The Dynamics of Global Financial Cycle and Domestic Economic Cycles:
Evidence from India and Indonesia

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K.P. Prabheesh¹, Reza Anglingkusumo² and Solikin M. Juho³

Abstract

This paper analyses the role of the global financial cycle in determining domestic economic cycles, defined as business and credit cycle, of India and Indonesia, two key open lower-middle income emerging economies in Asia. The paper particularly examines to what extent the global financial cycle can explain the variation in domestic economic cycles in the two countries and analyses the differences. Using quarterly data from 2000 – 2018, and employing various econometric techniques such as concordance index, DCC-GARCH model and standard SVAR, the study finds: (i) the domestic credit cycle is highly synchronized with global financial cycle for India, whereas in the case of Indonesia the synchronization is muted and indirect, (ii) exchange rate appreciation leads to credit boom in India, indicating risk taking behaviour through the financial channel; while in Indonesia, credit boom is driven mainly by the indirect impact of global financial cycle through the domestic real economy, (iii) the Reserve Bank of India responds to output gap strongly, suggesting an adherence to inflation targeting framework, and (iv) Bank Indonesia also responds to exchange rate volatility and credit cycle as an approach to mitigate the risks associated with large and often volatile capital flows. These differences in monetary policy approach may explain the differences in transmission of spill-over effects of global financial cycle on domestic economic cycles in the two countries.

Keywords: global financial cycles, spill-over, capital flows, risk taking, monetary policy

JEL Classification: E32, E52, E58, F32, F44

¹ Indian Institute of Technology Hyderabad, Hyderabad, India
² Bank Indonesia Institute, Jakarta, Indonesia
³ Bank Indonesia Institute, Jakarta, Indonesia
1. Introduction

Recent decades witness ‘dual impact’ of financial integration in the emerging economies. The duality arises in two-fold; one way the integration acts as a growth catalyst and on the other hand, it invigorates global shocks to the economies. It is argued that global shocks play a crucial role in determining the financial conditions in emerging market economies (EMEs) and it affects financial stability (Rey, 2015). The global financial crisis and the subsequent low-interest rate in advanced economies through unconventional monetary policies induced global investors to allocate more investment to emerging economies. Hence, many emerging economies have experienced large capital inflows with subsequent repercussion on its macroeconomic fundamentals such as exchange rate adjustments, credit boom, and business cycle expansion. As is evident, the domestic financial conditions of emerging economies react faster and stronger to capital flows than to the changes in domestic monetary policy.

In studying the dynamics of global financial cycle and its spill-over effects, it is important to note that monetary policy of the US plays an important role in shaping the global financial condition through the leverage of global banks and the significant role of the dollar in the global markets (Bruno and Shin, 2015b,a). Hence, the global financial condition, determined by the US monetary policy, influences the financial conditions of the other economies outside the US, which includes open economies that follow inflation targeting framework and flexible exchange rate regime (Passari and Rey, 2015). Subsequently, the spill-over from global financial condition may also affect the real economy, through the equity and asset markets (Kose, Ha, Otkro and Prasad, 2018).

The data from the Bank of International Settlements (BIS) shows that the outstanding US dollar credit to non-bank borrowers in the EMEs has risen from $1.69 trillion in 2008Q4 to $3.65 trillion in 2018Q4. If the level of availability of credit goes beyond the absorbing capacity, then it may end up with a credit boom, which may often deviate the domestic credit cycle from the business cycle. This poses macro-stability challenges for policymakers as policy may need to react more pre-emptively (Bruno and Shin, 2015; Georgiadis and Mehl, 2016). In the context of this present paper, it is equally important to understand the role of the global
financial cycle in shaping the domestic economic cycles in open emerging economies. Accordingly, this paper addresses the impact of the global financial cycle on domestic economic cycles, defined as credit and business cycle, in two key open lower-middle income emerging economies in Asia: India and Indonesia. More specifically, the study tries to explain: (i) the level of synchronization between domestic and global financial cycle, (ii) the impact of global financial cycle on domestic macroeconomic fundamentals, and (iii) the respond of central banks to global financial cycle.

Policy discussions related to global financial cycle becomes more prominent in the literature after the 2008 global financial crisis. It is argued that the financial shocks are more prevalent in driving business cycle (Smets and Wouters, 2007; Justiniano et al., 2010; Jermann and Quadrini, 2012; Christiano et al., 2014; Iacoviello, 2015). The recent empirical studies suggest that global credit cycle amplifies the credit availability in the EMEs through ‘risk taking channel’ of the financial institutions (Borio and Zhu, 2012, and Azis and Shin, 2015). Moreover, domestic currency appreciation in the recipient county of large capital inflows induced by expansion of global financial liquidity, may lead to depressed risk premium and perceived lower credit risk. More specifically, domestic currency appreciation strengthen the balance sheet of the financial institutions that borrow in foreign currency, as their liabilities fall relative to assets, which makes the borrower appear more creditworthy and attract creditors to extend more credit (Hofmann, et al., 2017). If the domestic lending standards are relaxed at the time of capital inflows, then it may lead to credit boom in the recipient economies and hence increases the potential of systemic risk (Agenor and Silva, 2018). Similarly, the process domestic credit expansion may be reversed if the there is a shift in exchange rate expectations, i.e. a depreciation of domestic currency, due for instance to the tightening cycle in global interest rate and global liquidity condition, and thereby ending the domestic credit boom. The evidence indicates that the credit boom often ends up with

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4 Literature often uses credit and financial cycle, interchangeably. Global financial shocks transit across the borders through various channels, such as through the asset market, when arbitrage activities equalize asset prices (Dedola and Lombardo, 2012; Perri and Quadrini 2011), or when leverage-constrained investors rebalance internationally diversified portfolios (Krugman, 2008; Devereux and Yetman (2010), Devereux and Sutherland (2011). Similarly, the shocks can also be transmitted when multinational financial institution raise funding from foreign markets or sell the assets when they face liquidity crunch (Enders et al., 2011; Borio et al., 2011).
financial crisis (Reinhart and Rogoff, 2009; Gourinchas and Obstfeld, 2012; Aikman et al., 2015), and may adversely affect income distribution (Azis and Shin, 2015). Therefore, understanding the dynamics of the interplay between domestic credit cycle with the global financial cycle is vital for policy makers.

From policy makers’ perspective, the synchronization of domestic credit cycle and global financial cycle reduces the policy makers ability to steer domestic financial conditions away from the global trends (Habib and Venditti, 2019). Countries may adopt flexible exchange rate regime to attain the monetary policy autonomy when capital account is open, i.e. to manage ‘policy trilemma’ owe to Mundell (1963). However, opting to a flexible exchange rate regime may not yield the desired policy autonomy if financial institutions are prone to risk-taking behaviour of during the currency appreciation. In this scenario, the traditional and more complex policy trilemma will morph into a challenging yet more manageable dilemma, as the policy choice is restricted between independent monetary policy and capital account openness, i.e. exchange rate volatility (Rey, 2015; Passari and Rey, 2015). It is further argued that financial conditions of inflation targeting countries with floating exchange rate are affected by global credit cycle, originating from US monetary policy, leave the exchange rate option irrelevant (Rey, 2016). Monetary policy alone may not be effective in maintaining both macroeconomic and financial stability during credit cycle expansion (Badarau and Popescu, 2014).

Though there has been an increased interest in understanding the dynamics of credit cycle in recent years, the studies on the impact of the global financial cycle on emerging economies are still scarce, particularly related to the synchronization of credit cycles and the central banks responses to the global financial cycle. The existing studies suggest that the loose monetary policy adopted in advanced economies may increase the flow of credit growth in the EMEs and play a major role in the formation of credit cycle in EMEs (Guo and Stepanyan, 2011; Bräuning and Ivashina, 2019). One possible mechanism of this spill over effect is through

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5 However, the exchange rate appreciation can also affect the net exports adversely and thereby aggregate demand and hence the net effect of global financial cycle is largely determined by the relative importance of risk taking channel over the trade channel.
the risk-taking behaviour of banks, specifically through banks’ asset substitution, search-for-yield, and pro-cyclical leverage (Borio and Zhu, 2008; Adrian and Shin, 2009; and Azis and Shin, 2015). Yet, most of the existing studies consider the EMEs as a whole and hence may not offer the insights related to differences in idiosyncratic characteristics, particularly on the choices of policy to respond to the spill-over of global financial cycle and the ensuing capital flows on the domestic economy. Hence understanding the individual country-specific cyclical dynamics in responding to the global financial cycle may provide useful insights for policy. The present study addresses the dynamics of domestic economic cycles in open lower-middle income EMEs in Asia, namely India and Indonesia. More particularly, the study tries to answer the following questions: (i) Does credit cycle in India and Indonesia co-move or synchronized with global financial cycle, if yes, to what extent? (ii) How has the cycle synchronization evolved overtime? (iii) How do the central banks in these economies respond to the spill-over effects of the global financial cycle?

To address the above questions, we adopt the following approach. First, we constructed the concordance indices for India and Indonesia’s credit cycles with the global financial cycle, to measure the degree of cycle synchronization. Second, we apply the dynamic conditional correlation- generalized autoregressive conditional heteroscedasticity (DCC-GARCH) model to assess the evolution of domestic credit cycle synchronization with the global financial cycle. Finally, we proceed to estimate a system of equations using Structural VAR (SVAR) to examine the impact of the global financial cycle on domestic economic cycles, i.e. the business and credit cycle, and identify the central bank’s response.

The main findings of our study are as follows:

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6 Both India and Indonesia are small (price taker) open lower-middle income EMEs in Asia, with strong integration to the global markets. The two countries have declared the adoption of medium term pre-announced (ex-ante) inflation target, suggesting a desire to implement an independent monetary policy despite the challenge of monetary policy trilemma typically faced by a small – open economy. This makes an interesting individual case for global spill-over analysis, and departs from the literature which tends to lump EMEs together into specific groupings. The global credit to India has increased from USD 15 Trillion in 1990 to USD 178 Trillion in 2018. Whereas, in the case of Indonesia, it is from USD 30 Trillion to 117 Trillion during the same period (BIS database).
(i) For the case of India, the domestic credit cycle is highly synchronized with global financial cycles, whereas in the case of Indonesia the direct link between the two cycles is rather weak.

(ii) Bank risk taking behaviour in the event of large capital inflows is observed in India; while in Indonesia, credit boom is driven mainly by the indirect impact of global financial cycle through the trade channel and hence the domestic business cycle.

(iii) The implementation of and adherence to an inflation targeting framework in India is reflected by the strong respond of Reserve Bank of India to output gap, i.e, business cycle.

(iv) As a way to manage capital flows, Bank Indonesia also responds to exchange rate volatility and credit cycle strongly. This finding suggests the use of an integrated policy (a policy mix) framework in Indonesia.

(v) Finally, the differences in monetary policy approach may explain the differences in transmission of spill-over effects of global financial cycle on domestic economic cycles in the two countries.

The rest of the paper is organized as follows. Section 2 and 3 discuss the data and econometric methodology, respectively. Section 4 presents the empirical findings. Section 5 concludes the paper and offers some policy recommendations.

2. Data

We use quarterly data from 2000Q1 to 2018Q4 for India and Indonesia, respectively, for the analysis. The starting period of data is attributed to the availability of global liquidity indicators provided by BIS. The study uses global financial cycle, exchange rate, interest rate, domestic business cycle and domestic credit cycle for the analysis. In order to construct these variables, the data have been collected from various sources: the BIS, the IMF International Financial Statistics, Reserve Bank of India, and the CEIC database. The total credit to non-bank borrowers outside the United States is used as the proxy for global financial cycle. Similarly, we use bi-lateral exchange rate Indian Rupee-US Dollar and Indonesian Rupiah-US Dollar as the proxy for domestic exchange rate. Exchange rate is defined as the number of

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7 The bi-lateral exchange rate with US Dollar is the appropriate proxy to measure the impact of risk-taking behavior of financial institutions due to the currency appreciation, rather than weighted average of exchange rate (see for instance Hofmann, et al, 2016)
domestic currency per US Dollar and hence an increase in exchange rate indicates the
depreciation of domestic currency against US Dollar. Likewise, the bank rate of RBI and the
7-day interbank interest rate are used as the proxy for the monetary policy stance for India
and Indonesia, respectively. To calculate the domestic business cycle, the Gross Domestic
Product (GDP, at constant price) of both economies is used. Finally, total claim on private
sector is used to measure the domestic credit India and Indonesia. We measure all variables
in nominal terms except GDP, as it is most appropriate to measure the financial variable
indicators of concurrent market conditions (Azis and Shin, 2015).

3. Econometric Methodology

The present paper uses various econometric methodologies to address the research
questions. First, to measure the global financial cycle and domestic credit cycle, we follow the
Hodrick-Prescott filter (H-P filter) method to retrieve the cyclical components of the credit
series. Similarly, to measure the domestic business cycle, we also applied the H-P filter on the
real output series. Second, we construct a concordance index to test the degree of credit cycle
co-movement or synchronization between domestic credit cycle and global financial cycle.
Third, to understand the evolution of domestic credit cycle and its co-movement with the
global financial cycle, we calculated the time-varying credit cycle synchronization index using
dynamic conditional correlation through GARCH. Finally, we used the SVAR to analyse the
spill over effects of global financial cycle on domestic economic cycles and domestic monetary
policy.

3.1. Filtering Techniques

The present study adopts following three popular filtering techniques to derive the
cyclical components of credit and business cycle.

Hodrick-Prescott Filter

The H-P (Hodrick and Prescott, 1997) filter removes the trend ($\tau_t$) from the series
($\ln TC_{NFS_t}$), where $\ln TC_{NFS_t} = \tau_t + u_t$. Here, $u_t$ represents the deviation from the trend,
known as cycle. The trend part of the $ln TC_{NFS,t}$ can be calculated by solving the minimization problem given below.

$$
\min_{\{\tau_t\}_{t=-1}^{T}} \left\{ \sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=2}^{T} [\tau_{t-1} - (\tau_t - \tau_{t-2})]^2 \right\}
$$

(1)

Here, $c_t = ln TC_{NFS,t} - \tau_t$ and $\lambda$ is the smoothing parameter. The value of the smoothing parameter is $\lambda = 1600$ for quarterly.

**Baxter-King (BK) Filter (1999)**

An ideal low-pass filter removes high-frequency cycles, whereas an ideal high-pass filter removes low frequencies from the data. Conclusively, an ideal band-pass filter removes both low and high frequencies from the data. In this context, Baxter-King (1999) Filter is an ‘ideal band-pass filter’ that isolates the component of a time series that lie within a given range of frequencies. It is a filter of finite order $K$, which is optimal that becomes an approximate band-pass filter with trend reducing properties and symmetric weights. Further, the filter series is the cyclical component and the trend component is the difference between actual and cyclical series. Following Baxter and King (1999), three years of data is used as approximate the moving average, to retrieve the cyclical component.

**Christiano-Fitzgerald (CF) Filter (2003)**

Solving an optimization problem similar to Baxter and King (BK) (1999), Christiano-Fitzgerald (2003) proposed an alternative filter with a notable difference from BK filter. The objective function associated with the CF filter is the mean squared error, but different from the use of weight on squared deviation from the approximate filter and ideal filter associated with BK filter. The CF filter is derived under the assumption that $y_t$ follows a random walk. In contrast to BK Filter, the symmetry restriction is not imposed on the coefficient of $y_t, T = 1, \ldots, T$, all of which may be non-zero in case of CF Filter. The simple way to calculate the CF filter to extend the data sample $\{y_t, T = 1, \ldots, T,\}$ indefinitely in both directions by taking $y_t = y_1$ for $T < 1$ and $y_t = y_T$ for $t > T$. This extension is motivated by the predictive properties of random walk assumption, and ideal weight is assigned to the extended sample.
further. In this context, it is asymptotically ideal in the sense that it approaches the ideal filter as the sample size approaches to infinity in both directions.

### 3.2 Concordance Index

The concordance index shows the average number of periods in which two cycles occurs at the same phase of the cycle. In other words, it measures the proportion of time, in which two cycles are in the same phase (Harding and Pagan, 2002; 2006). The value of concordance index ranges between 1 and 0. The concordance index will have the maximum value of unity when $S_{X,t} = S_{Y,t}$ and zero when $S_{X,t} = (1 - S_{Y,t})$. If it the value is 1, a perfect concordance, implies both cycles are in the same direction. If the value is 0, indicates perfect dis-concordance, there is indicating both cycles are in the opposite direction. The concordance index value between 0.5 to 1 reveals weak to perfect synchronization and the value 0 to 0.5 reveals perfect to weak concordance.

First, we identify the turning points of the credit cycle and define a variable $S_{X,t}$ as follows:

$$S_{X,t} = \begin{cases} 1, & \text{if } X \text{ is in expansion in time } t \\ 0, & \text{Otherwise} \end{cases}$$

Similar way we defined $S_{Y,t}$.

$$S_{Y,t} = \begin{cases} 1, & \text{if } Y \text{ is in expansion in time } t \\ 0, & \text{Otherwise} \end{cases}$$

The concordance index between the two series X and Y can be constructed as follows:

$$C_{XY} = \frac{1}{T} \sum_{t=1}^{T} \left[ S_{X,t} S_{Y,t} + (1 - S_{X,t})(1 - S_{Y,t}) \right]$$ (2)

For series X we can say it is pro-cyclical with Y series for concordance index value between 0.5 and 1, and countercyclical for the value between 0 to 0.5. Further, the index value close to 1 would indicate perfect procyclicalty, where an index value of 0 would indicate perfect counter-cyclicalty.

Further, the test of the null hypothesis of the two series are synchronized can be estimated as:
\[
\frac{S_{Y,t}}{\sigma_{S_Y}} = v + \rho_s \left( \frac{S_{X,t}}{\sigma_{S_X}} \right) + \epsilon_t
\]  

(3)

The null hypothesis states that two cycles are not synchronized i.e. \( \rho_s = 0 \). The value of \( \rho_s = 1 \) indicates the value of the concordance index is unity and \( \rho_s = -1 \) indicating the value of concordance index is zero. The Newey-West heteroscedasticity and autocorrelation consistent (HAC) adjusted standard error is used to estimate the t-statistics to avoid extensive serial correlation as identified by Harding and Pagan (2006).

### 3.3 Dynamic Conditional Correlations (DCC)

We use the DCC-GARCH model to calculate the evolution or the time-varying nature of synchronization of cycles between countries over time. As the relationship between cycles can vary over time, measuring the time-varying nature of the relationship would be a robust indicator for analysing the evolution of credit cycle synchronization. To determine the time-varying correlation between the cycles, we use Engle’s (2002) DCC model. The DCC model is a multivariate generalized autoregressive conditional heteroscedastic (MGARCH) model and has advantageous over other multivariate GARCH models because of its limited parameter estimation and varying conditional correlation matrix.

In this study, we have considered the following dynamic conditional correlation (DCC) specification of the \( M \) dimensional multivariate GARCH (1, 1) model to determine the dynamic conditional correlation.

\[
Y_t = \phi_0 + \phi_1 Y_{t-1} + \epsilon_t \quad \epsilon_t \sim (0, H_t)
\]

\[
H_t = \Gamma_t R_t \Gamma_t'
\]

\[
\Gamma_1 = diag \{ \sqrt{h_{11,t}}, \sqrt{h_{22,t}}, \ldots, \sqrt{h_{MM,t}} \}
\]

\[
h_{iit} = w_i + \beta_1 h_{iit-1} + \gamma_i \epsilon_{i,t-1}^2 \quad i = 1, 2, \ldots, M
\]

\[
R_t = (diag(Q_t))^{-1/2} Q_t (diag(Q_t))^{-1/2}
\]

\[
Q_t = (1 - \alpha - \beta) \bar{Q} + \alpha u_{t-1} u_{t-1} + \beta Q_{t-1}
\]
Where, $Y_t = (Y_{1,t}, Y_{2,t}, \ldots, Y_{M,t})'$ and $\epsilon_t = (\epsilon_{1,t}, \epsilon_{2,t}, \ldots, \epsilon_{M,t})$ are the $M \times 1$ vectors. $H_t$ is the conditional covariance matrix of the random vector $\epsilon_t$ and $u_t = \left( \frac{\epsilon_{1,t}}{\sqrt{h_{11,t}}}, \frac{\epsilon_{2,t}}{\sqrt{h_{22,t}}}, \ldots, \frac{\epsilon_{M,t}}{\sqrt{h_{MM,t}}} \right)'$ is a vector that contains the standardized values of $\epsilon_t$. $R_t$ is the time varying correlation matrix and $Q_t$ is the positive definite symmetric matrix. $\bar{Q}$ represents the unconditional variance matrix of $u_t$. $\alpha$ and $\beta$ are scalars, $\alpha \geq 0, \beta \geq 0$ and $\alpha + \beta < 1$, for the positive definiteness of a conditional correlation matrix. The time varying elements of $Y_t, \rho_{ij,t}$ are as follows:

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}} \quad (4)$$

Where $q_{ij,t}$ is the $i - j^{th}$ element of $Q_t$. For estimating the unknown parameters, the following likelihood function is maximized:

$$L(\theta) = -\frac{1}{2} \sum_{t=1}^{T} (M \log(2\pi) + 2 \log(|\Gamma_t|) + \log(|R_t|) + u_t' R_t^{-1} u_t) \quad (5)$$

Here, $T$ is the number of observations, and $M$ is the number of the variables in the system; $\theta$ represents all the parameters to be estimated.

### 3.4 Structural VAR

The paper applies SVAR methodology to analyse the dynamics of global financial cycle and domestic economic cycles. The SVAR model is an alternative to simultaneous equation models, which was originally proposed by Sims (1980). The following form shows a standard SVAR model

$$A_0 X_t = A_1(L)X_t + B_t \quad (6)$$

Where $X_t$ denotes an $n \times 1$ vector of variables at time $t$, $A_0$ and $B$ are $n \times n$ matrices of coefficients, $A_1(L) = \sum_{i=1}^{p} A_i L^i$ shows the matrices polynomial in the lag operator. Matrix $B$ comprises the structural form parameter of the model and $\epsilon_t$ is an $n \times 1$ vector of serially

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8 In the literature, most of the studies used SVAR to analyze the monetary policy transmission mechanism due to its dynamic nature as compared to other econometric techniques. For a survey on the use of SVAR models in the monetary transmission mechanism see Christiano et al. (1999).
uncorrelated and zero mean structural shocks with an identity covariance matrix \( \Sigma \varepsilon = (\varepsilon_t \varepsilon_t') = I \). The reduced form of the model can be expressed as

\[
X_t = C(L)X_t + u_t
\]  

(7)

Where \( C(L)X_t = A_0^{-1}A_1(L) \) with \( A_0u_t = B_t \).

The residuals \( u_t \) from the reduced VAR model are also assumed to be white noise, but can be correlated with each other due to the contemporaneous effect of the variables across equations. Hence, we have to impose the restrictions in the equation to identify the structural shocks. The present paper adopts the identification strategy by applying short-run restrictions on contemporaneous coefficients in \( A_0 \). More precisely, to exactly identify the structural shocks we need to impose \( n(n - 1)/2 \) restrictions.

We estimate separate SVAR models for India and Indonesia, and include the following five variables in the SVAR system i.e. global financial cycle, exchange rate, interest rate, domestic business cycle, and domestic credit cycle.

The identification for the SVAR model are as follows.

\[
X_t = (\text{global financial cycle, exchange rate, domestic interest rate, domestic business cycle, domestic credit cycle})
\]

Where \( \text{Global}_Cy, \text{Business}_Cy \) and \( \text{Credit}_Cy \) refer to global financial cycle, domestic business and credit cycles, respectively. In order to impose the contemporaneous restrictions on SVAR, we set the diagonal elements of the lower triangular matrix A in Eq (8) to equal 8. Identification by recursive ordering relies on the variables’ degree of exogeneity. Implied by the ordering of the
variables in Eq (8), we assume the global financial cycle is most exogenous to other variables as the two economies under study are assumed to be small and open, hence their domestic variables are predominantly determined by external forces. It is followed by exchange rate which is endogenous to the global financial cycle as capital flows directly affect the exchange rate movement and exogenous to the nominal interest rate and other variables. Furthermore, the nominal interest rate is contemporaneously exogenous to domestic business and credit cycle due to its delayed response. Likewise, the business cycle is exogenous to credit cycle. And finally, domestic credit cycle is assumed to be contemporaneously most endogenous to all variables in the system (Abouwafia and Chambers, 2015; Sims, 2007).

5. **Empirical Results**

Before addressing the research issues, we present the trends in domestic credit cycles of India and Indonesia along with domestic business and global financial cycle. In Fig. 1 we plot the domestic credit cycles of India with global financial cycle for the period 2000Q1-2018Q4. It can be observed that India’s domestic credit cycle is highly volatile as compared to the global financial cycle, indicating a higher response of India’s domestic credit cycle to global financial shocks. A high fluctuation can be observed in 2008 and post 2008 indicating after global financial crisis, domestic credit cycle in India has become more volatile. A similar trend can be observed in the case of Indonesia as well, but the co-movement is relatively less as compared to India (Fig. 2). It can also be observed from Fig.3 and 4 that domestic credit cycle of both countries co-move with their business cycle.

5.1 **Concordance Index**

The concordance index is used in this paper to measure the degree of domestic credit cycle synchronization with the global financial cycle. Table 1 reports the concordance index (2nd column), and its statistical significance through correlation coefficient (3rd column). The value of the concordance index pertains to India is found to be more than 0.5 with global financial cycle using three filters such as HP, BK and CF. This finding indicates there is a strong synchronization between India’s domestic credit cycle and global financial cycle. The
higher concordance value is observed is 0.81, which implies that around 81% of the time, India’s domestic credit cycle is in the same phase of the global financial cycle. The high concordance also reveals India’s credit cycle pro-cyclicality with global financial cycle. These concordance indices are statistically significant based on Newey West HAC t-statistics. Similarly, the correlation coefficient associated with concordance index is positive. The table 1 also shows the concordance index between Indonesia’s domestic credit cycle and global financial cycle. It can be observed that the concordance values less than 0.5, indicating a weak synchronization of the country’s domestic credit cycle to global financial cycle. The concordance indices are found to be statistically insignificant. Similarly, the size of correlation coefficient is low, which again indicates low synchronization.

5.2 Dynamic Conditional Correlation Results

In this section, we assess the evaluation of cycle synchronization using time-varying correlation, based on the DCC-GARCH model. Fig. 5 shows India’s time-varying correlation between domestic credit cycle and the global financial cycle. And the trend shows that there is a significant increase in correlation after the 2005 onwards and reach its peak during the global financial crisis. Since then, the time-varying correlation starts declining, but still remain positive and high, indicating high co-movement of India’s credit cycle with the global financial cycle.

Fig. 6 shows that time-varying correlation between Indonesia’s domestic credit cycle and global financial cycle is decreasing until 2008. However, after 2008, the correlation becomes positive but the size is too low, indicating a week correlation of domestic credit cycle with the global financial cycle. From the above, we conclude that India’s credit cycle is strongly synchronized with the global financial cycle; whereas, Indonesia’s credit cycle is weakly synchronized with the global financial cycles.

In the following sub-section, we formally analyse the role of the global financial cycle in explaining India’s and Indonesia’s domestic economic cycles using SVAR.

5.3 Unit Root Test Results
Before estimating SVAR, the stationarity properties of the variables have been tested using the conventional unit root tests such as ADF and PP. The obtained results are reported in Table 2. The results reveal that all variables are stationary at level except interest rate and exchange rate of both courtiers. Similarly, Table 3 reports the results obtained from the structural break unit root test proposed by Narayan and Popp (2010). This test employs the unit root test with account for two endogenous structural breaks and has an advantage over other structural break tests such as Lumsdaine and Papell (1997) and Lee and Strazicich (2003), as it uses a Dickey–Fuller-type test approach and it chooses the break date by maximizing the significance of the break date coefficient. The NP test has good size and stable power and identifies the structural breaks accurately in finite samples. NP test suggests two models M1 and M2 which permit two breaks in levels and two breaks in level and trend. The test statistics reported in Table 3 shows that all variables are stationary at levels, except interest rate and exchange rate, even after accounting for breaks. The break dates are largely revolving during global financial crisis, 2008 and 2013, during the winding-up of quantitative easing by the US.

5.4 SVAR Results

We estimate SVAR models for each country. To carry out, the SVAR procedure, the variable interest rate and exchange rate are converted to the first difference to ensure that all variables are stationary at levels. The lag length for VAR has been chosen such that the analysis includes sufficient data observations without causing the model to be over-parameterized and that the chosen model pass diagnostics tests such as normality, autocorrelation, and heteroskedasticity. For the Indonesian model, VAR (2) is chosen, whereas for India VAR (3). We have also included trend dummies for both countries as per the findings from the Narayan and Popp test for structural break\(^9\).

5.4.1 Findings from India

The cumulative impulse responses obtained from the SVAR system are shown in Fig. 7. The dashed lines correspond to plus or minus two standard errors around the impulse responses.

\(^9\) We incorporated trend breaks for 2008 and 2013. For Indonesian case, similar conclusions with regards to the presence of structural break can be found in Sharma, Tobing and Azwar (2018) in their study of structural breaks in the data generating process of Indonesia’s macroeconomic time series data.
The bottom panel of the Fig. 6 shows the response of the domestic credit cycle. It can be seen that an unexpected positive shock to global financial cycle is found to have positive and persistent effect on domestic credit cycle and the effect is statistically significant up to 5th quarter, indicating the role of global financial cycle in forming the domestic credit cycle in India. Similarly, the response of credit cycle to exchange rate shock is persistently negative and statically significant, indicating a depreciation of domestic currency leads to a downturn in the credit cycle. More interestingly, the response of exchange rate to global financial cycle is found to be negative and significant, which implies appreciation of the domestic currency (First panel). Based on these two evidences, it can easily be concluded that the global credit boom leads to domestic currency to appreciate and stimulates credit boom in the domestic economy. This may indicate the presence of ‘risk-taking channel’ of currency appreciation in India, where financial institutions’ balance-sheet strengthens when domestic currency appreciates. Subsequently, their creditworthiness increases, and hence they borrow more from the international market and lend at home (Bruno and Shin, 2015; Avdjiev et al., 2017; Chui et al. 2016).

It is striking to note that a positive shock to exchange rate leads to a downturn in the business cycle (3rd panel), indicating that domestic currency depreciation (appreciation) negatively (positively) affects the domestic economic activity. This is contradictory to the notion that exchange rate appreciation suppresses the demand through the trade channel. This may suggest the relative strength of financial channel (risk-taking) over the trade channel in India. More specifically, the risk taking channel of exchange rate acts as a potential offset to the trade channel, in that case an exchange rate appreciation boosts domestic economic activity through easier financial conditions (Kearns and Patel, 2016). Finally, the responses of interest rate to global financial cycle are found to be small and statistically insignificant.

5.4.2 Findings from Indonesia

The evidence from Indonesia shown in Fig. 8 is quite different from India. The figure reveals the following key findings:
(1) Domestic cycles, i.e. business and credit cycles, are positively and significantly affected by global financial cycle, directly for the domestic business cycle, and indirectly for the domestic credit cycle.

(2) The spill-over of shocks from the global financial cycle to the domestic credit cycle is indirect, as global shocks will first permeate through the domestic business cycle, before affecting the domestic credit cycle. This finding (2) and finding (1) above echo the findings from the Concordance Index analysis in Section 5.1. and the Dynamic Conditional Correlation analysis in Section 5.2. which show a weak direct link between global financial cycle and Indonesia’s domestic credit cycle.

3) Shocks to the domestic business cycle directly drive the domestic credit cycle, not vice versa, and indirectly, via the exchange rate.

(4) The domestic interest rate (monetary policy) responds to exchange rate and domestic credit cycle.

Several interpretations follow from the key findings above. First of all, the direct impact of global financial cycle on the domestic business cycle and its indirect impact on the domestic credit cycle (finding (2)), may suggest the importance of trade channel in the transmission of the global financial shocks to Indonesia. The argument is as follows. Concomitant to the global financial boom is the expansion of global real economic activity, fuelled by the easing of global monetary conditions. This stimulates global trade and strengthens the global demand for economic resources. Since Indonesia has an open current account regime and is well integrated into the global production network, such expansion of global demand will translate
into business cycle expansion at home. Hence, the prevalence of trade channel in transmitting
the global shocks\textsuperscript{10}.

The indirect impact of the global financial cycle on the domestic credit cycle is therefore
reflected by the expansion of the domestic business cycle and the demand for credit (finding
(2) and (3)). Moreover, as the domestic economy expands, the gap between domestic demand
and underlying production capacity will open and release inflationary pressures in both the
goods and asset markets, as well as an increase in the demand for foreign import that put
pressures on the current account. Such gap will subsequently trigger demand for foreign
exchange in the foreign exchange market, precipitating depreciation pressures on the
exchange rate and increase in inflation expectations. The nominal demand for credit will
respond accordingly to the changes in inflation expectations, as reported in finding (3).

The above interpretation that the trade channel is more prevalent in transmitting the
global financial shocks to the domestic economy in Indonesia, does not necessarily mean that
the financial channel is absent. The latter may exist, though rather muted because the central
bank responds to (i) limit the volatility of the exchange rate in the events of external shocks
and (ii) dampen the amplitude of the credit cycle, so as to limit the boom-bust cycle in credit
growth\textsuperscript{11}. This is as reflected in finding (4). In the event of strong capital inflows triggered
by the expansion of the global financial cycle, the central bank will tend to limit the
appreciation of the exchange rate by allowing the interest rate to be less accommodative to
inflows, or alternatively to outflows in the event of tightening global liquidity condition. The
central bank also imposes regulations to limit bank’s exposure to foreign currency liability
(i.e. to limit bank’s net open position), implements macroprudential measures (such as the
loan to value ratio and macroprudential liquidity buffer), and ensures orderly adjustment in
the foreign exchange market, through active foreign exchange interventions to manage the
volatility (as opposed to the level) of exchange rate. These policies are aimed at restraining

\textsuperscript{10} On a somewhat similar vein, a study conducted by Harahap et al (2019) using a Global Vector Autoregressive
(GVAR) method shows that Indonesia’s real GDP is more sensitive to shocks originating from US real GDP,
indicating a direct transmission of global variables into domestic economy via the trade channel.

\textsuperscript{11} An earlier study by Satria and Juhro (2011) reported an early indication of risk taking channel in Indonesia,
using a post Asian financial crisis sample up to 2010. The development of monetary policy framework in
Indonesia in the aftermath of the global financial crisis in 2008 includes the recognition that a strict adherence
to price stability alone may not yield an optimal policy path under open capital account regime when both price
and financial system stability are included in central bank’s reaction function. This point is explained in depth in
Warjiyo and Juhro (2019).
credit boom, and dampening the impact of capital flows on exchange rate fluctuations; hence, reducing risk taking behaviour that would affect the balance sheet of both financial and non-financial corporations. In addition, since the float of the Rupiah after the Asian financial crises, like in other emerging market economies, accumulation of foreign exchange reserves, both as self-insurance and an additional line of defence against external shocks, has served as an integrated part of Bank Indonesia’s policy framework.

The aforementioned SVAR results for Indonesia are also in line with the contention put forward in Juhro and Gultom (2015), Juhro (2015), and later in Warjiyo and Juhro (2019), that the transmission of global shocks to Indonesia is best viewed from the perspective of the management of policy trilemma. In this regards, given the fact that large and very often volatile capital flows is an unavoidable fact for a globally integrated small-open economy with open capital and current account regime such as Indonesia, Bank Indonesia employs multiple policy instruments to mitigate the risks associated with capital flows.

5.4.3. Summarizing the findings from the SVAR analysis

In summary, we have obtained the following findings from the SVAR analysis for India and Indonesia. For India, we found that the domestic credit cycle is significantly exposed to the global financial cycle, suggesting the pervasiveness of financial channel in transmitting global shocks to the Indian economy. Exchange rate appreciation leads to credit cycle boom, indicating the risk-taking behaviour of the financial institutions. This risk taking channel offset the trade channel of exchange rate appreciation, which triggers the credit boom. For Indonesia we found the link between global financial cycle and domestic credit cycle is not direct. It works through the domestic business cycle suggesting the importance of trade channel in transmitting global shocks to the domestic economy.

The difference in the “revealed” transmission of spill-over from global financial shocks between the two countries could be due to the “revealed” policy preferences of the two central banks as reported in the SVAR results. In India, Reserve Bank of India responds strongly to the domestic business cycle (“the output gap”), suggesting an adherence to the implementation of an inflation targeting framework (ITF) where price stability serves as the overriding objective of monetary policy. This allows the Reserve Bank of India to use one
dominant instrument, i.e. the interest rate policy, allowing for more clarity in terms of the conduct of monetary policy and less demanding communication strategy. But the key challenge for the Reserve Bank of India will be in ensuring the volatility of capital flows and pro-cyclicality of credit growth does not materialize into a build-up of systemic risk in the financial system. This may call for the use of macroprudential policy in addition to the standard monetary policy framework.

In Indonesia, there is tendency towards the adoption of a more flexible ITF, where Bank Indonesia also responds strongly to exchange rate shocks and excessive domestic credit expansion. This reflects the preference of Bank Indonesia to achieve both macroeconomic (price) stability and financial system stability, amidst the need to keep the economy comfortably integrated to the global capital market. To achieve these “multiple objectives” Bank Indonesia implements a policy mix (an integrated policy) as a central bank policy framework in post-global financial crisis era, comprising of monetary policy, macroprudential policy, and exchange rate stabilization measures. Given this preference, the SVAR results for Indonesia show that the financial channel for the transmission of global financial shocks appears muted and the direct link between global financial cycle and the domestic credit cycle becomes weak. This policy preference may lead to a less clear cut policy framework and calls for more demanding policy communication strategy.

6 Conclusion

This paper empirically analyses the role of global financial cycle in determining the domestic economic cycles in leading small open middle income emerging market economies in Asia: India and Indonesia. Using various econometrics techniques such as concordance index, DCC-GARCH model, SVAR analysis, our finding suggests the presence of financial channel in transmitting global shocks to the Indian economy, whereas for Indonesia the link between global financial cycle and domestic credit cycle is muted and only indirect, through the domestic business cycle suggesting the importance of trade channel in transmitting global shocks to the domestic economy. The differences in the dynamics of the global financial cycle and domestic economic cycle between the two countries could be due to the “revealed” policy preference of their respective central banks in responding to the spill-over effects of the global
financial shocks. The preferred policy framework implemented by the two central banks, though has some strengths and drawbacks, seem to have served both countries well.

References

10. BIS, 2014. 84th Annual Report, Chapter IV. Debt and the financial cycle: domestic and global


The table shows the estimated concordance index between domestic credit cycle and global financial cycles for India and Indonesia using BBQ algorithm. The correlation coefficient between two credit cycles, i.e., $\rho_s$ is estimated using HAC adjusted standard error. *, ** and *** represents significance at 1%, 5% and 10% respectively. The concordance index value lies between 0 and 1. This explains the number of times the economies are in the same phase of their business cycle. Further, the index value close to 1 would indicate perfect procyclicality, whereas an index value of 0 would indicate perfect counter-cyclicality. Where Cy refers to cycle. Further, HP, BK and CF represents Hodrick-Prescott, Baxter-King and Christiano-Fitzgerald Filter respectively.

<table>
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<th>Variables</th>
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<th>t-statistic</th>
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<td><strong>India</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Credit Cy with Global Cy (HP)</td>
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<td>1.991***</td>
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<tr>
<td>Credit Cy with Global Cy (BK)</td>
<td>0.761</td>
<td>0.410</td>
<td>2.121**</td>
</tr>
<tr>
<td>Credit Cy with Global Cy (CF)</td>
<td>0.787</td>
<td>0.461</td>
<td>2.055**</td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
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<td>Credit Cy with Global Cy (HP)</td>
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<td>0.046</td>
<td>0.321</td>
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<td>Credit Cy with Global Cy (BK)</td>
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<td>0.009</td>
<td>1.839</td>
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<td>Credit Cy with Global Cy (CF)</td>
<td>0.473</td>
<td>0.012</td>
<td>0.065</td>
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Table 2.
Conventional Unit Root Test Results

The table shows the unit root test of the variables based on Augmented Dickey-Fuller (ADF) and Phillips–Perron (PP). The null and the alternative hypotheses are series is non-stationary (contains unit root) and series is stationary (no-unit root), respectively. The test statistic of ADF and PP are compared with critical values tabulated by MacKinnon (1994) and MacKinnon (1996), respectively. Lags are selected automatically using the Schwartz Information Criterion (SBC). Where, *, ** and *** denotes rejection of unit root at 1%, 5% and 10% level respectively. The sample period used is from 2000Q1-2018Q4 for India and Indonesia, respectively. Where, Cy denotes cycle. Further, HP denotes Hodrick-Prescott.

<table>
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<th>PP</th>
<th>Results</th>
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<td>Global variables</td>
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<td>Global Cy (HP)</td>
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<td>-7.948*</td>
<td>-2.994**</td>
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<td>Indian Variables</td>
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<tr>
<td>Credit Cy (HP)</td>
<td>-3.980*</td>
<td>-9.945*</td>
<td>-3.966*</td>
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<td>-4.335*</td>
<td>-5.351*</td>
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<tr>
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<td>Credit Cy (HP)</td>
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<td>-1.358</td>
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Table 3

Narayan-Popp Unit Root Test Results

Table 3 shows the unit root test with structural breaks based on Narayan and Popp (NP). The M1 and M2 denote the two model used for the NP test: Model 1 allows for the two endogenous breaks in the intercept and Model 2 allows for two endogenous breaks in each of the intercept and the trend. The critical values are taken from Narayan and Popp (2010, pp. 1429), and *, ** and *** represent the 1%, 5%, and 10% significance levels. Where, Cy denotes cycle.

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<th>Variables</th>
<th>Lag</th>
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<td>(-4.511)***</td>
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<td>(-5.003)*</td>
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<td>Business Cy (HP)</td>
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<td>(-4.872)**</td>
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<td></td>
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<td>(-4.989)**</td>
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<td>(-4.697)***</td>
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<td>Interest rate</td>
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### Critical Values for Unit root test

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<tbody>
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<td>Model M2 (Break in Intercept and Trend)</td>
<td>-5.576</td>
<td>-4.937</td>
<td>-4.596</td>
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</table>

Note: The critical values are taken from Narayan and Popp (2010, pp. 1429) and *, ** and *** represent the 1%, 5%, and 10% significance levels.
Figure 1

Credit Cycles (India and Global)

The figure shows the credit cycles of India and Global financial cycles from 2000Q1-2018Q4. The cycles are retrieved using the H-P filter.
Credit Cycles (Indonesia and Global)

The figure shows the credit cycles of Indonesia and Global financial cycles from 2000Q1-2018Q4. The cycles are retrieved using the H-P filter.
Fig. 3. Domestic Credit Cycle and Business Cycle (India)
Fig. 4. Domestic Credit Cycle and Business Cycle (Indonesia)
Fig. 5. Dynamic Conditional Correlation (India’s Credit cycle with Global financial Cycle)

The figure shows the time-varying correlation between Indonesia credit cycle and the Global liquidity cycle. The results are calculated using the DCC-GARCH model.
Fig. 6. Dynamic Conditional Correlation (Indonesia’s Credit cycle with Global Financial Cycle)

The figure shows the time-varying correlation between Indonesia credit cycle and the Global financial cycle. The results are calculated using the DCC-GARCH model.
Fig. 7. Impulse response to one-standard-deviation (unit) structural shocks (India)

The figure represents the impulse response functions derived from SVAR from the Model. The *impulse response function traces* the effect of a one standard deviation shock to one of the variables on current and future values of all the endogenous variables in the VAR system. Dashed lines represent the intervals of two standard deviations, while the solid lines represent the impulse function.
Fig. 8. Impulse response to one-standard-deviation (unit) structural shocks (Indonesia)

The figure represents the impulse response functions derived from SVAR. The *impulse response function traces* the effect of a one standard deviation shock to one of the variables on current and future values of all the endogenous variables in the VAR system. Dashed lines represent the intervals of two standard deviations, while the solid lines represent the impulse function. Similar results are reported when the SVAR excludes the trend breaks.