APPLICABILITY OF BASEL III COUNTERCYCLICAL CAPITAL BUFFER GUIDANCE TO EMERGING MARKET ECONOMIES: AN EXPLORATION

Gopinath Tulasi
Reserve Bank of India

Abstract

Basel Committee on Banking Supervision (BCBS) has published its guidance for operating the countercyclical capital buffer. It has, *inter alia*, recommended that credit-to-GDP ratio could be the buffer guide. This paper argues that BCBS buffer guide is not suitable for Emerging Market Economies (EMEs) for variety of reasons and showcases an alternative buffer guide, reflecting their underlying banking business model. It verifies the historical performance of the alternative buffer guide in the Indian context and finds evidence – supported by the corroborative behaviour of the real sector and asset markets - that the alternative guide tracks credit cycles in India better. The paper demonstrates that the alternative indicator does not adversely impact the structural drivers of credit growth. Accordingly, the paper recommends the alternative countercyclical capital buffer guidance with triggers for the build-up and release of the additional countercyclical capital buffer.

---

1. Introduction

The recent financial crisis has redefined the broad contours of regulation of financial sector, globally. The G-20 Working Group 1 on *Enhancing Sound Regulation and Strengthening Transparency*, constituted in 2008, submitted its recommendations, which formed the blueprint for the global regulatory reform agenda. Procyclicality has been among the identified underlying causes for the recent crisis. Various measures have accordingly been proposed by international

standard setters to address the problem of procyclicality. One such measure put forward by the Basel Committee on Banking Supervision (BCBS) was countercyclical capital buffers.

In December 2010, BCBS issued *Guidance for national authorities operating the countercyclical capital buffer* recommending, *inter alia*, a buffer guide for the consideration of national authorities. In this context, relevant questions are: is the suggested buffer guide suitable for Emerging Market Economies (EMEs), especially for those which largely rely on retail model of banking business akin to India's? If not, is there any alternative buffer guide more suitable for them? If so, what is it? This paper endeavors to address these questions of relevance in detail and is organised into six sections. Section 1 outlines the BCBS set of proposals with regard to the guidance to the national authorities for operating the countercyclical buffer. Section 2 examines its suitability to EMEs. Section 3 outlines a literature review enumerating studies on the subject. This section attempts to position the paper in the evolution of the literature. While Section 4 analyses methodology for constructing an alternative buffer guide customised to macro-financial environments in which banks in EMEs operate, Section 5 presents the historical performance of the proposed alternative buffer guide in the Indian context. Finally, Section 6 concludes.

2. The BCBS Proposals for Operating Countercyclical Capital Buffer

2.1   *Objective*

A countercyclical capital buffer regime is targeted at dampening liquidity cycles. It mitigates the expansion in bank balance sheets and the build up of leverage during boom periods (CGFS, 2011) through the use of a buffer of capital to achieve the broader macroprudential goal of protecting the banking sector from periods of excess aggregate credit growth that have often been associated with the build up of system-wide risk. Protecting the banking sector in this context is not simply ensuring that individual banks remain solvent through a period of stress, but ensuring that the banking sector in aggregate has the capital on hand to help maintain the flow of credit in the economy without its solvency being questioned, when the broader financial system experiences stress after a period of excess credit growth. This primary objective could have a positive side-benefit of moderating effect on the build-up phase of the credit cycle. The relevant authority in each jurisdiction will be required to monitor credit growth and make assessments of whether such growth is excessive and is leading to the build up of system-wide risk. Based on this assessment, they will need to use their judgment to determine whether a countercyclical buffer requirement should be imposed. Principles underpinning the role of judgment and the common reference guide are as follows:

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

3

2.2 Principles

Principle 1: (*Objectives*) Protecting the banking system against potential future losses when excess credit growth is associated with an increase in system-wide risk which should be the primary motive behind buffer decisions.

Principle 2: *(Common reference guide)* The credit/GDP guide is a useful common reference point in making buffer decisions. Credit includes both bank and non-bank sources of credit. However, it does not need to play a dominant role in the information used by authorities to make and explain buffer decisions. Authorities should explain the information used, and how it is taken into account in formulating buffer decisions.

Principle 3: *(Risk of misleading signals)* Assessments of the information contained in the credit/GDP guide and any other guides should be mindful of the behaviour of the factors that can lead them to give misleading signals. In assessing a broad set of information to make buffer decisions in both the build-up and release phases, authorities should look for evidence as to whether the inferences from the credit/GDP guide are consistent with those of other variables. Some examples of other variables that may be useful indicators in both phases include various asset prices; funding spreads and CDS spreads; credit condition surveys; real GDP growth; and data on the ability of non-financial entities to meet their debt obligations on a timely basis.

Principle 4: *(Prompt release)* Promptly releasing the buffer in times of stress is essential as it can help to reduce the risk of supply of credit being constrained by regulatory capital requirements.

Principle 5: *(Other macroprudential tools)* The buffer is an important instrument in a suite of macroprudential tools at the disposal of the authorities.

2.3 Jurisdictional reciprocity

The host authorities should take the lead in setting buffer requirements that would apply to credit exposures held by local entities located in their jurisdiction. They would also be expected to promptly inform their foreign counterparts of buffer decisions so that authorities in other jurisdictions can require their banks to respect them. Without such a level playing field on the minimum buffer add-on, the impact of foreign banks (not subject to buffer) increasing their lending in response to lower competition from domestic banks (subject to buffer) could undermine the buffer regime's potential side-benefit of reducing excessive credit in a jurisdiction. As with the minimum capital requirement and capital conservation buffer, host authorities would have the right to demand that the countercyclical capital buffer be held at the individual legal entity level or consolidated level within their jurisdiction.

2.4 Communications

It is essential to build understanding and credibility in the buffer decisions through effective communication with all stakeholders including banks and authorities in other jurisdictions (BCBS 2010).

3. BCBS Buffer Guide and its Suitability to EMEs

BCBS recommends that deviation of credit-to-GDP ratio from its long-term trend could be a useful starting reference point for assessing the build-up of system-wide risk in the financial system. Before recommending this buffer guide, BCBS considered a broad range of indicator variables. The variables assessed can be divided into three groups. The first includes aggregate macroeconomic variables: GDP growth, (real) credit growth and deviations of the credit to GDP ratio from a long term trend and deviations of real equity prices as well as real property prices from their respective long-term trend. The second includes measures of banking sector performance: profits (earnings) and proxies for (gross) losses. The final group includes proxies for the cost of funding, in the form of credit spreads. BCBS felt that the credit-to-GDP gap was the best performing of the range of variables considered. It is smoother and normalised by the size of the economy, and is therefore not influenced by the normal cyclical patterns of credit growth: Furthermore by being based on credit, it has the significant advantage over many of the other variables by appealing directly to the objective of the countercyclical capital buffer, which is to achieve the broader macroprudential goal of protecting the banking sector from periods of excess credit growth.

How does the credit-to-GDP ratio behave in EMEs? An attempt is made to assess and verify how the credit-to-GDP gap performs in the Indian context. Figure 1 presents time series of bank credit- to- GDP ratio and its long-term trend since 1950-51.

The trend line was based on the Hodrick-Prescott (HP) filter with λ = 400,000 (as suggested by the BCBS guidance). Some of the observations of the figure 1 are as follows. Firstly, in the 1950s, 1960s, 1970s, and 1980s, credit-to-GDP ratio was almost close to the trend. Secondly, in the 1990s the credit-to-GDP ratio began slightly deviating from the trend but basically remained below but close to the trend up until 2002-03. Lastly, since 2003-04 the credit-to-GDP ratio remained above the trend and positive deviation widened thereafter.

In the light of the above observations, the usefulness of credit-to-GDP ratio as a policy guide in the Indian context is debatable for the fundamental reason that the credit-to-GDP gap did not show any worthwhile variability up until 2002-03 with the standard deviation of the gap during 1950-51 to 2002-03 which was estimated at just 3.0 (this finding was corroborated by the Financial Stability Report (June 2011) of Reserve Bank of India) though there emerged a significant positive gap since 2003-04 as the standard deviation almost doubled during this five year period. In other words, from the historical perspective, the credit-to-GDP gap was too small to be of any value in the Indian context for policy purposes.

How to rationalise and explain the inapplicability of the BCBS guidance as posited above? The observed lack of variability in the credit-to-GDP gap in the Indian context until recently is not hard to explain. Informal credit market has

dominated the Indian scene over the decades, though the formal credit market has expanded its reach in the meantime. Illustratively, analysis of share of rural household debt by source as revealed by All India Debt and Investment Surveys, is of relevance in this regard. The share of non-institutional agencies, consisting of money lenders, traders, landlords and friends and relatives, in the rural household debt remained more or less stagnant at over 30 per cent during the last 30 years. Approximately 40 per cent of the population across India has bank accounts. Furthermore, the credit market in India largely remained underdeveloped due to the so-called financial repression reflecting fiscal dominance. The preemption of banking sector resources to fund persistently large fiscal deficits was once as high as 63.5 per cent of net demand and time liabilities of all the banks, though this has waned because of financial sector reforms in the recent decade. Thus, in the historical sense, the credit market in India remained dormant, reflecting the absence of structural drivers of credit, thereby resulting in credit-to-GDP gap being too small to be of any use from the policy perspective.

Thus in the *ex post* sense, BCBS guidance is not applicable to India. Besides, it is further argued below that it is not applicable going forward into the future either, in the *ex ante* sense. Essentially, the BCBS buffer guide implicitly assumes that the long-term trend of the credit-to-GDP ratio is a reliable proxy for the optimal/equilibrium credit required for an economy and any positive/ negative deviation denotes excess/deficit credit growth. This is presumably valid in the case of the advanced economies operating generally at equilibrium with full employment (potential growth), and mature and integrated financial markets. Points on the long-term trend line typically signify equilibrium credit market compatible with full employment/potential employment. However, the BCBS capital buffer guide of deviation of credit-to-GDP ratio from its long-term trend is not suitable for EMEs. Fundamentally, rise in credit-to-GDP ratio may be unrelated to any signs of over-leverage in the credit market. The long-term past trend does not represent optimal/equilibrium credit requirements of these economies. Factors which predominantly determine the credit-to-GDP ratio in the EMEs in the future include various structural drivers *viz.*, structural shift from services to manufacturing (Subbarao, 2011), financial deepening from a low base, rising efficiency of goods markets, rising efficiency of credit markets, and policy initiatives to improve flow of credit to sectors like the agriculture, small scale units and infrastructure (Mohan, 2006[1]).

Most of the EMEs are refocusing on positioning manufacturing sector as drivers of growth, going forward. Illustratively, India's New Manufacturing Policy aims to grow manufacturing about 3 per cent faster than GDP so that its contribution to GDP can increase from 16 per cent to 25 per cent in the next 15 years. Typically, credit intensity of manufacturing is higher per unit of GDP. Further, in EMEs, various segments of the real sector continue to be outside the purview of the formal credit market, funded basically through informal sources of credit, as mentioned earlier. As the process of financial deepening gathers

pace and manifests in the form of these segments seeking formal credit, there is a switch in sources of credit from informal to formal.

Typically, EMEs are supply-constrained economies. As the supply constrains ease over time, goods markets tend to become more and more efficient. Rising factor mobility leading to enhanced allocative efficiency is one such manifestation. These improvements in goods markets generally get reflected in structural shifts in supply elasticities, resulting in increasing demand for credit to finance rising production. Over time, credit markets in EMEs become more efficient in intermediating funds between the users and providers of credit, facilitating easier fund mobility at lower transaction costs. In other words, as the cost of intermediation drops, credit off-take rises. Illustratively, the intermediation cost (defined as the spread between cost of deposits and return on loan assets) for the scheduled commercial banks in India consistently fell from 6.24 per cent in 1991-92 to 3.59 per cent in 1999-2000 and further to 3.31 per cent in 2009-10. Moreover, there have been conscious policy initiatives in EMEs to augment credit flow to certain identified sectors including agriculture, small scale units and infrastructure. Illustratively, the Government of India, as part of its strategy to boost agriculture production, announced a package to double the flow of institutional credit to agriculture within three years starting 2004-05. The agricultural credit in fact doubled in 2-year period, as against the stipulated period of three years.

Furthermore, for EMEs including India, credit demand is also expected to go up due to investment needs of infrastructure and the demand for upscaling financial inclusion. For example, in India credit requirements for the next five years for infrastructure development are estimated at US $ 1 trillion. Additionally, subtle behavioural changes underway, typical of a fast developing economy, push up credit and these include, *inter alia*, rising consumption financed through debt as consumers become wealthy, i.e., behavioural changes arising out of wealth effect.

Reflecting these structural determinants, the long-term trend itself would be bodily shifting upwards over time, thereby rendering it less and less useful as a secular benchmark. Consequently, any deviation (positive/negative) from the frequently shifting yardstick loses its theoretical underpinning. Positive deviation *per se* does not necessarily signify over-leverage nor does negative deviation *per se* necessarily denote under leverage. Therefore, credit (including bank and non-bank) growth in EMEs, thus, fundamentally will embody both structural and cyclical components. While it is necessary to address cyclical components through countercyclical capital buffer, structural components, on the other hand, should not be impacted by such buffer. In practice, it is almost impossible to identify and differentiate structural and cyclical components of credit growth. It could, however, be argued that corroborative evidence from other variables could be sought to decipher two components of credit growth. However, this exercise is fraught with the potential risk of adversely impacting the structural component of credit growth. Thus, interpretation of secular movement of credit-

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

7

to-GDP ratio *vis-à-vis* its long-term trend will be ambiguous in the context of EMEs. To cap this discussion, it would be apt to quote the following extracts:

> The BCBS framework uses the metric "Credit to GDP ratio" and its upward deviation from the long term trend to signal the need to build up countercyclical capital buffer. This metric is not suitable for Indian economy and other EMEs, as was also pointed out in the Financial Stability Report (FSR) of June 2011, due to structural changes taking place in the economy on account of high growth rate and financial inclusion etc. (Sinha, 2011).

> In a structurally transforming economy with rapid upward mobility, credit demand will expand faster than GDP for several reasons. First, India will shift increasingly from services to manufactures whose credit intensity is higher per unit of GDP. Second, we need to at least double our investment in infrastructure which will place enormous demands on credit. Finally, financial inclusion, which both the Government and the Reserve Bank are driving, will bring millions of low income households into the formal financial system with almost all of them needing credit. What all this means is that we are going to have to impose higher capital requirements on banks as per Basel III at a time when credit demand is going to expand rapidly. The concern is that this will raise the cost of credit and hence militate against growth (Subbarao, 2011).

Hence, there is a need for an alternative buffer guide, which can unambiguously mirror the macro-financial environment, especially the leverage conditions, in which banks in EMEs operate. In fact, BCBS proposal (Principle 2) acknowledges the fact that the credit-to-GDP ratio does not need to play a dominant role in the information used by authorities to make and explain buffer decisions. Furthermore, supervisors in each jurisdiction are free to emphasise any other variables and qualitative information that make sense to them for purposes of assessing the sustainability of credit growth and the level of system-wide risk, as well as in making and explaining buffer decisions. Then, what could be the alternative buffer guide? What does the literature offer in this regard? The next section reviews the relevant literature.

4. Literature Review

Ever since the BCBS has come out with the countercyclical buffer guidance in December 2010, there have been studies empirically verifying its usefulness for a variety of jurisdictions. Repullo and Saurina (2011), based on the select advanced economies, argued that credit-to-GDP ratio as the common reference point for application of the buffer would tend to reduce capital requirements

when GDP growth is high and increase them when GDP growth is low, so it may end up exacerbating the inherent pro-cyclicality of risk-sensitive bank capital regulation. Instead, they recommended deviation of credit growth with respect to the long-term average as a common reference point for capital buffer operations. This author feels that while the drawbacks of the BCBS guidance for capital buffers acerbating procyclicality are properly diagnosed, the alternative proposed, namely credit growth gap is not suitable for EMEs in the sense that historical long-term trend for credit growth (backward looking) is not an equilibrium credit growth as explained earlier in Section 2. Hence, it does not reflect the realities of the EMEs.

Geršl and Seidler (2012) criticised the BCBS guidance for the way the excess credit growth is defined. positive credit-to-GDP gap from the long-term trend derived by the HP filter. They contended that the backward looking long-term trend is not an appropriate benchmark for assessing the excess credit growth, reason being that HP-filter based long-term trend does not reflect macro-economic fundamentals of converging economies and hence does not account for the needed catch-up in and convergence of credit growth of EMEs *vis-à-vis* credit growth of advanced economies. Instead, they proposed estimating equilibrium credit elasticities of the advanced EU countries (involving a suitable econometric model) and applying these credit elasticities to Central and East European (CEE) countries to arrive at credible (excess) credit growth and equilibrium credit level. This paper recognises the fact that credit growth in EMEs (what is called convergence countries) needs to catch up with that of the advanced economies and any methodology for assessing excessive credit growth of these economies should need to factor in this imperative. However, this author feels that the paper's criticism of the HP filter that it does reflect the economic fundamentals is not fair as the problem is not with the filter *per se* but with the indicator on which the filter is applied. The HP filter is one method which statistically extracts the long-term trend for a time-series. If the equilibrium credit levels of the advanced economies were to be the benchmark for assessing excessive credit growth of the EMEs, the straight forward option is to compare the actual credit-to-GDP growth of EMEs against the long-term trend of credit-to-GDP growth of advanced economies. More importantly, the paper ignores the significance of funding sources for financing identified equilibrium credit levels. It is that attaining estimated equilibrium credit levels financed through unstable source of funding is not sustainable and hence has a built in systemic vulnerability for the banks.

Mathias Drehmann *et al.* (2011) analysed the behaviour of a wide range of possible indicator variables around episodes of systemic banking crises, drawing on the empirical evidence from more than 40 crises in 36 countries for setting the level of the countercyclical regulatory capital buffer requirements for banks. The authors found evidence that the gap between the ratio of credit to GDP and its long-term backward-looking trend performs best as an indicator for the accumulation of capital, because this variable captures the build-up of system-wide vulnerabilities that typically leads to banking crises. Other

indicators, such as credit spreads, are better at indicating the release phase, as they are contemporaneous signals of banking sector distress that can precede a credit crunch.

Against the above-mentioned backdrop, the alternative common reference point proposed in this paper does not rely on any estimated equilibrium credit levels. It accommodates expansion in the asst-side of the balance sheet of the banks and thereby the catch up in credit growth of EMEs, to the extent that it is financed by stable sources from the liability-side of the balance sheet. Hence, it ensures sustainable catch up in credit growth. Furthermore, the alternative capital buffer guide is not procyclical and moves in synchronisation with the business cycles as measured by real GDP growth. The next section attempts to present the methodology underlying the alternative common reference point. However, before the methodology is presented, it needs to be noted that this paper does not claim to have found the single indicator capable of guiding buffer decisions (both build up and release) in EMEs. All indicators provide false signals. Thus, no fully rule-based mechanism is perfect. Some degree of judgment, both for the build-up and particularly for the release phase, would be inevitable when setting countercyclical capital buffers in practice.

5. Methodology for an Alternative Capital Buffer Guide for EMEs[2]

As mentioned at the outset, the countercyclical capital buffer should dampen liquidity cycles. The optimal candidate for buffer guide should, therefore, reflect the evolving macro-financial environment associated with credit growth. In particular, the buffer guide should be able to capture system-wide vulnerabilities and risks associated with what is perceived to be excessive credit growth. Banking business model in EMEs, including India, is basically retail in nature meaning that the principal source of funding for the banking business is retail deposit base. This business model has endured over the years, *inter alia*, because for banks in the EMEs, including India, dependence on credit risk sensitive purchased sources of funding is limited. This historical dependence of these banks on deposits as a source of funding has inherently imparted an element of built-in stability to the banking sector in these jurisdictions. Any departure from the reliance on deposits to fund credit growth, on a sustained basis, would signal build-up of system-wide risk.

Theoretically it could, however, be argued that the process of financial development in the EMEs may involve a trend increase in securitisation, which would bias the proposed measure of excessive credit growth. In other words, in the context of pick up in securitisation, departure from the reliance on deposits may not necessarily signify over-leverage and thereby rising systemic risk, but may instead underscore financial development in the form of diversification of funding sources for banks involving investors, like pension funds, insurance companies, etc. In this context, it is essential to note the following. The

securitisation markets in EMEs, at present, are either small in size and nascent in stage, or non-existent. In fact, the regulatory framework in EMEs and India in particular underlying securitisation strives to promote orderly development of the securitisation market. Moreover, EMEs do have a huge untapped potential rural retail deposit base to harness going forward. It will, therefore, be a long time before securitisation markets acquire critical mass in EMEs. Secondly, any large deviation from the reliance on deposits as a primary source of funding on a sustained basis-be it due to securitization - does highlight potential build-up of systemic risk as market liquidity conditions tend to acquire greater influence on the stability of the banking sector. The episode of the failure of Northern Rock in the UK illustrates the case in point. Furthermore, as would be evident later in this section, the methodology for developing an alternative capital buffer guide has built-in cushion to tolerate and accommodate prudent credit growth funded by non-deposit sources.

Viewed from the above stand point, it is not the credit growth *per se* but the pattern of funding of the credit growth that needs to be the criteria for the conduct of capital buffer operations on the theoretical premise that expansion of the asset-side of the balance sheet of banks (credit growth) supported by increasingly unstable growth of liability-side signifies worsening system-wide risk. Thus, capital buffers need to be built to protect banks from vulnerabilities arising out of excessive credit growth, not *vis-à-vis* GDP but *vis-à-vis* retail deposits.

Against this back drop, rising Credit Deposit Ratio (CDR) over time could denote increasing system-wide leverage and hence deterioration in macro-financial environment in which banks in EMEs operate. Ideally, the alternative buffer should capture the combined movement of absolute and incremental CD ratios.[3] Absolute CD ratio measures leverage on stock basis, while incremental CD ratio measures leverage on flow basis. However, given the fact that from a purely arithmetic stand point, one is derived from the other, reflecting thereby a strong correlation between the two, use of both absolute CD ratio and the incremental CD ratio deserves a detailed justification.

Incremental CD ratio, in isolation, provides only a partial view of the extent of leverage by the banks. Nor does the absolute CD ratio alone give a complete picture on banks' leverage. The following illustration would underscore this point. Let absolute CD ratio at t_1 be 45 per cent (45/100) and at t_2 57 per cent (68/120). The incremental CD ratio during t_1 and t_2 works out to 115 per cent. However, ICD of 115 per cent does not necessarily signify over-leverage, as it is on the back of a lower absolute CD ratio at t_1. Higher credit growth during t_1 and t_2 might be supported by an overhang of relatively large deposits at t_1. To illustrate further, let absolute CD ratio at t_1 be 75 per cent (75/100) and at t_2 be 77.5 per cent (93/120). The incremental CD ratio during t_1 and t_2 works out to be 90 per cent. However, ICD of 95 per cent does not necessarily signify under-leverage, as it is on the back of a relatively larger overhang of credit manifest in higher absolute CD ratio at t_1. Thus, the holistic view of banks' leverage is provided

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

11

only when the incremental CD ratio is seen in conjunction with the absolute CD ratio.

In fact, historically, credit aggregates - both absolute and incremental - have been amongst the host of variables, forming an integral part of macro-economic and prudential policy formulation in India. In this context in particular, the following extract from a speech by Smt Usha Thorat (2010) assumes relevance:

> Absolute and incremental credit aggregates (including credit deposit ratio) are amongst the host of variables, forming an integral part of macro-economic and prudential policy formulation. In the Indian context, an incremental credit-deposit ratio of more than 100 per cent, when the system itself has a high overall absolute credit deposit ratio (say beyond 70 per cent) is taken as a sign of over-leverage. A prudential focus on credit deposit ratio encourages the banks in India to raise deposits for funding credit flow and minimises the use of purchased funds.

Against this theoretical underpinning, the methodology for constructing the alternative buffer guide is enumerated below:

Step 1: Calculate time-series data on both absolute CD ratio (cd_j) and incremental CD (icd_j) ratios

Step 2: Compute moving maxima of both cd_j and icd_j ratios. Smoothening (moving maxima) of the ratios is suggested to account for the possible non-linear impact of the ratios on the conduct of capital buffer operations. Moving maxima is recommended for smoothening to reflect the imperative of conservatism in regulation. Empirically, it is found that three-year window offered better fit in terms of the compatibility of the alternative guide with other relevant indicators of real sector and asset prices (for details see below).

Step 3: Construct a moving Maxima of Composite CD Ratio (MAXCCDR) by combining moving maxima of both cd_j and icd_j ratios with weights.

Notationally,

let 3-year moving maxima of cd_j ratio be $\underset{n-3<j\leq n}{\text{Max}}(cd_j)$ for n = 3,6,9,----

let 3-year moving maxima of icd_j ratio be $\underset{n-3<j\leq n}{\text{Max}}(icd_j)$ for n = 3,6,9,---

then $MAXCCDR_j = [(w)(\underset{n-3<j\leq n}{\text{Max}}(cd_j) + (1-w)(\underset{n-3<j\leq n}{\text{Max}}(icd_j)]$, $0<w<0$

where w is the weights (for determination of weights please see endnote 4)

The theoretical justification for the use of moving maxima and the determination of weights are as follows. In the literature on financial timeseries

data analysis, moving maxima is employed especially in the area of Multivariate Extreme Value Theory, which is concerned with the joint distribution of extremes of multiple random variables. Multivariate Extreme Value Theory has applications in banking and finance also wherein extreme events dependent across different assets occur in clusters. Estimation of such joint distributions generally involves modeling extreme multivariate events based on Moving Maxima (MM) process and a multivariate extension known as Multivariate Maxima of Moving Maxima (M4) process (Stuart et al 1991; Chamu Morales, 2005).

Furthermore, literature also supported the use of maxima for calibration of macroprudential policy. Davis *et al.* (2010), *inter alia*, estimated the impact of capital adequacy and liquidity on probability of financial crisis. In particular, they generated the required maxima for capital adjustment and liquidity adjustment and both together for protecting against banking crisis anywhere in the world. Drawing from the work of Davis et al. use of maxima is recommended in this paper for calibrating countercyclical capital buffers.

Regarding determination of weights, assigning equal weights to various components of a composite indicator is generally an accepted practice in the literature relating to financial/banking regulation. For instance, BCBS (2011) assigned equal weights to 5 indicators for identification of Globally Systemically Important Banks (G-SIBs). Drawing from this standard practice, cd_j and icd_j were assigned equal weights while computing MAXCCDR[4].

Thus computed MAXCCRD could be the alternative buffer guide in the EMEs context. Statistical details underlying the computation of MAXCCDR is provided in Appendix 1. The theoretical interpretation of MAXCCDR is unambiguous, unlike the credit-deposit ratio. Deviations from the long-term trend of the MAXCCDR (TMAXCCDR) do reflect underlying changes in the macro-financial environment i.e. leveraged funding conditions in which banks in EMEs operate. The long-term trend is computed using Hodrick Prescott (HP) filter with *lambda* (λ) = 400000 with the help of E-Views, as suggested by the BCBS. In the literature, there were various detrending methods and Rochelle and Ralf (2011) provided an excellent summary of these methods and the implications thereof. Any practical attempt to detrend a series would need to involve some consideration of issues such as the deterministic or stochastic nature of the trend and the most appropriate filter to use. The MAXCCDR, based on an augmented Dickey-Fuller test, has a unit root and thus has a stochastic trend. This implies that the HP filter, which is able to remove a unit root, is more appropriate to apply to MAXCCDR since deterministic detrending methods will generate spurious cycles. Thus, contrary to the stand taken by Geršl and Seidler (2012), this paper supports HP filter methodology for detrending.

Actual MAXCCDR being higher than the computed trend MAXCCDR (positive gap) depicts the situation wherein the three-year window moving maxima is higher than the trend MAXCCDR signifying thereby worsening

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

13

macro-financial environment of over-leverage[5]. On the other hand, negative gap denotes under-leverage. Next section attempts to present the historical performance of MAXCCDR in the context of Indian banks using India relevant data.

6. Historical Performance of MAXCCDR

The computed MAXCCDR and TMAXCCDR on the basis of the above-methodology, involving data since 1950-51 is presented in Figure 2. Analysis of Figure 2 reveals the following:

During the last 60 years, banking sector in India operated, by and large, below but closer to the long-term trend. This means that leverage position of Indian banks on a secular basis remained in balance. Further, there have been 5 episodes of over leverage (positive gap) during mid-1950s, mid-1960s, mid-1970s, mid-1990s and since 2003-04. Out of these 5 episodes, there were 3 episode of positive gap (during mid-1950s, mid-1960s and since 2003-04) exceeding the long-term trend by a substantial margin.

There have been 3 episodes of under-leverage (negative gap) during late 1950s, late 1970s to early 1990s and during 1998-99 to 2003-04. Till 1965-66, the amplitude of alternate swings of phases of under leverage and over-leverage, as measured by standard deviation at 27.4, was indeed high. Since 1965-66 to 1995-96, there has been a discernible moderation in amplitude of credit cycles as standard deviation during this period was estimated at 8. Since 1995-96, alternate phases of pronounced under and over-leverage are again apparent as standard deviation rose to 23. There was a brief period of over-leverage during mid-1990s followed by a prolonged period of under-leverage till 2003-04, which was replaced by a phase of over-leverage since then. Meaning, credit cycles have relatively become more pronounced in India since mid-1990s.

From the above exposition, it could be inferred that the proposed alternative buffer guide is able to track phases of over/under leverage in the banking sector in India. Can, thus, MAXCCDR be taken as lead indicator for capital buffer operations? The BCBS guidance cautioned about the potential possibility of misleading signals emanating from the buffer guide and hence recommended looking for evidence as to whether the inferences from the buffer guide are consistent with those of other variables such as real GDP growth, asset prices, etc. So, do the phases of over/under leverage in the banking sector, as identified by the MAXCCDR, correspond/coincide with the phases of over/under-leveraging in the Indian real sector? In other words, how does the MAXCCDR map and track the performance of the economic activity, as measured by real GDP *vis-à-vis* credit to GDP ratio?

6.1   MAXCCDR and the Real Sector

The real GDP growth in percentage since 1950-51 is presented in Figure 3. It is evident from the Figure 3 that until 1990-91, volatility in real GDP growth was indeed very high. The decadal average of real GDP growth and the volatility therein are shown in Table 1 below.

Table 1: Decadal Growth and volatility of real GDP

Decade	Average	Standard Deviation
1950s	3.9	2.7
1960s	4.0	3.4
1970s	3.3	4.2
1980s	5.5	2.2
1990s	5.6	1.7
2000s	7.2	2.0

Analysis of MAXCCDR and real GDP growth *vis-à-vis* credit-to-GDP ratio and the real GDP would be attempted on the basis of the data since 1990-91 for the following reasons:

The real GDP growth prior to 1990-91 was characterized by high volatility. However, the real GDP growth was on a higher trajectory thereafter on the back of the economic reforms ushered-in since 1990-91. Financial sector reforms - which were a significant component of these economic reforms – reduced preemption of resources of the banks, thereby increasing the contribution of bank credit to real GDP growth.

The Figure 4 presents credit-to-GDP gap (ratio minus the trend) and the real GDP growth during 1990-91 to 2009-10. The Figure 5 presents MAXCCDR gap (MAXCCDR minus MAXCCDR trend) and the real GDP growth during the same period. Based on Figure 4 and Figure 5, the following observations are indeed striking:

Firstly, there is a discernible lack of co-movement (syncronisation) between the credit-to-GDP gap and the real GDP growth. On the contrary, there is a clear co-movement (syncronisation) between the MAXCCDR gap and the real GDP growth. Secondly, the correlation coefficient between credit-to-GDP gap and the real growth in GDP, apart from being extremely sensitive to the choice of the start and end dates, has a negative bias in general. On the contrary, the correlation coefficient between the MAXCCDR gap and the real growth in GDP, apart from being robust to the choice of the start and end dates, has been an unambiguous positive as shown in Table 2 below.

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

15

Table 2: Credit-to-GDP gap and real GDP growth versus MAXCCDR gap and real GDP growth: Correlation Coefficient

	Credit-to-GDP gap and GDP	MAXCCDR gap and GDP
1990-91 to 2009-10	0.53	0.66
1990-91 to 2003-04	-0.08	0.24
2004-05 to 2009-10	-0.13	0.69

Note: Statistical significance of correlation coefficients is presented in Appendix 2

Similar observations are evident if real GDP growth is replaced with real GDP gap (difference between real GDP growth and the long-term trend based on HP filter with $\lambda = 400,000$) as can be seen from the Table 3 below:

Table 3: Credit-to-GDP gap and real GDP gap versus MAXCCDR gap and real GDP gap: Correlation Coefficient

	Credit-to-GDP gap and GDP	MAXCCDR gap and GDP gap
1990-91 to 2009-10	0.38	0.57
1990-91 to 2003-04	-0.13	0.22
2004-05 to 2009-10	-0.23	0.76

Note: Statistical significance of correlation coefficients is presented in Appendix 2

The fundamental implication of these observations is that credit-to-GDP ratio has a procyclical bias. It would call for release of additional capital when real GDP growth accelerates and it would call for build-up of additional capital when the real GDP growth decelerates, as is evident from Figure 4. Illustratively, during the three-year period of 2006-07 to 2008-09, real GDP growth decelerated from 9.7 per cent to 9.2 per cent, and further to 6.7 per cent. During these years, credit-to-GDP gap rose from 11.9 per cent to 14.0 per cent, and further to 15.4 per cent. Following BCBS guidance, countercyclical capital buffer would have hit the upper limit of 2.5 per cent of the risk-weighted assets. On the contrary, as is evident from Figure 5, MAXCCDR gap during this period fell from 47.7 per cent to 24.5 per cent and further to 14.1 per cent calling for release of countercyclical capital buffers. These findings are in agreement with those of Repullo and Saurina (2011). According to them, the basic drawback of the credit-to-GDP ratio is as follows:

The problems with the credit-to-GDP gap variable may be traced to the following two sources. First, there is the empirical regularity that credit usually lags the business cycle (see, for example, the evidence in Giannone, Lenza, and Reichlin, 2010). In particular, in downturns the credit-to-GDP ratio continues to be high due to greater credit demand by households and firms (making use of credit lines, partly to finance inventory accumulation) and a slower, sometimes

even negative, GDP growth. Second, the use of deviations of the credit-to-GDP ratio with respect to its trend compounds the problem, because it takes some time before the ratio crosses the trend line".

This author in total agreement with the above argument. As is evident from the Figure 5 and the above results of coefficient of correlation, MAXXCDR gap apparently does not suffer from these flaws. Furthermore, from the EMEs' perspective, as explained earlier, credit-to-GDP gap may call for additional capital requirements even if credit growth (the numerator) is driven by structural factors. MAXXCCDR gap does not curtail credit growth in so far as it is financed by a stable source of funding. Thus, MAXXCD is not only not procyclical, but also accommodates structural drivers of credit growth.

6.2   MAXCCDR and the Asset Markets

How does MAXCCDR (*vis-à-vis* credit to GDP ratio) map the asset market behaviour? Does the phase of over/under-leverage in the banking sector, as measured by MAXCCDR gap, reflect asset price movements? This analysis was carried out involving data during 1990-91 to 2009-10. In this paper, return on Bombay Stock Exchange's 30-stock benchmark *Sensex* was taken as a proxy for asset prices. Figure 6 presents performance of actual asset prices (*Sensex* returns) *vis-à-vis* credit-to-GDP gap and Figure 7 presents actual asset prices (*Sensex* returns) *vis-à-vis* MAXCCDR gap.

It is obvious from the Figure 6 and Figure 7 that there is a relatively better co-movement (syncronisation) between MAXCCDR gap and *Sensex* returns than between credit-to-GDP gap and *Sensex* returns, especially in 2000s. These graphical observations are supported by the relevant coefficients of correlation as in Table 4 below.

Table 4: Credit-to-GDP gap and Sensex Return versus MAXCCDR gap and Sensex Return: Correlation Coefficient

	Credit-to-GDP gap and Sensex	MAXCCDR gap and Sensex
1990-91 to 2009-10	0.11	0.18
1990-91 to 2003-04	0.23	-0.16
2004-05 to 2009-10	-0.33	0.63

Note: Statistical significance of correlation coefficients is presented in Appendix 2

Similar observations are evident if *Sensex* returns is replaced with Sensex returns gap (difference between Sensex returns and the long-term trend based on HP filter with $\lambda = 400,000$), as can be seen from the Table 5 below:

Based on the above analysis, it can be inferred that MAXXCDR gap is relatively better sychronised with asset price movements than the credit-to-GDP gap.

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

17

Table 5: Credit-to-GDP gap and Sensex gap versus MAXCCDR gap and Sensex gap: Correlation Coefficient

	Credit-to-GDP gap and Sensex gap	MAXCCDR gap and Sensex gap
1990-91 to 2009-10	0.26	0.30
1990-91 to 2003-04	0.27	-0.15
2004-05 to 2009-10	-0.28	0.59

Note: Statistical significance of correlation coefficients is presented in Appendix 2

6.3   *MAXCCDR and Credit Losses*

Now, how does the MAXCCDP gap map the credit loss behaviour? Theoretically, the over-leverage phase characterised by positive MAXCCDR gap signifies excessive exuberance underpinned by large-scale credit expansion on the back of improving asset quality. In contrast, the under-leverage phase characterised by negative MAXCCDR gap signifies excessive pessimism underpinned by large-scale credit contraction on the back of worsening asset quality. Therefore, the MAXCCDR gap should move negatively with credit losses. In order to examine this, a simple single-variate regression model linking MAXCCDR gap to credit loss was estimated. Gross non-performing assets (GNPA) represent credit losses. The regression results are presented below.

Dependent Variable: GNPA (growth rate of gross non-performing assets)

Method: Least Squares

Date: 11/28/15   Time: 18:32

Sample: 1997 2009 (Asset quality data for India prior to 1997 not available)

Included observations: 13

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.169231	2.587686	1.997627	0.0711
MAXCCDRGAP	-0.571511	0.213128	-2.681538	0.0213
R-squared	0.395294	Mean dependent var		5.169231
Adjusted R-squared	0.340320	S.D. dependent var		11.48727
S.E. of regression	9.330035	Akaike info criterion		7.444993
Sum squared resid	957.5451	Schwarz criterion		7.531908
Log likelihood	-46.39245	F-statistic		7.190647
Durbin-Watson stat	0.715379	Prob(F-statistic)		0.021349

The coefficient of MAXCCDR gap is negative and statistically significant. The interpretation of the results of the regression model is: over-leverage phase of MAXCCDR gap being positive is a forerunner of impending credit losses. Hence MAXCCDR gap is a leading indicator of credit losses.

To sum up, inferences about credit cycle from MAXCCDR are cross-verified for evidence of consistency and support from the behaviour of the real sector, the asset market, and credit loss. The graphical analysis and the measures of correlation coefficient corroborate the inferences about the credit cycles from MAXCCDR. Thus the historical performance of MAXCCDR proved to be reliable.

6.4   Determination of Lower and Upper Triggers of MAXCCDR

The next step was to determine lower and upper threshold triggers for build up and release of capital buffer for Indian banks. The BCBS guidance contains criteria for determination of such triggers, as follow.

Criteria for the minimum threshold (L) when the guide would start to indicate a need to build up capital.

Criteria 1. *L* should be low enough, so that banks are able to build up capital in gradual fashion before a potential crisis. As banks are given one year to raise additional capital, this means that the indicator should breach the minimum at least 2-3 years prior to a crisis.

Criteria 2. *L* should be high enough so that no additional capital is required during normal times.

Criteria for the maximum (H) at which point no additional capital would be required, even if the gap would continue to increase.

Criteria 3. *H* should be low enough, so that the buffer would be at its maximum prior to major banking crises.

The BCBS criteria/rationale are the broad principles for the determination of lower and upper threshold triggers for build up and release, and are valid across jurisdictions. For the purpose of fixing the thresholds, behaviour of the credit-to-GDP gap in the runup to the banking crises was analysed by the BCBS. It was generally observed that a gap exceeding 10 per cent on a sustained basis proceded the banking crisis. On the basis of this observation, the maximum threshold has been fixed by the BCBS at 10 per cent gap. To ensure that Criterion 1 is met, L has been set at 2 so that the rule would require the build up of capital for all major banking crises 2-3 years in advance.

The practical difficulty of applying BCBS guidance for determining '*L*' and '*H*' in the Indian context is that India has not suffered any banking crisis so far and hence it is not possible to observe the behaviors of MAXCCDR gap in the runup to the crisis. Instead, analysis of percentage positive deviation of the MAXCCDR from its long-term trend during the pronounced three over-leveraged periods (1955-56, to 1958-59, 1962-63 to 1965-66 and 2004-05 to

2009-10) in the last 60 years in India, as presented in Figure 8, indicateds that the average was around 20 per cent during the three episodes of over-leverage and reached a maximum of 33.4 per cent (the maximum reached during any episode of over-leverage during the last 60 years). Thus, countercyclical capital buffer may kick-in once the MAXCCDR positive gap exceeds the historical average of 20 per cent and increase linearly to reach the maximum of 2.5 per cent of the risk-weighted assets once the positive MAXCCDR gap reaches 33 per cent.

Regarding the determination of threshold for the release of capital buffer during times of stress, past three episodes of under-leverage during 1959-1962, 1978-1995 and 1998-2004 (see Figure 2) were analysed. The Figure 9 presents the minimum, average, and maximum of the MAXCCDR negative gap during these three episodes of under-leverage. As Figure 9 shows, there is a large dispersion in minimum, average and maximum of the MAXCCDR negative gap among these episodes, though MAXCCDR negative gap has become moderate in recent episodes, as compared to the first episode during 1959-1962. This makes determination of threshold for release more arbitrary. Be that as it may, if the first episode is omitted from consideration, the capital buffer release may commence if the MAXCCDR negative gap goes beyond 10 per cent and increases linearly to exhaust the buffer of 2.5 per cent once the MAXCCDR negative gap reaches 20 per cent. On the other hand, if all the three episodes are considered, the capital buffer release may commence if the MAXCCDR negative gap goes beyond 10 per cent and increases linearly to exhaust the buffer of 2.5 per cent once the MAXCCDR negative gap reaches 30 per cent.

Thus, to conclude, the alternative countercyclical capital buffer indicator that this paper recommends is MAXCCDR. Furthermore, the capital buffer build up process is recommended to commence once the positive MAXCCDR gap exceeds 20 per cent and increases linearly to reach the maximum of 2.5 per cent of the risk-weighted assets once the positive MAXCCDR gap reaches 33 per cent. The capital buffer release process is recommended to commence once the negative MAXCCDR gap goes beyond 10 per cent and increases linearly to exhaust the maximum buffer of 2.5 per cent of the risk-weighted assets once the negative MAXCCDR gap reaches 30 per cent.

7. Concluding Observations

While acknowledging the fact that supervisors in each jurisdiction are free to rely on any capital buffer guide and qualitative information that make sense to them for purposes of assessing the phase of the credit cycle and the associated level of system-wide risk, BCBS recommends credit-to-GDP as the preferable buffer guide for operating the countercyclical capital buffer. This paper attempts to explain why the BCBS buffer guide is not suitable for EMEs, both in *ex post* and *ex-ante* senses, and suggest an alternative buffer guide, namely MAXCCDR, which is a smoothened (moving maxima) composite credit deposit ratio. The paper empirically verified the historical performance of the MAXCCDR both

through graphical analysis and the measure of correlation coefficients in tracking credit cycles in India and found evidence of support and consistency from the behaviour of the real sector and the asset markets, apart from being able to be the forerunner of ensuing credit cycle behaviour. Further based on the episodes of positive and negative MAXCCDR gaps, thresholds for build up and release of capital buffers were determined, respectively.

However, before concluding, it needs to be noted that this paper does not claim to have found the single indicator capable of guiding buffer decisions (both build up and release) in EMEs. All indicators provide false signals. Thus, no fully rule-based mechanism is perfect. Some degree of judgment, both for the build-up and particularly for the release phase, would be inevitable when setting countercyclical capital buffers in practice.
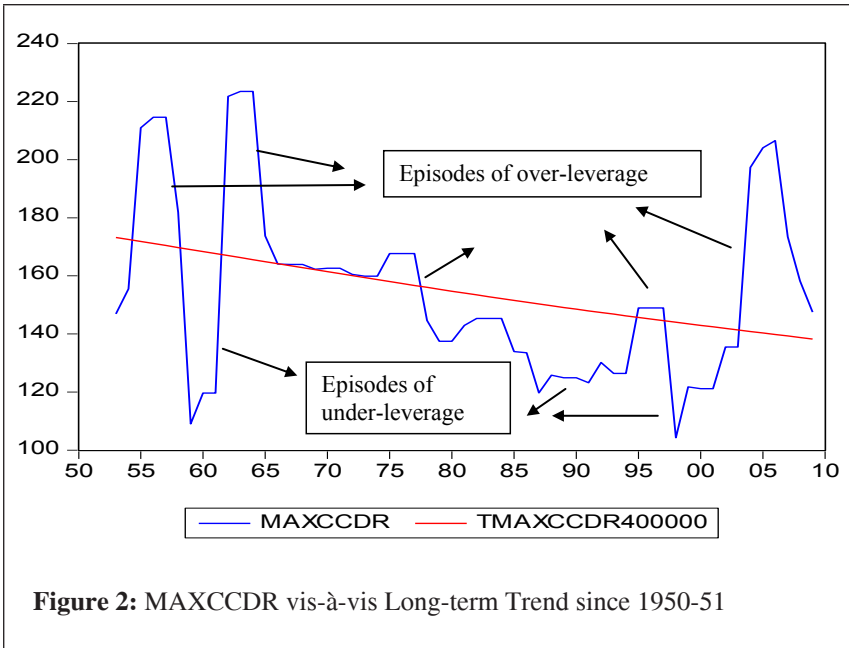
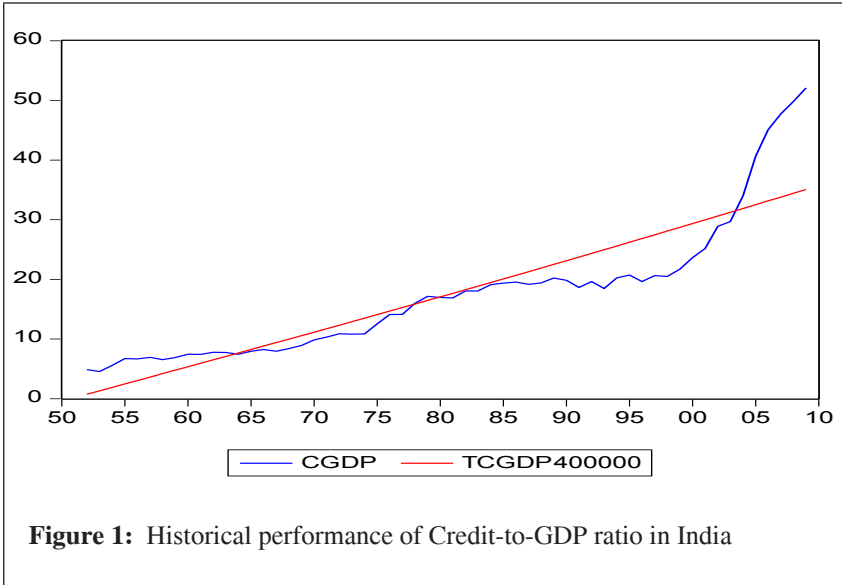## Acknowledgement

Author information:

[1] Dr. Rakesh Mohan attributed these factors to credit growth in India. However, this author feels that they also apply to EMEs in general too.
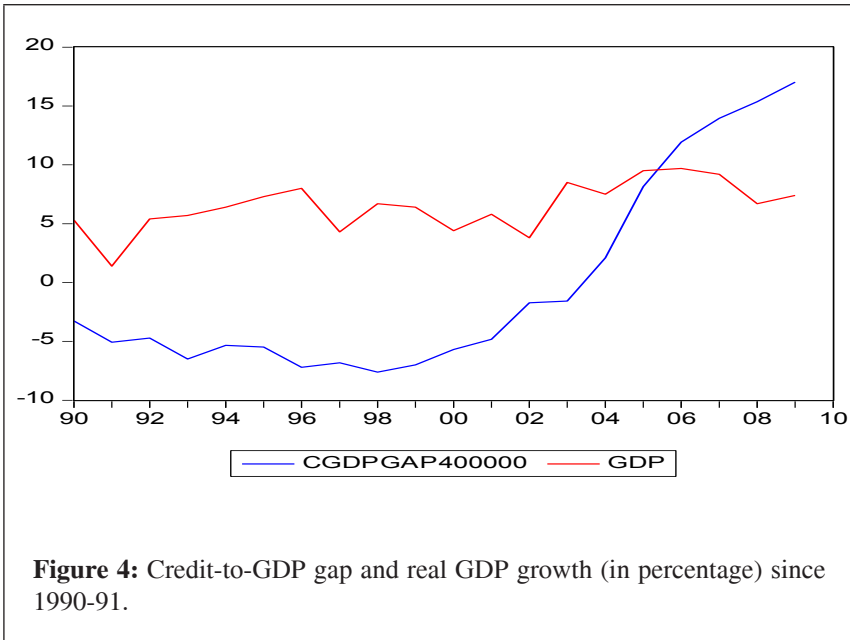
[2] The methodology proposed in this section relates to those EMEs, whose banking business model is primarily retail in nature, meaning retail deposits are the major component of liabilities. Hence, for the purpose of this section, EMEs refer to these jurisdictions.

[3] For the purpose of this paper, credit denotes bank credit and deposits mean deposits mobilised by banks. Since the EMEs' financial sector, including India's, is basically bank-dominated, CD ratio of banks is taken as a proxy for system-wise leverage. Incidentally, although non-bank credit in India has grown both in terms of flow and stock, it is felt that this trend is of recent origin maybe in 2000s.

[4] A further attempt was made by the authors to verify whether differential weights to absolute CD ratio and incremental CD ratio would have varying results. However, it was found that number of identified episodes of over/under leverage did not change, though there were marginal variations to the magnitude of positive/negative gaps. In other words, the secular behaviour and the inflexion points of the credit cycles are by and large robust to the changes in weights. Thus, changes in weights do not materially matter.

[5] Deviation of 3-year moving maxima of MAXCCDR from the trend accommodates prudent credit growth funded by non-deposit sources.

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

21

Figure 1: Historical performance of Credit-to-GDP ratio in India

Figure 2: MAXCCDR vis-à-vis Long-term Trend since 1950-51

Figure 3: Real GDP growth since 1950-51.

Figure 4: Credit-to-GDP gap and real GDP growth (in percentage) since 1990-91.

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

23

Figure 5: MAXCCDR and GDP since 1990-91.

Figure 6: Credit-to-GDP gap and Sensex returns.

Figure 7: MAXCCDR gap and the Sensex returns.

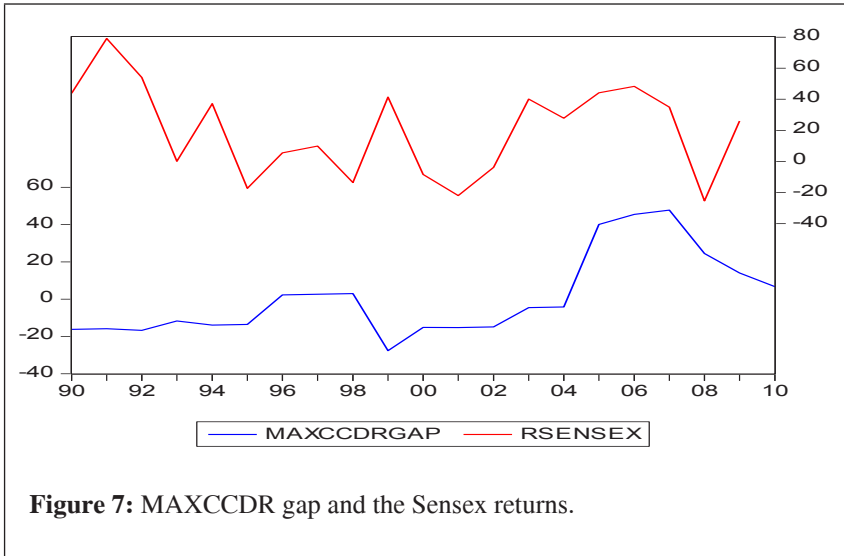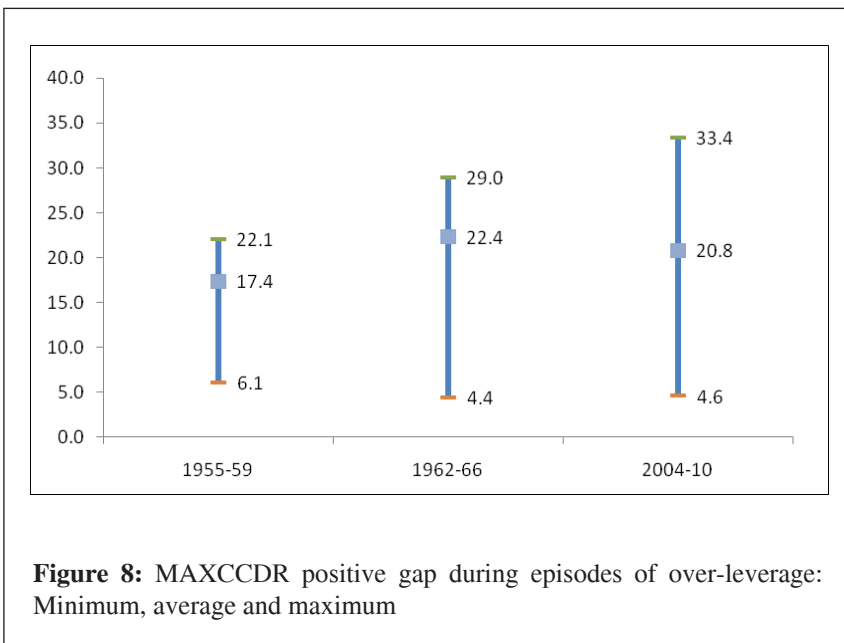**Figure 8:** MAXCCDR positive gap during episodes of over-leverage: Minimum, average and maximum

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

25

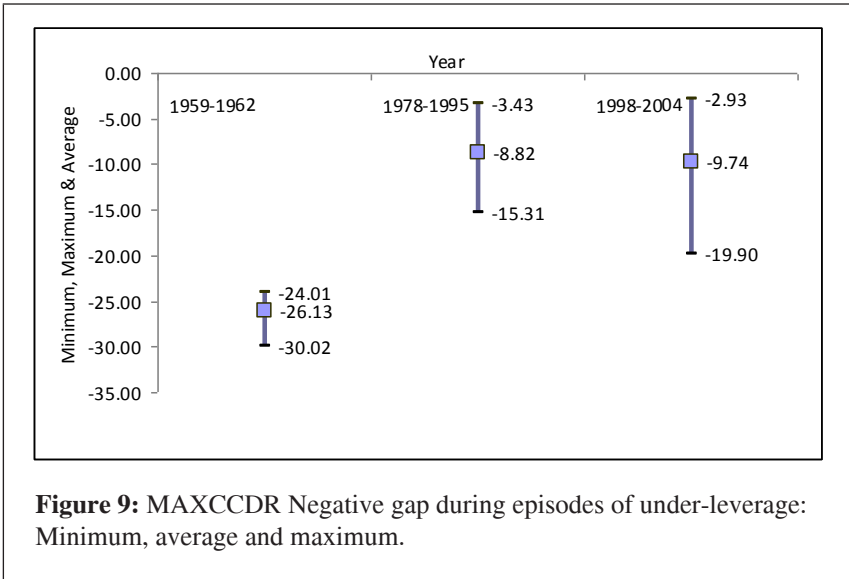**Figure 9:** MAXCCDR Negative gap during episodes of under-leverage: Minimum, average and maximum.

Appendix 1

Computation of MAXCCDR: Statistical Details

Year	Bank Credit (C)	Aggregate Deposits (D)	CD	ICD	MaxCD (3-year moving window)	MaxICD (3-year moving window)	Weighted MAXCD	Weighted MAXICD	MAXCCDR
1953-54	538	848	63	56	64	83	31.8	41.7	73.5
1954-55	623	943	66	89	66	89	33.0	44.7	77.8
1955-56	761	1043	73	138	73	138	36.5	69.0	105.5
1956-57	900	1175	77	105	77	138	38.3	69.0	107.3
1957-58	963	1452	66	23	77	138	38.3	69.0	107.3
1958-59	1014	1635	62	28	77	105	38.3	52.7	90.9
1959-60	1128	1902	59	43	66	43	33.2	21.3	54.5
1960-61	1336	1736	77	-125	77	43	38.5	21.3	59.8
1961-62	1408	1917	73	40	77	43	38.5	21.3	59.8
1962-63	1588	2042	78	144	78	144	38.9	72.0	110.9
1963-64	1817	2285	80	94	80	144	39.8	72.0	111.8
1964-65	2035	2583	79	73	80	144	39.8	72.0	111.8
1965-66	2287	2950	78	69	80	94	39.8	47.1	86.9
1966-67	2692	3425	79	85	79	85	39.4	42.6	82.0
1967-68	3032	3856	79	79	79	85	39.3	42.6	81.9
1968-69	3396	4338	78	76	79	85	39.3	42.6	81.9
1969-70	3971	5028	79	83	79	83	39.5	41.7	81.2
1970-71	4684	5906	79	81	79	83	39.7	41.7	81.3
1971-72	5263	7106	74	48	79	83	39.7	41.7	81.3
1972-73	6115	8643	71	55	79	81	39.7	40.6	80.3
1973-74	7399	10139	73	86	74	86	37.0	42.9	79.9
1974-75	8762	11827	74	81	74	86	37.0	42.9	80.0
1975-76	10877	14155	77	91	77	91	38.4	45.4	83.8
1976-77	13173	17566	75	67	77	91	38.4	45.4	83.8
1977-78	14939	22211	67	38	77	91	38.4	45.4	83.8
1978-79	18285	27016	68	70	75	70	37.5	34.8	72.3
1979-80	21537	31759	68	69	68	70	33.9	34.8	68.7
1980-81	25371	37988	67	62	68	70	33.9	34.8	68.7
1981-82	29682	43733	68	75	68	75	33.9	37.5	71.5
1982-83	35493	51358	69	76	69	76	34.6	38.1	72.7
1983-84	41294	60596	68	63	69	76	34.6	38.1	72.7
1984-85	48953	72244	68	66	69	76	34.6	38.1	72.7
1985-86	56067	85404	66	54	68	66	34.1	32.9	67.0
1986-87	63308	102724	62	42	68	66	33.9	32.9	66.8
1987-88	70536	118045	60	47	66	54	32.8	27.0	59.9
1988-89	84719	140150	60	64	62	64	30.8	32.1	62.9

(continued)

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

27

Year	Bank Credit (C)	Aggregate Deposits (D)	CD	ICD	MaxCD (3-year moving window)	MaxICD (3-year moving window)	Weighted MAXCD	Weighted MAXICD	MAXCCDR
1989-90	101453	166959	61	62	61	64	30.4	32.1	62.5
1990-91	116301	192541	60	58	61	64	30.4	32.1	62.5
1991-92	125592	230758	54	24	61	62	30.4	31.2	61.6
1992-93	151982	268572	57	70	60	70	30.2	34.9	65.1
1993-94	164418	315132	52	27	57	70	28.3	34.9	63.2
1994-95	211560	386859	55	66	57	70	28.3	34.9	63.2
1995-96	254015	433819	59	90	59	90	29.3	45.2	74.5
1996-97	278401	505599	55	34	59	90	29.3	45.2	74.5
1997-98	324079	598485	54	49	59	90	29.3	45.2	74.5
1998-99	368837	714025	52	39	55	49	27.5	24.6	52.1
1999-00	435958	813345	54	68	54	68	27.1	33.8	60.9
2000-01	511434	962618	53	51	54	68	26.8	33.8	60.6
2001-02	589723	1103360	53	56	54	68	26.8	33.8	60.6
2002-03	729215	1280853	57	79	57	79	28.5	39.3	67.8
2003-04	840785	1504416	56	50	57	79	28.5	39.3	67.8
2004-05	1100428	1700198	65	133	65	133	32.4	66.3	98.7
2005-06	1507077	2109049	71	99	71	133	35.7	66.3	102.0
2006-07	1931189	2611933	74	84	74	133	37.0	66.3	103.3
2007-08	2361914	3196939	74	74	74	99	37.0	49.7	86.7
2008-09	2775549	3834110	72	65	74	84	37.0	42.2	79.1
2009-10	3244788	4492826	72	71	74	74	36.9	36.8	73.8

Source: Calculated by the authors based on the data from Handbook of Statistics on Indian Economy 2010-11.

Appendix 2

Statistical Significance of Correlation Coefficients

An attempt was made to examine the statistical significance of the correlation coefficients estimated in this paper. Under H_0: $\rho = 0$ and H_1: $\rho \neq 0$, the statistical significance was tested using the following formula for t-distribution with degrees of freedom = N-2 and N $\geq$ 6.

$$t = \frac{r\sqrt{(n-2)}}{\sqrt{(1-r^2)}}$$

1)   The results of the statistical significance of the correlation coefficient between MAXCCDR gap and GDP are presented below.

Statistical Significance of Correlation Coefficient between MAXCCDR gap and GDP

	MAXCCDR gap and GDP	Calculated t-value	Degrees of Freedom (df)	P-value
1990-91 to 2009-10	0.66	3.622	17	0.002
1990-91 to 2003-04	0.24	0.856	12	0.41
2004-05 to 2009-10	0.69	Not calculated as N ‹ 6		

As can be observed from above, the correlation coefficient for the period 1990-91 to 2009-10 is highly significant.

2)   The results of the statistical significance of the correlation coefficient between MAXCCDR gap and GDP gap are presented below.

Statistical Significance of Correlation Coefficient between MAXCCDR gap and GDP

	MAXCCDR gap and GDP gap	Calculated t-value	Degrees of Freedom (df)	P-value
1990-91 to 2009-10	0.57	2.86	17	0.01
1990-91 to 2003-04	0.22	0.78	12	0.44
2004-05 to 2009-10	0.76	Not calculated as N ‹ 6		

As can be observed from the above, the correlation coefficient for the period 1990-91 to 2009-10 is highly significant.

Applicability of Basel III Countercyclical Capital Buffer Guidance
to Emerging Market Economies: An Exploration: 1-30

29

3)   The results of the statistical significance of the correlation coefficient between MAXCCDR gap and Sensex return are presented below.

Statistical Significance of Correlation Coefficient between MAXCCDR gap and Sensex Return

	MAXCCDR gap and Sensex Return	Calculated t-value	Degrees of Freedom (df)	P-value
1990-91 to 2009-10	0.18	0.754	17	0.46
1990-91 to 2003-04	-0.16	-0.561	12	0.58
2004-05 to 2009-10	0.63	Not calculated as N < 6		

As the above results indicate, the correlation coefficients between MAXCCDR gap and Sensex returns are not statistically significant.

4)   The results of the statistical significance of the correlation coefficient between MAXCCDR gap and Sensex gap are presented below.

Statistical Significance of Correlation Coefficient between MAXCCDR gap and Sensex Return

	MAXCCDR gap and Sensex gap	Calculated t-value	Degrees of Freedom (df)	P-value
1990-91 to 2009-10	0.30	1.297	17	0.21
1990-91 to 2003-04	-0.15	-0.526	12	0.608
2004-05 to 2009-10	0.59	Not calculated as N < 6		

As can be observed from the above, the correlation coefficients between MAXCCDR gap and Sensex return gap are not that statistically significant.

References

Basel Committee on Banking Supervision (BCBS) (2010). *Guidance for National Authorities Operating the Countercyclical Capital Buffer.* Bank of International Settlements, December.

BCBS (2011). *Global Systemically Important Banks: Assessment Methodology And the Additional Loss Absorbency Requirement*. Bank of International Settlements, November.

Franciso, (2005). *Estimation of max-stabe Processes using Monte Carlo methods with applications to financial risk assessment* (PhD dissertation). The University of North Carolina, Chapel Hill.

Committee on Global Financial System (CFFS), (2011). *Global Liquidity - Concept, Measurement and Policy Implications*, Bank for International Settlements, September (Restricted).

Davis, B., E.P., Karim, D, & Liadze, I. (2010). Calibrating Macro-prudential Policy, NIESR and Brunel University.

Financial Stability Report (June 2011). Reserve Bank of India.

Geršl, A., & Seidler, J. (2012). Credit Growth and Countercyclical Capital Buffers. Empirical Evidence from Central and Eastern European Countries, *IES Working Paper 3/2012.* IES FSV. Charles University.

Drehmann, C. B., & Kostas T. (2011). Anchoring countercyclical capital buffers: The role of credit Aggregates. *International Journal of Central Banking*, December 2011.

Mohan, R. (2006). State of the Indian Economy [Word file], Reserve Bank of India. Bulletin. November

Rafael, R. & Jesús, S. (2011). The countercyclical capital buffer of basel III: A critical assessment. *Discussion Paper Series No.8304*, Centre for Economic Policy Research.

Reserve Bank of India. (June 2011). *Financial Stability Report*, Mumbai.

Rochelle,M. E., & Ralf, R. M. (2011). The unreliability of credit-to-GDP ratio gaps in real time: Implications for countercyclical capital buffers. *International Journal of Central Banking*, December 2011.

Sinha, A. (2011). Reflections on Regulatory Challenges and Dilemmas [Word file]. Reserve Bank of India. Bulletin. September.

Stuart, G. C., & Janathan, A. T. (1991). Modeling Extreme Multivariate Events. *Journal of Royal Statistical Society*, *53*(2).

Subbarao, D. (2011). Financial Regulation for Growth, Equity and Stability in the Post-Crisis World [Word file]. Reserve Bank of India. Bulletin. December.

Thorat, U. (2010). Indian Perspective on Bank Regulation [Word file]. Reserve Bank of India. Bulletin. April.