIX is a key indirect indicator of the willingness to provide funding. The several empirical findings on global factors confirm the explanatory power of the VIX with flows decreasing in the face of greater volatility. Specifically, the VIX and the TED spread appear to be important drivers of portfolio flows. In particular, the aggregate offshore bond issuance by EME firms is negatively correlated with shifts in market risk aversion, as measured by the VIX (BIS, 2016).

It also should be noted that the implied stock market volatility expresses not only the level of uncertainty of future stock price changes, but also the perceived price. In light of this, Bekaert et al. (2013) decomposed the VIX index into components of risk aversion and uncertainty. Although these separated elements help policymakers to distinguish the interactions between global liquidity and market uncertainty/risk aversion, in our case, we are only considering the usual aggregate VIX index. However, equity and bond flows into emerging market economies do not fully reflect the degree of risk. For example, the degree of investors’ risk aversion was significant (high level of the VIX index) during 2009 and 2010, but it was observed that substantial amounts of private capital still flowed into emerging markets. Therefore, some scholars suggest that the link between risk appetite indicators and observed cross-border investment flows may have weakened recently. In particular, Azis and Shin (2013) showed that the impact of global market uncertainty, measured by the VIX index, seemed less significant in Asian countries, and the elasticity had an opposite sign in most cases.
Global Liquidity and the Impact on SEACEN Economies

**Figure 3**

**Risk Appetite Indicators**

A at September 2016 (Monthly, 31 January 2001 = 100)

* VIX = Chicago Board Options Exchange Market Volatility Index, a measure of the implied volatility of S&P 500 index options. Implied stock market volatility indices are forward looking measures of stock index volatility computed based on option prices and measure market expectations of stock market volatility in the next 30 days. For a more detailed discussion of the VIX and its interpretation, see Whaley (2009).

MOVE = Yield curve-weighted index of the normalized implied volatility on one-month Treasury options.

TED Spread = Calculated by BBA LIBOR US$ 3 Month minus the US Generic Government 3 Month Yield.

The vertical lines represent the periods of three phases of global liquidity.

Source: Bloomberg.

In addition, the movements of the abovementioned global liquidity indicators are not completely separate, which means that they are interrelated. For instance, Bekaert et al. (2013) showed that there is a close relationship between the Fed Funds rate and VIX index of implied volatility on U.S. equity options using a vector autoregression (VAR) assessment. They concluded that a loosening of monetary policy in the USA lowers the risk aversion in stocks for more than two years. Furthermore, CGFS (2011) states that there is a self-reinforcing interaction between risk appetite and liquidity, thus, implying that the relationship between risk appetite and liquidity is two-sided.
3. Transmission Channels

Global liquidity adds to the global financial cycle, which could lead to boom-bust phases in emerging market economies (EMEs). In the past, the interaction between global liquidity conditions and financial cycles in EMEs had received much attention. However, real economic spillovers in EMEs have tended to be neglected and till today, these implications are not fully understood. Excesses in global liquidity can contribute to the endogenous build-up of vulnerabilities, and liquidity shortages may have important implications for stability and growth.

The question of how liquidity conditions in global financial markets are transmitted to other economies, specifically, emerging market economies is an interesting one. The transmission channels of the activities of global investors and financial intermediaries can be substantiated by cross-border capital flows. There are three different channels through which global liquidity can be transmitted - via international equity portfolios, bond portfolios, and bank flows. Papers investigating the impact of global liquidity on capital flows include Sugimoto and Enya (2015). Additionally, He and McCauley (2013) investigated three price channels and two quantity channels of monetary policies of major economies in East Asia and found that lower bond yields from large-scale central bank bond purchases in advanced economies are transmitted to lower bond yields in local currency bond markets. However, Sukhee and Byambasuren (2016) suggested that capital flows in Mongolia are mainly driven by commodity prices (copper, coal, and gold) since mining sector investment flows dominate the aggregate capital flows.

A lot of research has been done to analyze the impact of global liquidity on world commodity prices. In the context of the Mongolian economy especially, the main channel of global liquidity is the interaction between global liquidity conditions and international commodity prices. The developments of commodity prices and global liquidity over the last decade illustrate that these variables move together and have the same cycle. For example, the boom in commodity prices up till 2008 was followed by a sharp drop during the GFC, with commodity prices substantially increasing subsequently since early 2009. In addition, from the beginning of the third phase of global liquidity, international commodity prices have declined to almost pre-crisis levels.

It is asserted that there is a strong interconnection between monetary policy developments and shifts in commodity prices (Frankel, 2006; Browne and Cronin, 2010). Due to the fact that commodity prices signal important information about
economic activity and inflation dynamics, they are closely observed by central banks or monetary authorities. But the role of commodity prices in monetary policy setting is still debatable (e.g., Angell, 1992; IMF, 2010b). Based on Dornbusch’s (1976) “Theory of Exchange Rate Overshooting”, Frankel (1986) introduced the “Overshooting Theory of Commodity Prices”. Browne and Cronin (2010) argue that the adjustment process of commodity prices is relatively swift, while consumer prices tend to adjust in the longer run. When there is a change in monetary policy stance, the response of commodity prices tend to be larger than expected while consumer prices tend to be stickier. Thus, commodity prices are said to ‘overshoot’ their long-run equilibrium level.

Belke et al. (2010) separated the impact of global liquidity on commodity prices and other asset prices by examining a co-integrated VAR approach for major OECD countries for the period 1970-2008. Their results suggest that global liquidity increases spillovers to commodity prices and note that commodity price is an important forecaster of future inflation even at a global level (see for example Darius and Radde, 2010; Anzuini et al., 2010). In addition, Van Limbergen (2011) examined the effects of global liquidity and global monetary policy on housing, equity and commodity prices, adopting the structural VAR method using data from 1990 until 2007 for a country set of 85% of global gross domestic product.

Kang, Yu and Yu (2016) propose that the effect of global liquidity has been more pronounced for energy and metal prices since the GFC, by estimating a structural VAR model comprising of commodity supply, demand and prices. They also suggest that a price-based liquidity indicator has a greater explanatory power for commodity price dynamics than the commonly-used monetary aggregates in the post-crisis period. Furthermore, Chakraborty and Bordoloi (2012) show that excess global monetary liquidity plays a significant role in explaining the surge in commodity prices during the pre- and post-financial crisis of 2008, comparing the results from the Time Varying Structural VAR with the Stochastic Volatility (TVP-VAR) and State Space Model. In keeping with previous studies, Beckmann et al. (2014) found a significant and time-varying long-run relationship between global liquidity and commodity prices by estimating a Markov-switching vector error correction model. Additionally, Belke et al. (2013) support the hypothesis of a long-run relation between global liquidity and changes in food and commodity prices by applying a global cointegrated VAR model for the period 1980-2011. Ratti and Vespignani (2015) find that unanticipated increases in the liquidity of BRIC countries (Brazil, Russia, India, China and South Africa) is associated with significant and persistent increase in commodity prices using a structural factor-augmented error correction (SFAVEC) model.
Some studies examine the adverse impact of volatility in global liquidity and capital flow reversals on EMEs. For instance, Eichengreen and Gupta (2015) suggest that countries that experienced strong capital inflows and large currency appreciation pressures during 2010–12 underwent a sharp retrenchment of capital flows in 2013 when market volatility increased. In addition, Rey (2015) found that a global financial cycle in capital flows, asset prices, credit growth, and market volatility is mainly affected by US monetary policy stance through the leveraging of global banks and cross-border capital/credit flows. Capital flows and exchange rate volatility in small open economies induced by the change in global liquidity conditions can negatively affect macroeconomic and financial stability through domestic credit boom-bust and resource allocation (Caballero and Krishnamurthy, 2004; Caballero and Lorenzoni, 2014; and Korinek, 2010). Surging liquidity in the global perspective typically leads to appreciation pressure of the domestic currency, boom in asset prices such as bond prices, stock prices and housing prices, and an easing of domestic monetary policy.

Theoretically, liquidity expansion in advanced economies can spillover to output developments of EMEs either positively or negatively (Mundell-Fleming). A positive impact of global liquidity on both global output developments and individual country output in the short-run is generally agreed upon by scholars. Researchers also generally agree that the same kind of indicators are applicable on both the global and country level. Regarding international liquidity spillover on output, Sousa and Zaghini (2008) indicate that an increase in global liquidity will increase output in the Euro area in the short- and medium-term. Kim (2001) also verifies the spillover impact by affirming that a positive shock of US monetary policy raises both domestic and foreign output. Other studies look at the direction of international liquidity spillovers on foreign GDP growth (e.g., Rüffer and Stracca, 2006).

There is also substantial literature on the effects of global liquidity on inflation overseas. For instance, Ciccarelli and Mojon (2010) show that global liquidity accounts for 70% of the movement of inflation in 22 OECD countries. Sousa and Zaghini (2008) postulate that increases in global liquidity lead to the growth in Euro area inflation due to the corresponding hike in money supply. They conclude that global liquidity acts as a long-term factor for variations in inflation.

4. Methodology and Data

4.1 The Model

To empirically examine the transmission of global liquidity on the local economy, we estimated the structural vector autoregression (VAR) model. We applied the Kim and Roubini (2000) approach to identify the effects of monetary
policy shocks of advanced countries on exchange rates and other macroeconomic variables. In so doing, we generally followed the non-recursive system described by Sims and Zha (1995) and Kim and Roubini (2000). The structural vector autoregression models (SVAR) pioneered by Sims (1980) were introduced in the 1980s in response to the criticism of the use of non-restricted VAR models to analyze impulse propagation. Sims (1980) proposed a statistical orthogonalization method based on the Cholesky decomposition of error variance, and the recursive SVAR models were thus introduced. Despite the advantages of recursive SVAR models, they can be inconvenient and may lose out on economic simultaneity. The model used in this paper is described in the following equation:

\[ G(L)y_t = e_t \]  \hspace{1cm} (1)

where \( G(L) \) is a matrix polynomial of the lag operator, \( y_t \) is a \( n \times 1 \) variables vector of interest, and \( e_t \) is an \( n \times 1 \) vector of structural disturbances with zero-mean and \( \text{var}(e_t) = \Lambda \) (where \( \Lambda \) denotes a diagonal matrix). The estimation of the reduced-form equation of the structural model represented in (1) can be described as follows:

\[ y_t = B(L)y_t + u_t \]  \hspace{1cm} (2)

where \( B(L) \) is a matrix polynomial of the lag operator and \( u_t \) is a vector of the VAR residuals with zero-mean and \( \text{var}(u_t) = \Sigma \). Moreover, the relation between the structural disturbances \( (e_t) \) and the residual form VAR residuals \( (u_t) \) is defined by the following equation:

\[ e_t = G_0 u_t \]  \hspace{1cm} (3)

where \( G_0 \) is a matrix of parameters and at least \( n \times (n - 1)/2 \) restrictions on \( G_0 \) will be needed to achieve identification since diagonal elements of \( G_0 \) are normalized to 1’s. The recursive systems use the Cholesky decomposition to build the matrix of parameters \( (G_0) \). The disadvantage of this technique is the triangular matrix and losses in simultaneity. Therefore, the advantage of the structural VAR approach with non-recursive contemporaneous restrictions is that \( G_0 \) does not have to be triangular because it has sufficient restrictions.

4.2 Identification

In this model, the data vector is \( \{GL, COM, FLOW, RER, CPI, RATE, GDP\} \), where \( GL \) is a measure of global liquidity, \( COM \) the commodity price, \( FLOW \) the net capital flows, \( RER \) the real effective exchange rate, \( CPI \) the consumer price index, \( RATE \) an interest rate, and \( GDP \) the real gross domestic product. While there
are several ways to impose restrictions, we will use the short-run restriction for non-recursive systems. For the restrictions on the contemporaneous structural parameters $G_0$, we generally emulate the idea of Sims and Zha (1995) and Kim and Roubini (2000). However, while they emphasize the effects of monetary policy shock on the economy, we highlight the macroeconomic impact of global liquidity on the individual emerging economies. Thus, the restrictions and the data sets are totally different from those of the aforementioned papers. The following equation outlines the identification based on Equation (3):

\[
\begin{bmatrix}
    e_{GL} \\
    e_{COM} \\
    e_{FLOW} \\
    e_{RER} \\
    e_{CPI} \\
    e_{RATE} \\
    e_{GDP}
\end{bmatrix}
= \begin{bmatrix}
    1 & 0 & 0 & 0 & 0 & 0 & 0 \\
    g_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\
    g_{31} & g_{32} & 1 & 0 & 0 & g_{36} & 0 \\
    g_{41} & g_{42} & g_{43} & 1 & 0 & g_{46} & 0 \\
    g_{51} & 0 & 0 & g_{54} & 1 & g_{56} & g_{57} \\
    g_{61} & g_{62} & g_{63} & 0 & 0 & 1 & 0 \\
    g_{71} & g_{72} & g_{73} & g_{74} & g_{75} & g_{76} & 1
\end{bmatrix}
\begin{bmatrix}
    u_{GL} \\
    u_{COM} \\
    u_{FLOW} \\
    u_{RER} \\
    u_{CPI} \\
    u_{RATE} \\
    u_{GDP}
\end{bmatrix}
\]

(4)

where $\{e_{GL}, e_{COM}, e_{FLOW}, e_{RER}, e_{CPI}, e_{RATE}, e_{GDP}\}$ are the structural disturbances, and $\{u_{GL}, u_{COM}, u_{FLOW}, u_{RER}, u_{CPI}, u_{RATE}, u_{GDP}\}$ are the residuals in the reduced form equations, which represent unexpected shocks of each variable.

As this paper analyses how liquidity conditions in the global financial market affect the economy of Mongolia, we chose both exogenous and endogenous variables in the structural V AR model based on the literature of transmission channels of global liquidity discussed in Section 3. The detailed descriptions of the selected macroeconomic indicators for the empirical analysis is provided in the following section.

### 4.3 The Data

The model is constructed using quarterly data from January 2001 to June 2016. As a proxy for liquidity conditions in global financial markets, three indicators (credit aggregates, US interest rate and VIX index) were included in our model sequentially, and we defined which one(s) is/are more applicable to illustrate an international spillover of global liquidity in Mongolia. The variables included in our model are real gross domestic product, consumer price index, domestic interest rate, real exchange rate, net capital flows, commodity prices, and global liquidity indicator. The definitions of the data are provided in Table 1. The seasonal effects of the variables were adjusted using the “TRAMO/SEATS” method.
Table 1  
Data Definition

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Liquidity</td>
<td>Annual (year-on-year) growth rate of credit aggregate</td>
<td>BIS</td>
</tr>
<tr>
<td></td>
<td>U.S. short-term shadow interest rate</td>
<td>Reserve Bank of New Zealand</td>
</tr>
<tr>
<td></td>
<td>VIX index</td>
<td>Bloomberg</td>
</tr>
<tr>
<td>Commodity Prices</td>
<td>Log of commodity price index (weighted average of copper, gold and coal prices)</td>
<td>Bloomberg, IMF, Authors’ calculation</td>
</tr>
<tr>
<td>Capital Flows</td>
<td>Log of equity flows (net)</td>
<td>BoM</td>
</tr>
<tr>
<td></td>
<td>Log of bank flows (net)</td>
<td>BoM</td>
</tr>
<tr>
<td></td>
<td>Log of non-bank flows (net)</td>
<td>BoM</td>
</tr>
<tr>
<td></td>
<td>Log of total capital flows (net)</td>
<td>BoM</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>Log of real effective exchange rate (REER)</td>
<td>BoM</td>
</tr>
<tr>
<td>Inflation</td>
<td>Log of consumer price index</td>
<td>BoM</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>Central bank bill rate</td>
<td>BoM</td>
</tr>
<tr>
<td>Output</td>
<td>Log of real GDP</td>
<td>NSO</td>
</tr>
</tbody>
</table>

Notes: BoM = Bank of Mongolia, NSO = National Statistics Office, IMF = International Monetary Fund, BIS = Bank for International Settlements

*, **, *** indicate probability to reject null hypothesis that there is a unit root, with respectively 10, 5 and 1% significance.

The presence of nonstationarity will not affect the statistical inference since the structural VAR model follows a Bayesian inference.3 Sims, Stock and Watson (1990) concluded that:

“...the common practice of attempting to transform models to stationary form by difference or cointegration operators whenever it appears likely that the data are integrated is in many cases unnecessary... Whether to use a transformed model when the distribution of a test of the hypothesis of interest depends on the presence of nonstationarity is a difficult question...”

In backing this seminal work, we found that many of the applied research on monetary policy analysis using VAR approach, for example, Christiano, Eichenbaum and Evans (1999) did not necessarily transform the data from non-stationary to stationary.

The trends of capital inflows are shown in Figure 4. Capital flows into Mongolia started to surge from around 2010 to the end of 2013, mainly comprising of equity and non-bank financial flows. Since then, there has been a sudden drop in capital inflows due to sovereign bond and commercial bond issuances in the international capital market. The dynamics and trends of capital flows in Mongolia suggest that they are closely correlated with global liquidity conditions since 2008 (proxied by SSR in Figure 4).

**Figure 4**

**Mongolia’s Net Capital Flows and U.S. Shadow Rate**

As at second quarter of 2016 (Quarterly)

![Graph showing capital flows and shadow rate](image)

* SSR = Shadow Short Rate
Sources: Bank of Mongolia, Reserve Bank of New Zealand.

However, without the commodity price channel, capital flows into Mongolia would not have reflected global liquidity. The dynamics of international commodity prices also suggest that it has the same cyclical component with the liquidity conditions in global financial markets. Thus, this paper hypothesize that the international spillover from global liquidity is transmitted through shifts in commodity prices induced by changes in global liquidity conditions. The commodity price channel for global liquidity is discussed at length in Section 3.
Figure 5 shows that the commodity price index (T-R CCI) and Mongolia’s prices for its main exporting goods are strongly correlated and move closely together over time. Thus, it makes little difference in the choice of the commodity price indices that are used in our empirical analysis. It can be seen that the Mongolian economy is impacted from the capital inflows induced from shifts in international commodity prices and global liquidity conditions. It must be mentioned, however, that prior to the GFC, Mongolia seemed to be less connected to the international market. Prior to the crisis, the economy was experiencing year-on-year increase in the exchange rate and CPI inflation while money growth was relatively stable, with fluctuating domestic interest rate. After the GFC, there was a boom in global liquidity conditions and international commodity prices which led to surges of capital flows into Mongolia. This resulted in very high economic growth and substantial increases in money supply and total credit as well as the nominal exchange rate.

**Figure 5**

**Commodity Prices**

As at Aug 2016 (Monthly, January 2000 = 100)

* Mongolia’s aggregate index of export price includes 10 export goods including copper, gold, coal, zinc, crude oil, iron ore, molybdenum and cashmere.

T-R CCI = Thomson Reuters Equal Weight Commodity Index. The Continuous Commodity Futures Price Index is an equal-weighted geometric average of commodity price levels relative to the base year average price.

Source: Bloomberg, IMF.

However, since capital flows reversed in 2013 due to the contraction in global liquidity and downward shift in commodity prices, Mongolia’s economy has slowed down, along with a significant depreciation in the exchange rate and deceleration in credit and money growth back to GFC levels.
In general, Mongolian macroeconomic variables have tended to closely respond to global economic and financial conditions with corresponding cyclical patterns after the GFC.

5. Impact of Global Liquidity on the Mongolian Economy

In this section, we examine the impulse response functions of the estimated 7-variable structural VAR model from positive shocks of the liquidity indicators for each macroeconomic variable including commodity prices. The specification of the lag length of the VAR has strong implications for subsequent modeling choices.
Global Liquidity: Does it Matter for Mongolia?

Table 2
VAR Lag Order Selection Criteria

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-184.0217</td>
<td>NA</td>
<td>1.92e-06</td>
<td>6.702517</td>
<td>6.953418</td>
<td>6.800025</td>
</tr>
<tr>
<td>1</td>
<td>203.2477</td>
<td>665.8316</td>
<td>1.36e-11</td>
<td>-5.166586</td>
<td>-3.159378*</td>
<td>-4.386516*</td>
</tr>
<tr>
<td>2</td>
<td>256.2929</td>
<td>78.17184*</td>
<td>1.28e-11*</td>
<td>-5.308522</td>
<td>-1.545006</td>
<td>-3.845892</td>
</tr>
<tr>
<td>3</td>
<td>301.9680</td>
<td>56.09231</td>
<td>1.76e-11</td>
<td>-5.191861</td>
<td>0.327962</td>
<td>-3.046670</td>
</tr>
<tr>
<td>4</td>
<td>350.2530</td>
<td>47.43786</td>
<td>2.80e-11</td>
<td>-5.166772</td>
<td>2.109358</td>
<td>-2.339020</td>
</tr>
<tr>
<td>5</td>
<td>438.0999</td>
<td>64.72929</td>
<td>1.66e-11</td>
<td>-6.529821*</td>
<td>2.502616</td>
<td>-3.019508</td>
</tr>
</tbody>
</table>

Notes: * indicates lag order selected by the criterion.

LR = sequential modified LR test statistic (each test at 5% level); FPE = Final prediction error; AIC = Akaike information criterion; SC = Schwarz information criterion; HQ = Hannan-Quinn information criterion

With regard to the formal testing, lag length criteria, based on the maximum likelihood function, the choice of lag length of one is supported for Mongolian quarterly data by the “Schwarz” and “Hannan-Quinn” information criteria (Table 2). Therefore, we estimate the reduced form VAR model with one lag. The shaded area plotted in each graph is of two-standard-error intervals.

We first looked at the price-based global liquidity indicator and analyzed its impact on the Mongolian economy. Figure 7(a) illustrates the impulse response functions of Mongolian macroeconomic variables to a positive shock in the short-term shadow interest rate (positive shock meaning an increase in SSR), and a contraction in global liquidity conditions. The results from the impulse-response show that there is a decline in the commodity price, decrease in capital inflows, depreciation in the real exchange rate, declines in inflation as well as interest rate while the gross domestic product decreases in real terms due to a reduction of global liquidity in the short-run. This impact of international spillover of global liquidity is in line with the theoretical assumptions and also confirms that commodity prices reflect the liquidity conditions in the global financial markets.

Secondly, the credit aggregates (international claims on banks and non-banks) are assessed as a proxy for global liquidity, and the impulse response functions for the Mongolian economy are illustrated in Figure 7(b). From the estimation results, it can be seen that there is a short-run negative relationship between global credit aggregates and commodity prices, which is inconsistent with the theoretical assumption. The statistically insignificant relationship (IRF) shows that an increase
Figure 7
Impulse Responses to Global Liquidity Shocks

(a) Shadow Short Rate  (b) Credit Aggregates  (c) VIX Index

Commodity Price

Total Capital Flows

Real Exchange Rate

Consumer Price Index

Domestic Interest Rate

Output

Source: Author’s Estimation.
in credit aggregates does not translate into total capital flows and thus, this proxy is not a relevant measure of global liquidity for Mongolia.

In terms of the VIX index as a global liquidity indicator, the estimation results show that it is not an appropriate measure for Mongolia (Figure 7(c)) as the relationship between the VIX and Mongolia’s macroeconomic indicators are statistically insignificant.

It is also interesting to explore whether these relationships or transmission mechanisms have varied since the GFC of 2008/09. Thus, we estimate the VAR model using the data prior to the GFC and compare the impulse response functions with the empirical estimation covering the whole period until 2016:06. As illustrated in Figure 8, there is no significant impact of global liquidity conditions on the Mongolian economy, exhibiting statistically insignificant relationships (IRFs) over the period before the GFC. Therefore, we posit that international spillover of global liquidity into Mongolia strengthened substantially after the end of GFC (since 2009).

We also analyze the impact of global liquidity and commodity price shocks on different types of capital flows in Mongolia separately. From the IRFs portrayed in Figure 9, equity, bank and non-bank flows generally reflect global liquidity conditions (proxied by SSR). When commodity prices increase in the international market, equity and bank flows would surge into Mongolia. However, there is no relation between commodity prices and non-bank flows.

6. Conclusion and Policy Discussions

In an integrated world, global liquidity has a growing economic impact on domestic economic conditions and financial systems of individual countries. In view of this, the authorities of recipient countries may need to consider these feedback effects and internalize the spillovers in their policy-making processes. This paper, therefore, examined the international spillover of global liquidity on the Mongolian economy.

The structural vector autoregression (SVAR) approach with non-recursive contemporaneous restrictions was estimated using quarterly data over the sample period from January 2001 to June 2016. The key findings suggest that global financial conditions in Mongolia is reflected through the commodity price channel. The empirical results show that the easing of global liquidity conditions leads to an increase in the commodity price, surge in capital flows, as well as a strengthening of the real GDP growth. Local inflation and exchange rate fluctuations that are driven by strong economic activity can lead to changes in the domestic interest rate, and thus, domestic monetary policy generally responds to developments in global financial markets.
Figure 8
Impulse Responses to Global Liquidity Shocks (Prior to the GFC)

(a) Shadow Short Rate           (b) Credit Aggregates           (c) VIX Index

Commodity Price

Total Capital Flows

Real Exchange Rate

Consumer Price Index

Domestic Interest Rate

Output

Source: Author’s Estimation.
The alternative indicators of global liquidity were also considered in the empirical analysis with the price-based measure (i.e., U.S. short-term interest rate) found to be more significant in the case of Mongolia. In addition, the structural VAR model was estimated with the same identification for different types of capital flows (equity, bank and non-bank flows). The estimation results show that both equity, bank and non-bank flows into Mongolia tend to reflect the shifts in global liquidity conditions (proxied by the shadow short rate–SSR), exhibiting boom-bust cycles. It is also shown that the commodity price channel only exists in the case of the total capital flows, equity and bank flows.
While the impact of global liquidity on the Mongolian economy was weak before the GFC, it is found that the international spillover effect of global liquidity conditions in the economy has emerged significantly since the GFC. Therefore, global liquidity conditions matter to Mongolia, with its positive impact on capital inflows and economic growth. Domestic monetary policy in Mongolia responds to global liquidity conditions counter-cyclically, i.e., interest rates are lowered in response to hikes in the U.S. shadow short-term interest rate.

Recently, global liquidity conditions have tended to reverse in view of tighter markets. The main reasons for this is the anticipated hike in the Federal rate and adverse situation in the European Union. This may result in capital flows retrenching from emerging market economies and into advanced countries. In this environment, relevant micro and macroprudential policy measures should be implemented to prevent the build-up of financial fragilities and the emergence of economic vulnerabilities. These, for Mongolia, may include liquidity and capital adequacy-related measures as recommended by the Basel III accord, as well as the adoption of internationally consistent capital management techniques. In addition, maintaining precautionary foreign exchange reserves and strengthening international cooperation would be important in the face of global liquidity shortages. Further improvements in the financial regulatory framework need to be made in order to allow the central bank to better supervise the domestic banking sector.
References


Global Liquidity: Does it Matter for Mongolia?


Van Limbergen, D., (2011), The Impact of Global Liquidity on Commodity and Asset Prices, University of Ghent.

