A Study on The Mediating Effect of GDP on Relationship Between Gross Advances And NPA Of Indian SCBS

Siraj. K.K[1*]   P. Sudarsanan Pillai[2]
1.   Department of Business Studies, College of Technology, Sultanate of Oman
2.   Chairman, Board of Studies in Commerce, Cochin University of Science and Technology, Cochin – Kerala.
* siraj@hotmail.co.in

Abstract

The study investigates the role of GDP as a mediating variable in explaining the relationship between gross advances and NPA of Indian Scheduled Commercial Banks with particular emphasis on SBI & Associates, Nationalized Banks and Public Sector Banks during the period 2000-01 to 2011-12. The study also investigates whether the effect of GDP as a mediating variable differs before (2000-01 2006-07) and after the financial crisis (2007-08 to 2011-12). NPA is explained using Gross NPA and Additions to NPA. The relationship of variables is explained using a linear regression equation with interaction effect. The findings of the study reveal that the interaction effect is highly significant in explaining the relationship between gross advances and NPA of the selected bank groups. A scatter diagram and trend line is used to determine effect of interaction before and after the crisis. The significance of interaction on credit risk may be utilized by regulatory authorities for effective management of NPA in Indian SCBs. For SBI& Associates, the interaction significantly varies before and after the financial crisis.

Keywords: NPA, Gross Advances, Intermediation effect, Regression test.

1.0 Introduction

Asset quality management is a challenging task in modern banking environment. Since the government liberalized the Indian economy during 1990s, the Reserve Bank of India (RBI) has initiated several measures to improve the asset quality of banks. Asset quality impacts all other performance indicators such as profitability, liquidity, solvency etc. A strain on asset quality not only affects the above performance indicators, but also shrinks the capacity to advance funds for productive purpose. In banking institutions, asset quality is often assessed using Non Performing Assets (NPA) or bad loans. NPA is inevitable. It cannot be eliminated completely. One of the significant objective of reform measures implemented in banking sector since liberalization period is to manage the menace of NPA and brought it down below acceptable limit which is considered as less than 3% of gross advances. This target is achieved in Indian SCBs and is considered well managed in comparison to many international markets. Even though Indian SCBs achieved significant control over NPA since liberalization period, the upsurge in NPA during last few years, particularly with the financial crisis and recessionary pressures, pose question mark on the efficiency of NPA management. The regulatory authorities expect an increase of NPA as a percentage of gross advances over 3% in 2012.

What influence NPA of banks? A lot of researches investigated the reason for occurrence of NPA and is categorized into systematic and situational causes (Istrate et al 2007) into overhang component and incremental component (Poongavanam, S. 2000; Kumar, BS. 2005), into internal and external factors (Misra and Dhal. 2010; Muniappan. 2002), into random and non-random factors (Biswas and Deb, 2005) based on its effects (Islam, et al. 2005), into bank-specific business and institutional environment factors (Boudriga et al, 2009) and into macro-economic (systematic), debt and bank specific factors. (Louzis et al, 2012). As observed, in addition to bank specific reasons, NPA is also caused by change in economic variables. To put in other words, the level of NPA can be explained by changes in both bank specific performance indicators (including advances) and economic variables (including GDP). In this regard, a pertinent question is the role of economic variables, i.e., whether economic variables exercise a direct impact on NPA or exercise an interaction effect on relationship between NPA and bank specific performance indicators.

This study is relevant in this context. We assess the intermediation effect of economic variables on the relationship between gross advances and NPA of SCBs in India. It is evident that with increase in advances, NPA also increases.

But how far the economic variables especially the GDP interact with advances and influence NPA of banks? Also, whether the interaction is uniform during economic boom and economic recession? Whether the interaction effect is uniform among different public sector bank groups in India? The remaining discussions are classified in four major sections. The second section details literature review. The third section explains the research methodology. The fourth section explains the major analysis of the study. The last section, i.e., section five, concludes the study.

2.0 Literature Review

A lot of research studies in banking and finance have mentioned the role of financial institutions for economic development, and economic development for financial sector progress. These studies evaluated the complementary role of financial sector development and economic development and concluded that a stable financial sector is a necessity for economic development and prosperity (Rajan and Zingales, 1998; Levine, 2004; Rajeev and Mahesh, 2010; Koivu, 2002; Levine, 1997; Amaral and Quintin, 2007). These studies confirmed that bank's performance indicators and changes in economic variables are correlated.

Many economic variables exhibit relationship with bank's performance indicators, particularly on asset quality. Researches on NPA in India and abroad have pointed out the importance of economic variables that includes GDP (Earnest & Young, 2001; Lis et al, 2000), Inflation Rate, exchange rate, terms of trade, capital flows, equity prices etc; on bank's performance and quality of assets. Bock and Demyanets (2012) explained that strong balance sheet of companies in a period of economic progress may lead to excessive lending by financial institutions against inflated values of collateral. In a period of recessionary pressures, this will lead to higher levels of NPA. Higher levels of NPA witnessed in Indian SCBs since 2007 can be attributed to the higher levels of lending during the boom period i.e., from 2000-2007. Swamy (2012) also mentioned the role of macro economic variables on bank's NPA such as downturns/slowdowns in the economy, recessions, low rate of savings, weak markets, depressions in industrial production, a reduction in per capita income levels and most importantly the inflation levels in the economy. In a similar study, Salas and Saurina (2001) emphasized the role of real growth in GDP, rapid credit expansion, etc; in explaining the variations in NPAs. Gizycki (2001) in a study on Australian banks studied on the role of macro economic conditions on banks risk and profitability and concluded that macroeconomic variables are found to exert a strong influence on each bank's risk and profitability. Gerlach et al (2005) analyzed the extent to which macroeconomic developments affect bank profitability and, in particular, whether that impact differs across banks. The study found that the net interest margin of small banks are more, but their NPLs are less, exposed to changes in GDP growth.

In general, GDP is considered as a significant variable affecting the bank's performance. But the nature of impact of GDP on banking cannot be termed as direct, rather it mediate the relationship between other performance indicators. Two countries with similar banking structure generate different levels of NPA due to the economic conditions prevailing in each of the country. Thus, economic variables exercise significant influence on the relationship between banking sector variables, particularly the level of advances and NPA. For example, a growth in GDP is expected to influence the advances of banks which in turn affect the level of NPA.

Most of the existing researches on influence of relationship between NPA and bank performance indicators utilized cross country or panel regressions without involving the interaction effect of major economic variables. The interaction effect of economic variables and financial sector development and vice versa is subjected to detailed analysis in literatures. A notable study is by Ranjan and Zingale (1998) who explained the need for financial development in economic development and asserted that industrial sectors that are more dependent on external finance grow faster in countries with a high level of development.

3.0 Research Methodology

NPA is inevitable in banking sector because of the nature of the intermediation process. It is normal that NPA increases along with increase in advances. In fact, a major question arises in this regard is whether the change in NPA is influenced by any other variable. Further, the question also arouses discussion on the involvement of one or more mediating variables influencing the relationship between NPA and advances.

We have addressed this question by developing a regression equation with interaction effect. Three questions were addressed here.

1. Whether the relationship between additions to NPA and advances is affected by any interaction effect.

2. Whether the interaction effect is statistically significant.

3. Whether interaction effect is similar before and after the financial crisis.

In this study, the interaction of selected economic variables on NPA is addressed. Movement of NPA can be well explained by Gross NPA (which includes the overhang component and fresh additions to NPA) and additions to NPA.

In literature, regression studies (Gizycki, 2001) are primarily used to analyze the result of interaction effect. Ozer-Balli and Sorensen (2010) utilized Ordinary Least Squares and instrumental variable (IV) estimation to analyze the impact of mediating variable. Studies also utilized Box-Jenkins ARIMA model (Gay, 2008), Vector Autoregressive model (Muhd Hussain et al, 2012), block-restriction autoregression model (Havranek et al, 2010) etc.

Model and Data

To determine the effect macro economic variables on NPA of Indian SCBs, the following regression equation is analyzed.

Model:

$$X_{npa\,(t)} = \beta_1 + \beta_2 X_{ad\,(t)} + \beta_3 X_{ev\,(t)} + \beta_3 (X_{ad} \times X_{ev})_{(t)} + \epsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where X_{npa} is the dependent variable, β_1 represent the intercept, $X_{ad\,(t)}$ is the Advances, X_{ev} is the economic variable, and $(X_{ad} \times X_{ev})$ is the interaction effect of advances and economic variables and ϵ is the error. To undertake the study, the NPA variables include Gross NPA and Additions to NPA while the economic variable used in the study is GDP at factor cost. The data area sourced from reports published by Reserve Bank of India for the period 2000-01 to 2011-12. Two reports are mainly used (1) Statistical Tables Relating to Banks in India, and (2) Trend and Progress of Banking in India. The study is focused on SBI & Associates.

In order to avoid the multicollinearity problem, the variables centered value is computed. Aiken and West (1991) illustrated using an example that that considerable multicollinearity is introduced into a regression equation with an interaction term when the variables are not centered. This view is widely accepted and is considered as a measure to avoid multicollinearity in regression equation with intermediation effect. Robinson and Schumacker (2009) defined centering as subtracting the mean (a constant) from each score, X, yielding a centered score. Furst and Ghisletta (2009) explained that statistical interaction exists when a relation between 2 variables (say X-Y) changes as a function of a third variable (say Z).

A more adequate expansion of the model using centered value approach include;

$$X_{npa\,(t)} = \beta_1 + \beta_2 X_{ad\,(t)} + \beta_3 X_{ev\,(t)} + \beta_3 (X_{ad(t)} - \overline{X}_{ad}) (X_{ev(t)} - \overline{X}_{ev}) + \epsilon \ldots\ldots\ldots\ldots\ldots(2)$$

The above equation support the viewpoints of studies on interaction effect (Cohen, et al 2003) that (1) Main effects should be included in the model (even if non significant), in order to avoid confusion between simple effect and interaction; (2) the data must be multivariate normal (no outlier, normally distributed residuals, and homogeneity of variance); (c) The predictors should be centered (i.e. subtract the mean to all scores).

Considering the above view points, the equation (2) is more robust since it consider the Multicollinearity issue and using the centered value approach, estimate the interaction effect of GDP on relationship between Gross Advances and NPA.

Regression Study

This study utilized linear regression study to test whether interaction effect influence the relationship between NPA and advances of bank. In order to identify the strength of relationship between selected independent variables and NPA, R^2 value is computed. To assess the significance of regression equation, we calculated F- value. To examine the statistical significance of selected independent variables on NPA, t-test is computed. Beta value is calculated to assess strength of predictor-criterion variable. Further a scatter plot and trend line is used to assess whether there exists different in the intermediation effect before and after the financial crisis.

4.0 Data Analysis

4.1. SBI & Associates

4.1.1 Interaction effect on relationship between Advances and Fresh NPA

$$X_{anpa} = -5633 + (-0.007 \times X_{ad}) + (0.004 \times X_{ev}) + (5.60E\text{-}9 \times (X_{ad} \times X_{ev}))$$

The effect of two independent variables and its interaction effect on additions to NPA is addressed in the regression. From Table No 1, it may be inferred that; (1) R^2 value shows that 98.9% of the variability in fresh NPA every year can be explained from the change in advances, GDP and an interaction between GDP and advances. (2) The regression equation is found statistically significant (F =331.797, Sig =0.000). It may be concluded that the model is highly reliable in explaining the behavior of the fresh generation of NPA of SBI & Associates. (3) The impact of advances and GDP individually on fresh addition to NPA is not statistically significant, while the interaction between advances and GDP is statically significant (t =8.057, Sig = 0.000) in explaining the movement of fresh addition to NPA every year. It is also highly evident from the beta value (0.446) of interaction effect.

Further, a scatter plot is drawn as shown in Figure No. 1 to check whether the interaction effect is uniform before and after the financial crisis. The inference indicates a strong correlation (96.22%) after the financial crisis, while the correlation was 19.44% before the financial crisis. It shows that macro economic variables exhibit increased correlation during periods of financial crisis and recessionary pressure.

4.1.2 Interaction effect on relationship between Advances and Gross NPA

$$X_{gnpa} = 13994 + (0.029 \times X_{ad}) + (-0.004 \times X_{ev}) + (1.21^{E}\text{-}8 \times (X_{ad} \times X_{ev}))$$

The interaction effect of GDP on relationship between Gross NPA and Advances is statistically significant as may be observed from the analysis. Further, it may be inferred from Table No 2 that; (1) R^2 value shows that 98.70% of the variability in dependent variable i.e., Gross NPA can be explained by the advances, GDP and the interaction between GDP and advances. (2) The regression equation is found statistically significant (F =277.305, Sig =0.000). It may be concluded that the model is highly reliable in explaining the behavior of the Gross NPA of SBI & Associates. (3) Similar to the trend in fresh NPA, it may be inferred that the impact of advances and GDP individually on Gross NPA is not statistically significant, while the interaction between advances and GDP is statistically significant (t = 14.403, Sig = 0.000). The beta value (0.872) also highlights statistical significance of interaction effect on Gross NPA.

The inference from scatter plot and trend line analysis shows that interaction effect is similar before and after the financial crisis, as may be observed from the *r* value i.e., 91.4% before the financial crisis and 95.1% after the financial crisis. This inference questions the use of Gross NPA to analyze the effectiveness of NPA management in a particular year. Gross NPA has an overhang component, carried forward from previous years; hence will not show precise inference on NPA management and its relationship with various micro and macro variables during a particular period of time. Additions to NPA, i.e., fresh NPA generation is a more reliable tool to evaluate the effectiveness of NPA management and relationship with various micro and macro indicators.

4.2 Nationalized Banks

4.2.1 Interaction effect on relationship between Advances and Fresh NPA

$$X_{anpa} = -26675 + (-0.036 \times X_{ad}) + (0.019 \times X_{ev}) + (4.542E\text{-}9 \times (X_{ad} \times X_{ev}))$$

The effect of two independent variables (advances and GDP) and its interaction effect on addition to NPA of Nationalized Banks is analyzed using the above regression equation. It may be inferred from Table No 1 that; (1) R^2 shows that 98.40% of the variability in fresh NPA every year is explained from the change in advances, GDP and an interaction between GDP and advances. (2) The regression equation is found statistically significant (F =220.340, Sig =0.000). It may be concluded that the model is highly reliable in explaining the behavior of the fresh generation of NPA of Nationalized Banks. (3) A further analysis on the impact of the selected independent variable on additions to NPA indicates that the impact of interaction effect of GDP and advances is statistically significant, while the impact of GDP and advances individually on fresh addition to NPA is not statistically significant. This result enables us to conclude the significance of interaction effect of advances and GDP on NPA of Nationalized Banks.

Further, a scatter plot is drawn as shown in Figure No. 3 to check whether the interaction effect is uniform before and after the financial crisis. It may be concluded based on r statistics that the interaction effect is slightly higher during the period after the financial crisis (r = 96.54%) compared to before the financial crisis (87.52%).

4.2.2 Interaction effect on relationship between Advances and Gross NPA

$$X_{gnpa} = -16420 + (-0.075 \times X_{ad}) + (0.029 \times X_{ev}) + (7.808E\text{-}9 \times (X_{ad} \times X_{ev}))$$

Based on Table No 2, it may be inferred that; (1) R^2 value highlights that 97.60% of the variability in dependent variable i.e., Gross NPA can be explained by the advances, GDP and the interaction effect between GDP and advances. (2) The regression equation is statistically significant (F =150.207, Sig =0.000). It may be concluded that the model is highly reliable in explaining the behavior of the Gross NPA. (3) The impact of all independent variables is statistically significant. It is also found that if the interaction effect is not included in the equation, then the impact of two independent variables i.e., gross advances and GDP are not found to statistically significant. This highlights the fact that the interaction effect influences the trends in movement of NPA of Nationalized Banks.

The inference from scatter plot and trend line analysis shows that interaction effect is similar before and after the financial crisis, as may be observed from the r value i.e., 92.00% before the financial crisis and 95.3% after the financial crisis.

4.3. Public Sector Banks

4.3.1 Interaction effect on relationship between Advances and Fresh NPA

$$X_{anpa} = -28927 + (-0.024 \times X_{ad}) + (0.021 \times X_{ev}) + (4.559E\text{-}9 \times (X_{ad} \times X_{ev}))$$

The effect of independent variables and its interaction effect on addition to NPA of PSBs is analyzed using the above regression equation. It may observed from Table No 1 that; (1) R^2 shows that 99.10% of the variability in fresh NPA every year is explained from the change in advances, GDP and an interaction between GDP and advances. (2) The regression equation is statistically significant (F =421.980, Sig =0.000). It may be concluded that the model is highly reliable in explaining the behavior of the fresh generation of NPA of Nationalized Banks. (3) Similar to other bank groups, the unique feature observed from the significance of impact of selected variable on NPA is that only the interaction factor is found statistically significant while the impact of other independent variables are not statistically significant. This inference is evident in the case of SBI & Associates and Nationalized banks as well. This result enables us to conclude the significance of interaction effect of advances and GDP on NPA of PSBs.

Further, a scatter plot is drawn as shown in figure no. 5 to check whether the interaction effect is uniform before and after the financial crisis. It may be concluded based on r statistics that the interaction effect is higher during the period after the financial crisis (r = 97.00%) compared to before the financial crisis (75.40%).

4.3.2 Interaction effect on relationship between Advances and Gross NPA

$$X_{gnpa} = 4372 + (-0.040 \times X_{ad}) + (0.023 \times X_{ev}) + (8.031E\text{-}9 \times (X_{ad} \times X_{ev}))$$

The R^2 value from Table No. 2 shows that 98.4% of the variability in Gross NPA can be explained by change in advances, GDP and the interaction effect between GDP and advances. Also, the regression equation is found statistically significant (F =220.283, Sig =0.000). It may be concluded that the model is highly reliable in explaining the behavior of the Gross NPA. With regard to the significant of impact of variables used, it is evident from Table No 2 that the impact of the interaction effect is statistically significant, while the impact of GDP and advance is not statistically significant.

The inference from scatter plot (Figure No. 6) and trend line analysis shows that interaction effect is similar before and after the financial crisis, as may be observed from the r value i.e., 95.44% before the financial crisis and 98.33% after the financial crisis.

5.0 Conclusion

The results of the study strongly support the significance of GDP on the relationship between advances and NPA of banks. The relationship between advances and NPA improved with the interaction effect of GDP on advances. In fact, the interaction effect is found statistically significant for SBI & Associates, Nationalized Banks and PSBs. Since

the public sector banks occupy more than 75% of total advances and deposits, this result can be inferred as the result of Indian SCBs.

Banks need to foresee changes in economic environment so as to control the menace of NPA. The corrosion in asset quality faced by Indian SCBs can be largely attributed to the fact that banks may not properly anticipate how the aggregate economic conditions affect their operations. The period of economic boom results an upsurge in advances, many of which failed to repay with the advent of recessionary pressures. The excessive optimism and the resulting upsurge in advances must follow adequate provisioning and collaterals in order so that any distress to asset quality may be curtailed in future.

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Table No. 1

Linear Multiple Regression Coefficient with dependent variable Additions to NPA and interaction effect as an independent variable

Independent Variables	SBI & Associate	Nationalized Banks	PSB
t- statistic			
X_{ad}	-0.396	-1.629	-1.444
$X_{ev,}$	1.348	2.135	2.193
$X_{ad} \times X_{ev}$	8.057*	8.252*	13.340*
Constant	-1.647	-2.040	-2.156
Adjusted R^2	0.989	0.984	0.991
F Statistics	331.797*	220.340*	421.980*

Note: A single (*) asterisk indicate the coefficients denote significant at 01% level of significance.

Table No. 2

Linear Multiple Regression Coefficient with dependent variable Gross NPA and interaction effect as an independent variable

Independent Variables	SBI & Associate	Nationalized Banks	PSB
t- statistic			
X_{ad}	1.428	-3.508*	-1.896
$X_{ev,}$	-1.072	3.463*	1.967
$X_{ad} \times X_{ev}$	14.403*	14.813*	18.933*
Constant	3.386*	-1.311	0.263
Adjusted R^2	0.987	0.976	0.984
F Statistics	277.305*	150.207*	220.283*

Note: A single (*) asterisk indicate the coefficients denote significant at 01% level of significance.

Figure No. 1

Effect of interaction before and after the financial crisis – Additions to NPA of SBI & Associates
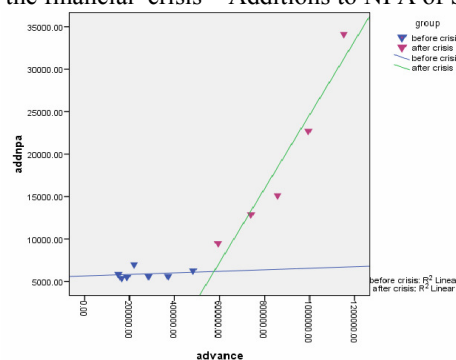
Figure No. 2
Effect of interaction before and after the financial crisis – Gross NPA of SBI & Associates
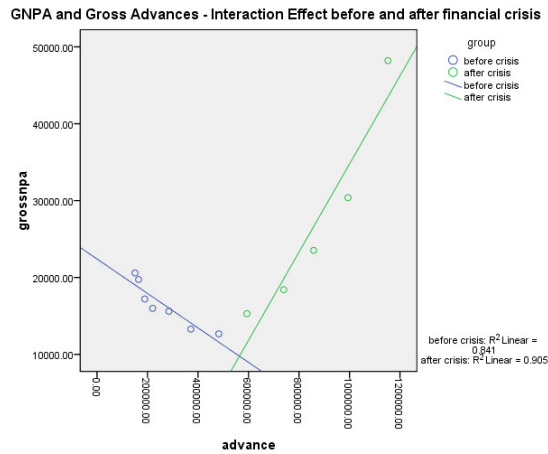

Figure No. 3
Effect of interaction before and after the financial crisis – Additions to NPA of Nationalized Banks
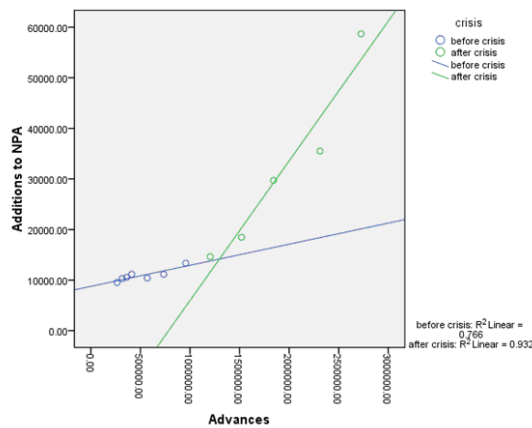

Figure No. 4
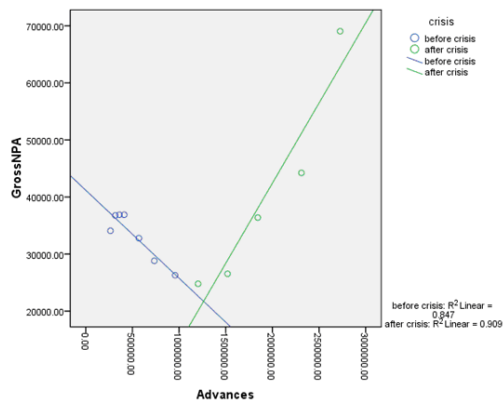Effect of interaction before and after the financial crisis – Gross NPA of Nationalized Banks

Figure No. 5
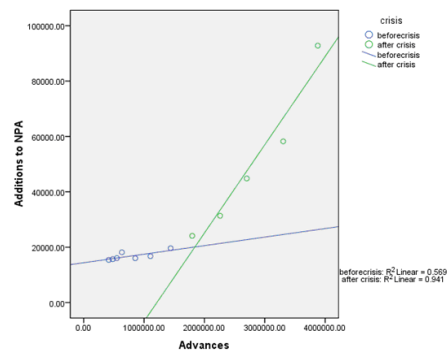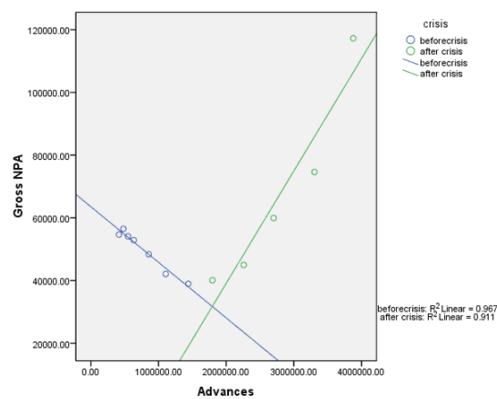Effect of interaction before and after the financial crisis – Additions to NPA of PSBs

Figure No. 6
Effect of interaction before and after the financial crisis – Gross NPA of PSBs

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