



## Extracting financial cycle and Business cycle of Nepalese Economy

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**Abstract:** *This paper is an attempt to extract the financial and business cycle of Nepalese economy with the application of time-based filter. In order to estimate the cycle, annual time series data from year 1979-2019 of domestic credit to private sector (% of GDP) and logarithm of real gross domestic product are used. Instrument or indicator used in this study was proposed by the Basel committee on banking supervision (BCBS). It is known as Basel gap (credit to GDP gap) which uses a statistical time-based filter (Hodrick–Prescott filter) to decompose the time series into two parts: growth component and cyclical component. The result of financial cycle shows that in year 2010-2011 there is a positive gap of more than 9% which suggest to increase capital requirement (i.e., countercyclical capital buffer). However, the current gap is near to zero which indicates adequate lending in the economy given to the current output producing ability of the Nepalese economy. The result of business cycle shows that economy is in expansion phase. Furthermore, the combine plotting of the cycles shows that the financial cycle is deeper than the business cycle, the amplitude of financial cycle varies more than business cycle and the synchronicity of the cycles are low.*

**Key words:** Credit to GDP ratio, Real GDP, Basel gap, financial cycle, business cycle, Hodrick-Prescott filter

### Introduction

Extracting business cycle and financial cycle from a time series gives an idea about the growth or downfall of an economy and financial risk prevailing in the economy. Estimating business cycle is a well-known issue among economists since every long. Various literatures have convinced that business cycle is the most significant fundamentals factor to study economic cycles. (Diebold & Rudebusch, 1996) Financial cycle, on the other hand, were identified later after the advanced economies suffered from financial crisis.

In 1819, Jean Charles Leonard de Sismondi's study title "Nouveaux Principes d'économie Politique" discussed about the economic crisis, which is one of the early expository writings about economic crises, in argument to the existing "economic equilibrium" theory. The development of theory suggested about business cycle, prior to that classical economics has refuse or reject the hypothesis of business cycles. Classical economist generally blamed external factors for economic crisis such as wars. Later, Charles Dunoyer developed Sismondi's theory of

periodic crisis into theory of alternating cycles. Later in 1860, Clement Juglar tried to identify economic cycles, and he concluded economic cycle to be 7- 11 years long. After the development of further studies on economic cycles, economist Joseph Schumpeter suggested that a Juglar's 7–11-year long cycle has four stages: Expansion, Crisis, Recession and Recovery.

Business cycles are generally the fluctuations (upward or downward) in the aggregate economic activity of nation. These fluctuations or movements includes shifts over time periods between relative stagnation or decline and relative economic growth (booms). The National Bureau of Economic Research (NBER), in their research study concluded the repetitive sequences in an economy named them as business cycles. Wesley C. Mitchell, developed the first working definition of the business cycle, along with (Burns & Mitchell, 1946), which was later characterized as follows: *“Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own.”*

There are various theories related to business cycle; pure monetary theory, monetary over investment theory, Schumpeter's theory of innovation, Keynes theory, Multiplier accelerator interaction theory and hicks' theory. However, out of various theories, one theory that recognition is credit cycle. Due to use of leverage in financial markets, credit cycle was seen as primary cause of economic cycles. The net expansion of credit in economy i.e., increase in private credit to GDP. was meant as expansion in economic activities, whereas net contraction in credit was seen as reason for recessions. This theory heavily emphasis on lending credit by banks and financial institutions to private sectors.

American economist Hyman Minsky proposed a financial instability hypothesis in which he explained cycles founded on variation in interest rates, financial frailty and excessive credits. He argued that during an expansion phase interest rates are kept low due to which firms borrows funds in low interest rate from financial institutions. Banks and financial institutions don't hesitate to give these loans, as an expansion of economic activities allows firms to enhance cash flows, which lowers the chances of default and banks continues to lend funds as they get interest income on loans. However, this mechanism leads firms to borrow excessive debt which eventually leads to default and economy faces contraction in economic activities (recession).

The emergence of financial cycle started with advance economies facing a financial crisis. (Borio, 2014) Defines financial cycle as “self- reinforcing interactions among the perceptions of value and risk, attitude towards risk and financing constraints”. He claims that these three variables can translate the financial sector into booms and busts. Financial cycle generally refers to contraction and expansion in the domestic credit activities. The history of Recession is generally accompanied by various financial disruptions which takes years to recover. These disruptions include sharp decline in prices, bubbles, housing prices crash, contraction in credit, credit default etc. which leads to links between finance and macroeconomics and the interaction

of the financial and business cycle. The study of interaction between business cycle and financial cycle are important to monetary and macro prudential policies. The countercyclical capital buffer (CCCB) proposed by the Basel committee on banking supervision (BCBS) assumes that the financial cycle is four times longer than the business one with direct impacts over its main indicators.

### **Need of Estimation of financial cycle in Nepal**

In 1984 there were only 2 Nepalese commercial banks. In mid 1980s, the government of Nepal introduce liberalization policies to attract foreign investment which opened gate for foreign investments and after 1990s Nepalese banking and financial institutions saw a surge in number of private banks especially from year 2000 to 2010 which eventually led to unusual growth in number of banking and financial institution. In 2011-2012 there were 32 commercial banks, 88 development banks, 79 finance companies and 21 microfinance which was quite large for a small country like Nepal. On the other side, global financial industry was just recovering from global financial crisis 2008, which has tighten the capital requirement of BFI's (Basel norm III issued by BCBS) in order to strengthen the banking sector capital requirement and to absorbs shocks cause by banking crisis. However, Nepalese banking sector was also performing poor with low level of capital, turnover, wide spread in interest rate, inadequate resource to finance major projects and inefficient management of BFI. International Monetary Fund and World Bank started to warn Nepalese banking sector about weak performance of banks and financial institutions, later International monetary fund (IMF) declared one third of institutions are underperforming, banks have inadequate working capital, excessive operating expenses, inefficient management, excess liquidity and unhealthy competition in Nepalese economy. International bodies and economists suggested Nepal Rastra Bank (Central bank of Nepal) to initiate financial consolidation policy of merger in order to tackle banking issues, to enhance the capacity of Nepalese banks and financial institutions (BFIs) and to compete with foreign counterparts. In 2011, Nepal Rastra Bank enacted "Merger bylaw 2011", in year 2014 "Acquisition bylaw" and in year 2016 NRB introduced "Merger and Acquisition bylaw", which generally expanded the capital requirement of BFIs which forced banks and financial institutions to merger and acquire in order to survive.

Aftermath of 2008-09 global crises gave introduction to macro prudential policies. Macro prudential regulation is an approach that aims to mitigate risk of the financial system as a whole "systemic risk". One of the main reason or foundation for developing new macro prudential policy in addition to traditional macro prudential policy was that the "financial cycles differ from business cycle". Policymakers develop macro prudential approaches to tackle systematic instability during the financial crisis. An important aspect of these policies is to tame the financial cycle. Policymaker argued if the properties of financial cycles are sufficiently different from those of regular business cycle, then monetary and fiscal policy are imperfect instruments for addressing them and the case for macro prudential policy separate third stabilization policy is strengthened. Moreover, calibrating macro prudential policy measures will depend on the properties of financial cycles. With the introduction of countercyclical capital buffer (CCyB) proposed by the Basel committee on banking supervision, a time varying capital requirement was

applied to banks and financial institutions. It aims to promote sustainable provision of credit to the economy by making system more resilient.

Growth in credit to private sector can have two folds of consequences, first credit to private sector will help firm to meet their fund requirement and second credit to private sector can also cause chaos if they fail to repay and loans get default which will eventually increase non-performing loans ratio (NPA). However, these fluctuations can be extracted from time series data with the help statistical filter. Policymakers can picture the timeline of economic activities and fluctuations which will help them to take corrective measure ahead of financial crisis. So, this study is an attempt to extract and estimate the business cycle and financial cycle of Nepalese economy and to find out the credit imbalances and irregularities which will help to identify the early warning signals for financial distress.

## Literature review

Every Past financial crises; the Great Depression, currency crises, economic crisis, sovereign defaults, dot com bubble, Banking panics, financial bubbles, stock market crashes and 2007-12 financial crisis all have devastated loss to an economy. However, the aftermath policy measure strengthens working framework.

Excessive credit circulation in an economy is cited as one of the main driving forces of systematic risk which leads to financial crisis in an economy. In order to track and tackle such excessive credit growth the Basel committee for banking supervision (BCBS) has proposed the implementation of countercyclical macro prudential instruments. For example, countercyclical capital buffer (CCyB). The idea behind implementation of countercyclical macro prudential instruments is to identify the excessive credit growth. The policymaker proposed to use a quantitative indicators which will provide information regarding building up of cyclical systematic risk. The committee proposed credit –to-GDP gap as an instrument to measure credit imbalances. It is also known as Basel gap. It basically decomposes credit to GDP ratio into two parts growth component and cyclical component with the help of statistical filter. The BCBS proposed statistical filter developed by (Hodrick & Prescott, 1997). The methodology uses a real-time (one-sided) version of the Hodrick–Prescott filter (HP). Now, The Basel gap is used as the standard indicator to identify credit imbalances and to gauge CCyB rates across BCBS jurisdictions mainly European Union countries. (BIS, 2010)

Countercyclical capital buffer was proposed by BCBS as an additional capital to capital adequacy requirement in order to absorb the shocks of financial crisis. (Giese, et al., 2014) In their paper “The credit-to-GDP gap and complementary indicators for macro-prudential policy” reviewed the performance of credit-to-GDP gap in setting the countercyclical capital buffer (CCyB). The result showed that indicator help to provide an advance warning for past United Kingdom banking distress. However, the indicator doesn’t guarantee to provide future signal for upcoming distress. Therefore, they identified some shortcoming of credit to GDP gap and concluded with some suggested complementary indicators to identify early possible financial distress.

(Tsatsaronis, Drehmann, & Borio, 2011) in their study for BIS compared the various possible early warning indicators such as credit spreads, real GDP and credit, monetary aggregates, asset prices, banking sector activities (banking sector profit and average gross losses) and cost of funding/borrowing (cost of liquidity, corporate bond spreads) and the result found out that credit to GDP gap as statistically the best alternative indicator to identify future banking crisis or distress.

(Filardo, Lombardi, & Raczko, 2018) In a working paper for BIS measured financial cycle time, influenced by traditional approach of business cycle introduced by Burns and Mitchell. They studied past 120 years data in order to estimate the financial cycle. They used continuous time autoregressive model and time deformation techniques to measure the financial cycle time. The result showed that time deformation was statistically significant and associated with the inflation volatility, long term real interest rates and perceived riskiness of macro-financial environment.

Due to increase in financial crisis, complexities and importance of financial cycle and business cycle has been increased and there has been a rapid increase in literature related to estimation of financial and business cycle. Various statistical tools, filter and techniques are introduced by research scholar to estimate and capture the complexities of economic and financial variable. However, The Basel gap or credit- to- GDP gap proposed by Bank for international settlements (BIS) has faced several criticism from critics. First criticism addresses the approach to normalize the credit in credit to GDP ratio (i.e. dividing domestic credit by nominal GDP), critics questions the use of nominal GDP may be not relevant. Second criticism addresses the use of HP-filter to estimates the gap ratio, critics argues various measurement problems and drawback of HP filter. (Jokipii, Nyffeler, & Riederer, 2020) in their study address these criticism in reference to Switzerland. The result showed no compelling evidence to support the critics or reason not to use BIS gap to measure the financial cycle. However, they address the need to interpret the signal with serious caution, mainly the long lasting boom phases and bust phases. They suggested regulator and authorities should enhance and strengthen their framework during the period of additional credit phase.

(Galan, 2019) in this paper “ Measuring credit to GDP gaps the Hodrick-Prescott filter revisited” address the major criticism questioned by critics. The author revisited the proposed Basel gap indicator by Basel committee for banking supervision (BCBS). He mentions the limitation regarding the inertia of estimating the long-run trend, which fails to capture sudden (structural) changes in the trend which result to estimate gap which don't reflect proper positioning of the financial cycle and the risk associated to it. Later, in his European Union countries study he mentions that the activation of countercyclical capital buffer (CCyB) in recent years were not followed the Basel gap signals. He later questions and doubts about the properties of statistical filter (HP filter) to measure the cycle. In order to assess the criticism author relaxed the assumptions and measure the financial cycle. The result suggested that filter with lower length of credit cycle helps to improve the early warning performance and correct the downward bias of original indicator proposed Basel gap by BCBS.

One of the criticism regarding the Basel gap is the use of one sided HP filter versus two sided HP filter. (Alessandri, Bologna, Fiori, & Sette, 2015) Introduced a technique to correct the deviation

between one side and two side HP filter with the help of forecasting data. The result showed two sided HP filter performed well to capture the changes in trend than the one sided HP filter. However, the performance completely depends on quality of forecast made. A similar study, in Chile, (Marinez & Oda, 2018) approach the problem of larger smoothing parameter in HP-filter for the computation of Basel gap. The result found that lowering the smoothing parameter improves the performance of the Basel gap.

(Bhatta, 2018) In his paper used the application of frequency domain filter to estimate the business and financial cycle in Nepal. The annual time series from 1991-2017 of gross domestic product, consumer price index and domestic credit to private sector were taken in the study. The result of business cycle showed that in year 2017 Nepalese economy was in recovery phase and the result of financial cycle showed that financial cycle witnessed a boom in 2013. Further, he mentioned the cycle properties results similar to advance economies suggesting financial cycle are longer and deeper than the business cycles.

## Methodology

Various paper has suggested that excessive credit growth is directly associated with systematic risk which contributes to amplify or fuel the financial crises. It is very important to track fluctuation in credit-GDP as it reflects domestic lending in an economy. Hence, it should be taken as standard indicator to measure the financial cycle (Schularick & Taylor, 2012). Using Credit variable to extract financial cycle can be explained with two major advantages. First, Credit-GDP ratio measures domestic credit as of percentage of GDP which tells financial deepening of the economy and second, credit can also be used as a proxy for consumption and investment in the economy which are used by private sector player to meet fund requirements and boost their operation. In addition to that, the Basel committee of banking supervision (BCBS) has also focused on monitoring credit growth in order to keep checks on excessive debt and systematic risk. BCBS has proposed Basel gap (credit to GDP ratio gap) as a standard indicator to measure credit imbalances and to gauge the countercyclical capital buffer rates.

### Why to use gap not the ratio?

Trend component of a time series generally reflects the sustainable evolution of the variable (uptrend or downtrend). The main reason to use “gaps” instead of ratio is because the gap reflects the short term tendencies which may be are not sustainable and these short term tendencies can lead to crisis if they are left unchecked. A Higher positive gap suggest that the private credit or borrowing at that level is not justified by the current output producing abilities (GDP) of the economy. Excessive lending or domestic credit can leads to high rates of credit defaults which can eventually leads to financial crisis in an economy and a negative gap suggests safe amount of additional private credit lending can be done. However, economy is unable to exploit it.

## Procedure

### Financial cycle

To estimate the financial cycle following procedure has to be followed:

1. We need to estimate the credit-GDP gap ratio. The following procedures are adopted to estimate such gap ratio.

$$\text{Credit to GDP ratio}_t = \left( \frac{\text{credit}_t}{\text{GDP}_t} \right) * 100$$

Where,

$\text{credit}_t$  = Total credit to the private, Non-financial sector (domestic credit) in period  $t$

$\text{GDP}_t$  = Nominal gross domestic product in period  $t$

2. Extraction of trend by applying Hodric-Prescott (HP) Filter
3. In order to calculate credit-GDP ratio gap, it is measured by the gap between the ratio and its trend

$$\text{Credit to GDP gap}_t = \text{Credit to GDP ratio}_t - \text{Trend}_t$$

### Business cycle

To estimate business cycle, following procedure has to be followed: Logarithm of real gross domestic product and HP filter is applied to the log of Real GDP time series.

$$\text{Cyclical component}_t = \text{LnRGDP}_t - \text{Trend}_t$$

### Time based filter: Hodric-Prescott (HP) Filter

HP filter is a tool for separating (detrend) economic time series data into two parts: The growth component and the cyclical component. This is important because every point in an economic time series is comprised of these two elements mixed together with each other. The HP filter decomposes a time series  $Y_t$  into additive cyclical component ( $Y_t^c$ ) and growth component ( $Y_t^g$ ).

$$Y_t = Y_t^g + Y_t^c$$

Applying the HP filter involves minimizing the variance of the cyclical component ( $Y_t^c$ ) subject to a penalty for the variation in the second difference of the growth component ( $Y_t^g$ )

$$\{Y_t^g\}_{t=0}^{T+1} = \text{argmin} \sum_{t=1}^T [(Y_t - Y_t^g)^2 + \lambda [(y_{t+1}^g - Y_t^g) - (Y_t^g - Y_{t-1}^g)]^2]$$

The first term is interpreted as the sum of squared deviations of the economic time series  $Y_t$  from its growth rate.

The second term is a second order difference equation that exists for the trend multiplied by  $\lambda$ . This second term measures the changes in estimated growth rate from one period to the next. The point of minimization problem is to identify the value of growth component.

Where  $\lambda$ , the smoothness parameter penalizes the variability in the growth component. The larger the value of  $\lambda$ , the smoother the growth component. If  $\lambda$  approaches to infinity, the growth

component corresponds to linear time trend. Hodrick and Prescott suggest  $\lambda = 1600$  for quarterly data. However, (Ravn & Uhlig, 2002) in their paper stated that  $\lambda$  should vary by the fourth power of the frequency observation ratio thus  $\lambda$  should equal 6.25 ( $1600/4^4$ ) for annual data and 129,600 ( $1600*3^4$ ) for monthly data.

## Result and analysis

### Domestic credit to Private sector (% of GDP)

After applying HP filter on annual time series data of Domestic credit to Private sector (% of GDP), it separates the trend and cyclical component according to the method explained in methodology section. Applying the HP filter involves minimizing the variance of the cyclical component subject to a penalty for the variation in the second difference of the growth component. The method breaks the time series into two terms. The first term is interpreted as the sum of squared deviations of the economic time series  $Y_t$  from its growth rate and the second term is a second order difference equation that exists for the trend multiplied by  $\lambda$ . This term measures the changes in estimated growth rate from one period to the next. The point of minimization problem is to identify the value of growth component. Where  $\lambda$  works as smoothness parameter which penalizes the variability in the growth component.  $\lambda$  value to penalize the growth component is taken as 6.25 (Ravn & Uhlig, 2002).

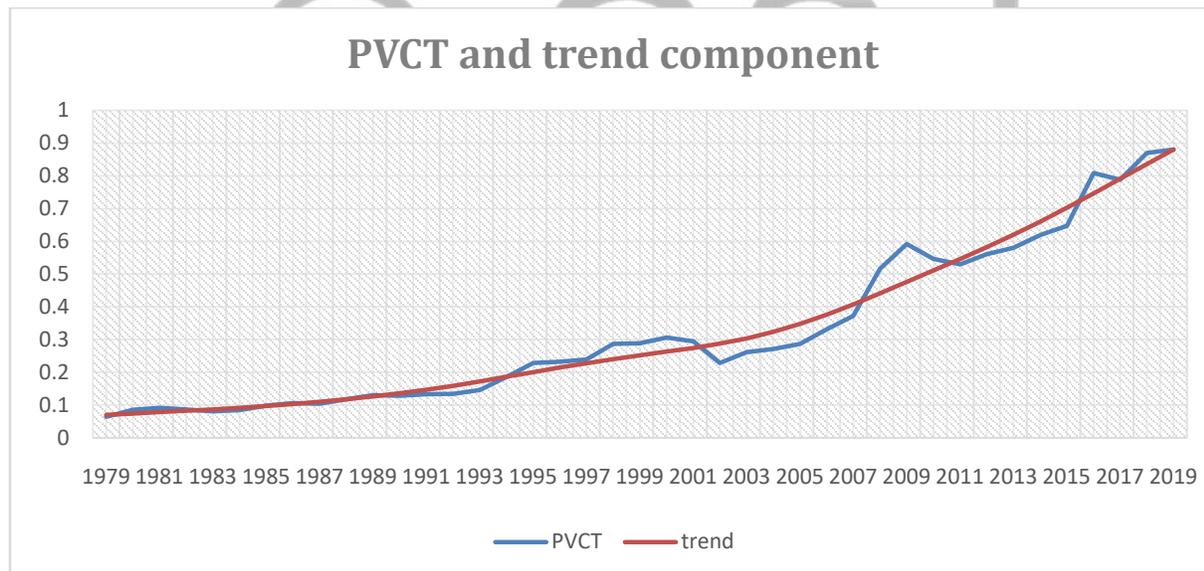


Figure 1: domestic credit to private sector (% of GDP)'s trend component

In above plotted figure, blue line represents domestic credit to private sector as a % of GDP (PVCT) whereas red line represents trend in the domestic credit to private sector (% of GDP). As we can see the trend of domestic credit to private sector (% of GDP) is increasing year to year.



Figure 2: domestic credit to private sector (% of GDP)'s cyclical component or financial cycle

In the above plotted figure, blue line represents the financial cycle in Nepalese economy. As mentioned earlier, HP filter decomposes time series into two parts. Trend component is plotted in figure 1 and second component (i.e. cyclical component) is plotted in figure 2. The cyclical component helps to identify the cycle in the financial activities of an economy. It is extracted by estimating the gap ratio. Gap ratio is used in order to examine short term tendencies which may not be sustainable and have potential to lead into crisis if it is ignored or unmanaged. The gap used in this study is also known as Basel gap. Basel gap was proposed by the Basel Committee on banking supervision (BCBS). It is an indicator which decomposes credit to GDP ratio into long run trend and cyclical component. BCBS also proposed a countercyclical capital buffer (CCyB) in order to absorb the shocks in credit cycle identified by Basel gap. This instrument helps to enhance the resilience of lending sector in the period of downturn through huge accumulation of capital during the expansionary phase of credit cycle.

The indicator measures the difference between domestic credits to nominal gross domestic product (GDP) and trend component of series through statistical filter. If the gap is positive and if it exceeds 2 % it indicates borrowing at the levels are not justified with the current output producing ability of the economy and capital requirement should be increased to absorb the shocks. Capital requirement here refers to the countercyclical capital buffer (CCyB). It should be set between 0 to 2.5 % in case the gap exceeds more than 2 %. If the positive gap is wider regulator should impose strict action and regulation in order to absorb the unforeseen banking crisis. CCyB should be added to the capital adequacy ratio (CAR). However, if the gap is negative it means long run trend of domestic credit to GDP is greater than the observed value and safe amount of additional lending can be done but it is unexploited yet.

In the figure 2, the financial cycle is higher than 2% in 1998-2001 which implies banking sector should increase their capital requirement (i.e. CAR + CCyB). In year 2002 till 2007, the safe amount of additional private lending remained unexploited which can be explained by the Nepalese civil war which lasted 10 year from 1996-2006. From year 2008 to 2011, we can see a massive positive increase in the credit to gap ratio of more than 9 % it can be explained by unusual growth in number of banks and financial institution in economy. In 2011-2012, there

were 32 commercial banks, 88 development banks, 79 finance companies and 21 microfinance which was quite large for a small country like Nepal. It was controlled by NRB by initiation of financial consolidation policy of merger in 2011, acquisition by law (2014) and merger and acquisition bylaw (2016). Later in year 2015, Nepal get hit by a devastated earthquake followed by blockade of terai border by madhesi protesters which blocked supplies and essential raw materials. As of 2019-2020, the gap is near to zero which implies adequate lending is prevailing in the economy.

### Real Gross domestic product

As discussed earlier HP filter decomposes time series into parts cyclical component ( $Y_t^c$ ) and growth component ( $Y_t^g$ ). Same methodology is applied to time series of log of real GDP with the same smoothing parameter ( $\lambda = 6.25$ ) to penalize the growth component.

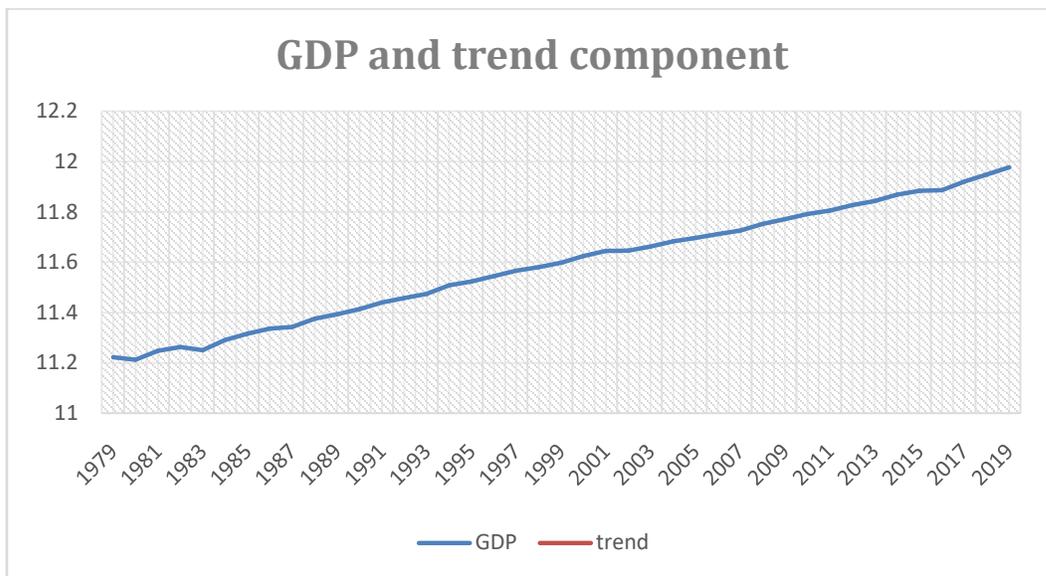


Figure 3: Real Gross domestic product's trend component

In the above plotted figure, blue line represents annual time series data of real gross domestic product (log of Real GDP) from year 1979 to 2019 whereas red line represents trend in the annual time series of real gross domestic product (log of Real GDP). Trend component of Real GDP is in upward direction increasing year by year. With the help of HP-filter, Real GDP has been decompose into trend component and cyclical component.

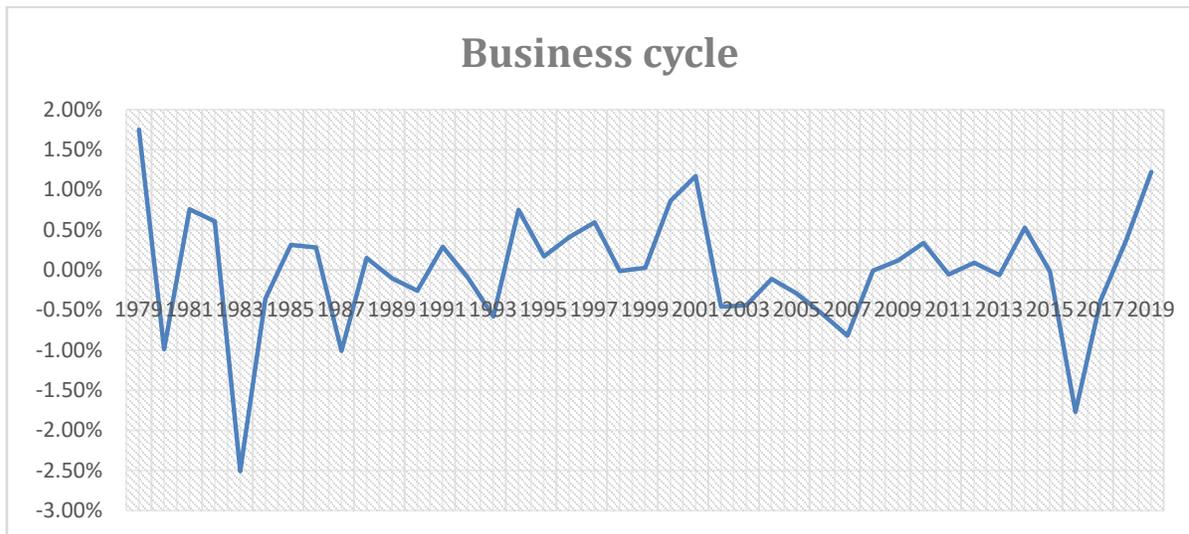


Figure 4: Business cycle or real gross domestic product’s cyclical component

In above plotted figure blue line represent the business cycle of Nepalese economy. As mentioned earlier, HP filter decomposes time series into two parts. Trend component is plotted in figure 1 and second component (i.e. cyclical component) is plotted in figure 2. The result shows that in 1983-84 Nepal’s economy has negative fall suggesting recession in year 1982-84. The Central Bureau of Statistics (CBS) has attributed contraction in economic activities to a drought happened in 1980-81 which led to a severe food crisis in Nepal. Similarly, in year 1987-88, 1993 and 2003-2008 Nepalese economy has seen some signs suggesting decline or contraction in economic activities.

Many economist has define recession in their own terms which varies according to their own study. The general idea about recession is it refers to massive contraction in economic activities of an economy. However, the most popular definition of recession was introduce by economist Julius Shiskin in year 1974. He suggested recession as decline in gross domestic product (GDP) for two consecutive quarters. In year 2015-2016, there is a contraction in economic activities which can be explained by the massive devastated earth quake happen in April 2015 followed by September blockade in terai border by Madhesi protesters which severely affected Nepalese economy. As of 2019, Nepal economy is witnessing expansion in economic activities.

## Business cycle and financial cycle

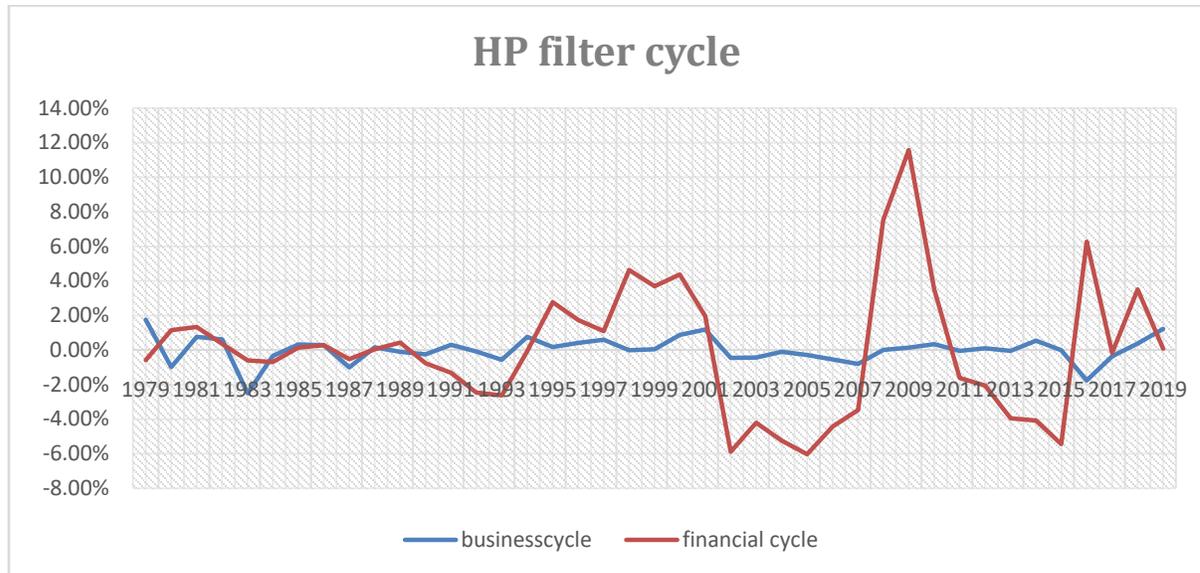


Figure 5: Business cycle and financial cycle of Nepalese economy

In the above plotted figure 5, blue line represents the business cycle of Nepalese economy extract from log of Real GDP whereas red line represents financial cycle of Nepalese economy extract from domestic credit to private sector (% of GDP) gap. In figure 5, we can see that the financial cycle are longer and deeper than the business cycle which is one of the major assumption of Basel committee on banking supervision (BCBS). BCBS assumes that the financial cycle is four times longer than the business cycle with direct impacts over its main indicators. The statistical features of financial cycle and business cycle vary in various aspects. First, business cycle shows recoveries and recession in the economy whereas financial cycle shows expansion and contraction in domestic credit (lending). Second, the duration of both the cycle also varies. Business cycles are shorter than financial cycle or financial cycle are longer than the business cycle in general and the amplitude of financial cycle also varies more than the business cycle and third, the synchronicity of both the cycle are low.

## Conclusion

Various literature suggest that BIS gap (credit-to-GDP gap) works as early warning indicator to identify financial crisis or distress. However, there are also several criticism regarding the normalization of credit with nominal GDP and the problem of measurement with statistical filter (HP filter). As mentioned earlier, the complexities of economy and financial interlinkages are very hard to ideally provide an indicator that captures or guides to measures the systemic risks. Various Policymakers and economists address that there is no single indicator which can provide a perfect guide for systematic risks due to the tendency of financial market to evolve over the period of time and the time lags before the risks becomes clear or apparent. Policymaker has to monitor wide range of time varying variables indicators which totally depends on emerging risks. Therefore, this indicator should be used as a complementary indicator with other time varying

indicators to identify upcoming future financial distress. The validity and reliability largely depend on the methodology of estimation and different statistical methodology can picture different results.

Figure 2 pictures financial cycle of the economy, it shows gap is higher than 2% in year 1998-2001, which implies banking sector should increase their capital requirement (i.e., CAR + CCyB). In year 2002 till 2007, the gap is in negative which suggest the safe amount of additional private lending remained unexploited. From year 2008 to 2011, we can see a massive positive increase in the credit to gap ratio of more than 9 %, which suggest regulator should strengthen the capital requirement for financial institutions by adding countercyclical capital buffer in capital adequacy ratio (CAR) and additional strict measures the minimize the unjustified exploitation. Later in year 2015, Nepalese banking activities saw contraction due to the devastated earthquake which was later followed by blockade of terai border by madhesi protesters. As of 2019-2020, the gap is near to zero which implies adequate lending is prevailing in the economy.

Figure 4 pictures business cycle of the economy, it shows that in 1983-84 Nepal's economy has negative fall suggesting recession in year 1982-84. Similarly, in year 1987-88, 1993 and 2003-2008 business cycle suggests decline or contraction in economic activities and from 2008 to 2014 business cycle indicates recovery from previous crisis and later in year 2015-2016, there is a again contraction in economic activities explained by the massive devastated earth quake happen in April 2015 followed by September blockade in terai border by Madhesi protesters. As of 2019, Nepal economy is witnessing expansion in economic activities.

In figure 5, we can see that the financial cycle is longer and deeper than the business cycle, the amplitude of financial cycle is also varying more than business cycle and the synchronicity of both the cycle are also low. Which is similar to the properties of financial cycle identified by the study of Basel committee on banking supervision (BCBS). This study provides evidence regarding the application of Basel gap (credit to GDP gap) in Nepalese context as positive gaps in year 2011 is captured by financial cycle and BIS indicator which raised serious concern regarding unjustified lending in year 2010-11. Hence, this indicator can be used as tool to identify the upcoming financial banking distress if the positive gap is too wide from its normal line (i.e., zero percent).

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