

Explanatory Power of Macroeconomic Variables as Determinants of Non-Performing Loans: Evidence from Pakistan

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Abstract: Since long the argument has been that both bank specific and macroeconomic factors affect the non-performing loans and the existing literature on macroeconomic variables suggests that many macroeconomic variables do strongly influence them. Over the last few years the literature that examines NPLs has expanded in line with the interest afforded to understanding the factors responsible for financial vulnerability. The study aimed to investigate the explanatory power of macroeconomic variables as determinants of NPLs. This study used time series data of NPLs ratio and nine macroeconomic variables over the period of 1990-2011 and OLS was used to test the explanatory power of macroeconomic variables as determinants of NPLs.

Key words: NPLs, OLS, macroeconomics variables, GDP

INTRODUCTION

It is widespread rule that before the recovery of global economy, the consumer and investor confidence in the markets must be restored, however this process is very slow leaving many small economies, industries and even small firms struggling to attain break even. The impact of Global Financial Crisis (GFC) and recession in developing countries was most evident in 2009. Like other Asian countries, GFC expressed its effects on the real sector of Pakistan economy. The major challenges that Pakistani economy faced during this time can be partially attributed to GFC. This partial effect was due to the decrease in the exports resulting from the recession and liquidity crunch in the global financial market, which lead to the withdrawal of foreign investment from Pakistan and depreciation of the local currency. Similarly, increase in global oil prices, energy crisis, underutilization of production facilities, high per unit cost, circular debts, decline in capital flow and growth, budget deficit and growth in corruption played important role in slowing down the recovery of economy. All these pressures on the economy and industry translated in the inability of households and firms to repay their debts, consequently resulting in the growth of Non-performing loans (NPLs).

The rapid growth in NPLs poses challenges on the flexibility of banking sector to increase their provisions for NPLs. This affected the dividend payments, resulting in the decline of stock prices.

The Pakistan commercial banking sector is blamed recently by both foreign as well as local stakeholders for apparently avoiding its responsibility to provide credit to different private sectors to stimulate the country economic growth. Locally, regulatory authorities and government are realizing the fact that commercial banks should provide the leverage where it is needed (private sector). Whereas foreign credit rating agencies such as Moody's are constantly highlighting that commercial banks should not increase their loan portfolio risk by putting all their eggs in single basket i.e. investing in the government securities only.

The total NPLs stood at Rs 613 billion for all banking sector exclusive of finance development institutions, as per data provided by State bank of Pakistan (SBP) on September 30, 2011. Out of total NPLs 62 percent comes from the balance sheet of private banks; nearly 31 percent reside on the public banks balance sheet, almost 6 percent comes from the specialized banks and foreign banks are holding very minor percent of the total NPLs. The NPLs are growing continuously on quarterly basis, registering

6 percent (almost Rs 37 billion) growth in the first quarter of fiscal year 2011-12. On the other hand cash recovery for the first quarter against the NPLs reached to Rs 14 billion, with major recovery by the private banks of Rs 10.5 billion. The Net NPLs/net loans for the banking sector is 6.4 percent; the ratio is high because of the 15.1 percent ratio contribution of publically held banks and 14.7 percent ratio contribution of specialized banks. Whereas foreign owned banks and local privately held banks have net NPLs/net loans ratios of 1.3 percent and 3.8 percent, respectively.

The government of Pakistan from time to time criticizes the private banks for not providing credit to the private sector, but in reality government owns the larger share of private banks lending. The depreciating currency of Pakistan is reducing the foreign exchange reserves, government in order to get the budgetary support rely heavily on the local bank borrowing. During the current fiscal year from July 1 to February government borrowed Rs 190 billion from the SBP, where as total borrowing of government from scheduled banks reached to a massive figure of Rs 700 billion.

About 20 percent of the private borrowing is done by the textile sector; the amount of the loans outstanding towards textile sector is Rs 555 billion in January 2012. Whereas manufacturing sector does the largest borrower in the private sector and own 51 percent of the total borrowings (Rs 1,464 billion). The persistent electricity shortfalls and gas shortages now become a consistent phenomenon; as a result the manufacturing and textile sector are made to borrow more than their usual working capital requirement. The biggest example of gas shortage effect on manufacturing sector is the world's largest single-train urea manufacturing plant which is not working because of the irregular supply of gas. The cost of this project is over \$1 billion which is mainly financed by the banks. As the plant is not fully operating thus there is every possibility of defaults of loans and increase in NPLs of the banking sector. Therefore, because of such infrastructure-based uncertainty banks of Pakistan avoid lending to the private sector, as it can translate into growth in NPLs. Thus banks are only lending to the government because of the growth in demand but also to reduce the riskiness of the loan portfolio.

The further reduction of 100-200 basis points in the current market interest rates would not likely to stimulate the growth in private sector lending, because of the infrastructural issues and energy deficit problems. If the government resolves the energy problem then it would increase the demand for the credit and will also help in the reduction of the loan portfolio risk of private banks.

Existing studies have proved that macroeconomic variables are the main source of systematic risk that translates in the growth or decline of loan quality [1, 2]. The loan quality is expressed in the ratio of NPLs to total gross loans. The decline in the loan quality can lead to the banking crisis [3], thus it can be used as an early warning indicator to prevent any banking crisis in the country.

The main aim of this study is to investigate the explanatory power of macroeconomic variables as determinants of NPLs. After an extensive literature review, nine macroeconomic variables are selected for this study. In this study 22 years time series data on NPLs ratio and nine macroeconomic variables was used and ordinary least square method was employed to get the empirical results.

This paper is divided into different sections. Section 1 presents the introduction of the study, section 2 highlights the exiting literature relating macroeconomic determinants of NPLs and presents the hypotheses used in current study. Section 3 provides the research methodology and results and analysis are presented in section 4. Finally, section 5 discusses the findings, policy related implication and future research.

Literature on Macroeconomic Variables: In literature relationship between loan quality and macroeconomic variables has been widely discussed by connecting the boom and depression of business cycles with financial vulnerability and stability of the banking sector. It is observed that during boom growth in bank loans occurs with rapid rate and declines during the depression. This cyclic trend in credit can be explained by several factors. On the supply side, boom is characterized by stable cash flow streams of the debtors and banks, timely repayments of loans, good credit scores of borrowers, increasing credit worthiness and willingness of banks for lending to borrowers. On the other hand during depression, banks are over conscious and doubtful relating the economic conditions, future outcomes of projects, subsequently not lending to the borrowers even with economically feasible project proposals. On the demand side, during boom investors are optimistic regarding future returns and demands for more credit to invest in new projects, whereas during depression investors are over conscious and pessimistic regarding the investment in new projects and other consumption decisions, consequently, holding back the lending decisions.

It is widely observed in existing literature that during boom NPLs are relatively low because high revenue of borrowers provides them with stable cash flows to meet

the credit obligations [4]. However, in order to earn more during boom banks even start lending to low quality borrowers. Subsequently in recession the inability of low quality borrowers to repay loans results in the growth of NPLs. The main reason for the growth in NPLs is the decline in the asset prices kept as collateral during the depression, consequently, not covering the loan amount in case of default, thus increasing the banks NPLs and riskiness.

Empirical studies have confirmed the linkage between NPLs and business cycle. For instance, Marcucci and Quagliariello [5] used the data of the Italian banking sector over the period of 1990-2004 and employed reduced-form Vector Auto-Regression (VAR) to investigate the effects of changes in business cycle on the quality of loans. They proved that NPLs follows a cyclic trend, increases during boom and declines during depression.

According to Keeton and Morris [6] depression in local economy in conjunction with bad performance of some sectors mainly explains the changes in NPLs. Keeton and Morris [6] used 2,470 United States of America (USA) commercial banks data over the period of 1979-85. Their results provided the fact that during boom banks tends to lend low quality borrowers and consequently have higher NPLs. They also find that larger banks with higher risk bearing ability registered higher loan losses.

After Keeton and Morris [6], various studies reported the same results by using the USA data. For instance, Sinkey and Greenwalt [7] used the USA commercial banks data over the period of 1984-87 and employed simple linear regression model to investigate the factors affecting the loan losses. Their results proved that both internal and external factors have significant influence in explaining loan losses. They found that internal factors such as volatile funds, excessive lending and interest rate have significant positive impact on the loan losses, confirming the findings of Keeton and Morris [6]. They further argued that country specific variables also have significant impact on the loan losses.

Later on Keeton [8] conducted a research to investigate the influence of loan delinquencies and credit growth by using data of USA banks over the period of 1982-1996 and employed VAR model for analysis. The results showed a highly significant relationship between loan losses and credit growth. Further, Keeton argued that in few states of USA higher loan losses was mainly due to the weak credit terms and standards of banks.

The similar studies conducted in other countries provided the same results. For instance, Bercoff *et al.* [9] found that both country specific macroeconomic and bank specific variables effect the NPLs. Bercoff *et al.* [9] conducted study by using Argentinean banks data over the period of 1993-1996.

Sales and Saurina [10] used Spanish banks panel data over the period of 1985-1997 and employed dynamic model to investigate the determinants of NPLs. They found that real growth in gross domestic product (GDP), bank size, market power, rapid credit expansion and capital ratio explains fluctuations in NPLs. Jimenez and Saurina [11] suggested that GDP growth, lenient credit terms and high real interest rates are main determinants of NPLs.

Gambera [12] used the USA data to investigate economic development impact on the loan quality. The loan quality was regressed against unemployment, real estate loans, sector income, number of bankruptcies, agricultural loans and car sales, commercial and industrial loans. The results proved that macroeconomic dynamics has impact on the loan quality whereas changes in macroeconomic variables and business cycles can be used to forecast future changes in loan quality.

Arpa, Giulini and Pauer [13] investigated the banks risk provisions association with operating income by using Austrian banks data. They employed regression analysis and found that risk provisions share in total banking sectors loans varies negatively with real interest rate and real GDP growth, whereas varies positively with real estate price inflation and consumer price index (CPI).

Kalirai and Scheicher [14] investigated the credit risk dependency on the macroeconomic variables by using the data of Australian banks over the period of 1990-2001 by employing simple regression analysis. They used real GDP, CPI, industrial production, money growth, stock market indices, interest rates and other macroeconomic variables as explanatory variables. They found that interest rates, stock market indices, industrial production and business confidence index strongly influence the loan quality.

Shu [15] used similar model as Kalirai and Scheicher [14] to investigate the correlation between macroeconomic variables and loan quality. They used Hong Kong data over the period of 1995-2002. They found that increase in interest rate has significant positive impact on NPLs, whereas growth in CPI, real GDP and property prices has significant negative impact on NPLs. They also suggested insignificant impact of performance of equity prices and unemployment on NPLs.

Quagliariello [16] regressed NPLs against GDP growth rate, unemployment rate, real gross fixed investment, real gross fixed consumption, CPI, M2 growth rate and real exchange by using Italy data. The results suggested significant negative effects of growth in unemployment and decline in GDP growth rate on NPLs, whereas CPI and real exchange rate has no significant influence on NPLs.

Fofack [17] used pseudo panel model for sub-Saharan African countries. Fofack [17] found that real exchange rate appreciation, economic growth, net interest margin, interbank loans and real interest rate play significant role in determining NPLs.

Babouèk and Janèar [18] used Czech banking data over the period of 1993-2004 to investigate the impact of macroeconomic development, measured by unemployment, exports, imports, real GDP growth, CPI, credit growth rate and real effective exchange rate on the NPLs by using unrestricted VAR model. They suggested empirically positive association of NPLs with CPI and unemployment. They also concluded that appreciation of real effective exchange rate has no influence on NPLs, whereas growth in GDP declines the NPLs level.

Gerlach, Peng and Shu [19] employed regression analysis by using Hong Kong data and regressed NPLs against nominal interest rates, equity prices, CPI, number of bankruptcies, property prices, real GDP and the unemployment rate. The results suggested that increase in nominal interest rates and bankruptcies raises the NPLs ratio, whereas increase in economic growth, CPI and property price inflation erodes the NPLs ratio. They also concluded that deflation in economy declines the economic growth, subsequently decreasing the profitability and affecting the debt paying ability of borrowers.

Hoggarth, Sorensen and Zicchino [20] employed VAR model by using United Kingdom data. They investigated the association of explanatory variables i.e., output gap, real estate prices, retail prices, real exchange rate and short-term interest rates with dependent variable loans write-offs. They found that dynamics of interest rate and inflation affected indirectly loan quality and financial stability.

Podpiera [21] conducted the empirical study to investigate the relationship between quality of regulation and supervision as measured by Basel Accord Principle and Banking performance as measured by net interest margin and NPLs by using 65 countries panel data.

The results concluded that higher compliance with the Basel Accord Principles showed positive impact on banks performance by lowering the NPLs and increasing net interest margin.

Babihuga [22] used the data from Asian; European and Sub-Saharan African countries to investigate the linkages between financial stability indicators and macroeconomic variables. They employed regression analysis to establish the association between variables. They regressed NPLs against banking sector regulations and supervision, business cycle component of GDP, terms of trade, real lending rates, unemployment and real effective exchange rate. The results suggested that financial stability indicators (capital adequacy, profitability and assets quality) vary strongly with phases of business cycle and inflation rate and real GDP has negative impact on NPLs and capital adequacy.

Jakubík [23] used regression analysis to investigate the impact of a set of explanatory variables: real GDP, the loan to GDP ratio, real effective exchange rates, unemployment, real interest rate and CPI on dependent variable NPLs by using Czech Republic banking sector data. The results suggested that corporate default rate is significantly determined by the growth in loan to GDP ratio and real effective exchange rate appreciation whereas in case of households, growth in interest rate and unemployment leads to decline in NPLs.

Zeman and Jurèa [24] employed multivariate regression analysis, using Slovakia banking data to investigate the dynamics in NPLs by using a set of explanatory variables: real GDP, exports, the output gap, oil prices, industrial production, M1, CPI, nominal exchange rates and nominal interest rates. They found that real GDP, the nominal interest rate and exchange rate are the most important influencing variables on the NPL dynamics. They also concluded that decline in GDP growth is not expected to have substantial impact on the banking performance.

Männasoo and Mayes [25] applied panel logit model by using Central Eastern European countries banking data. They used a set of explanatory variables including bank specific variables (liquidity ratio, loan to asset ratio, inverse liquidity ratio, cost-income ratio and equity to asset ratio) and macroeconomic variable (GDP growth). They found that decline in GDP growth and fluctuations in banks internal and external environments results in deterioration of banking sector performance and stability.

One of the Recent study relating determinants of NPLs is conducted by Dash and Kabra [26], in which they used panel data over 10 years from 1999-2009 and employed regression analysis. In their study both macroeconomic and bank specific variables are used as explanatory variables (GDP growth rate, real interest rate, real effective exchange rate, inflation, loans to total assets ratio, bank size and growth in loans). They suggested that real exchange rate has significant impact on NPLs whereas remaining variables are insignificantly associated with NPLs.

Louzis *et al.* [27] used dynamic panel data of Greek banking sector. Their study was aimed to investigate the impact of macroeconomic and bank specific variables on the NPLs. They selected three macroeconomic variables (unemployment, GDP and interest rate) and tested validity of seven bank specific hypotheses. They found that variables such as GDP, interest rate, unemployment have significant impact in explaining variation in NPLs.

Festić *et al.* [2] conducted the most recent study to investigate the influence of macroeconomic and bank specific variables as the source of systematic risk to assess vulnerability of banking sector towards NPLs of five newly member European Union States. They used deposit to loan ratio, foreign direct investment (FDI), loan to assets ratio, exports, net foreign assets to net assets ratio, gross fixed capital to GDP and compensation of employees relative to household demand and Basel core principle as explanatory variables. They used both panel regression fixed effect and random effect models for the analysis. The results suggested that loan to assets ratio stimulated the increase in NPLs because of the soft loans given by the banks. The gross fixed capital contributed in growth of GDP and consequently decreasing the NPLs, similarly growth in the exports and industrial production improves NPLs ratio.

Based on existing literature current study formulated nine hypotheses relating association between NPLs and nine macroeconomic variables. The hypotheses are given below:

H1: The growth in GDP results in the decline of NPLs.

H2: The increase in unemployment rate results in the growth of NPLs.

H3: The increase in interest rate results in the growth of NPLs.

H4: The inflation results in the decline of NPLs.

H5: The depreciation of local currency results in the growth of NPLs.

H6: The increase in CPI results in the growth of NPLs.

H7: The increase in exports results in the decline of NPLs.

H8: The increase in industrial production results in the decline of NPLs.

H9: The increase in foreign direct investment results in the decline of NPLs.

MATERIALS AND METHODS

The existing studies relating the determinants of NPLs have used NPLs/total advances as the dependent variable, for instance, Dash and Kabra [26]; Louzis *et al.* [27] and Festiæ *et al.* [2], current study also uses NPLs/total advances as dependent variable.

Macroeconomic Variables: The existing literature on macroeconomic variables suggests that many macroeconomic variables have strong influence on the NPLs. These macroeconomic variables are annual growth in GDP, unemployment rate, real interest rate, broad money supply, inflation rate, per capita GDP, CPI, stock price index, industrial production, credit growth, FDI, exports and real exchange rate. This research used nine macroeconomic variables: annual growth in GDP, unemployment rate, real interest rate, inflation rate, consumer price index, real exchange rate, exports, industrial production and FDI. The selection criteria of these variables are that existing empirically studies found significant positive or negative influence of these variables on the NPLs and availability of each variable data.

The existing literature has suggested the significant negative association between growth in GDP and NPLs [10, 14, 15, 16, 11, 17, 26, 27]. The explanation for negative relation is that increase in growth of GDP leads to the increase in income of the individuals and firms hence their ability to repay the loans increases, as a result NPLs decreases. Conversely, with the decrease in GDP, the individuals and firms income declines, hence their ability to repay loan decreases resulting in the growth of NPLs.

arious studies have found significant positive impact of unemployment on NPLs [18, 23, 27]. The explanation of positive association is that with the increase in unemployment, labor loses their source of income and has no money to repay their loans; as a result NPLs increases. Conversely, the decline in unemployment rate results in the increase in the number of earning individuals, thus number of debtors having the money to repay the loan increases consequently NPLs declines.

The existing literature has suggested empirically significant positive association between interest rate and NPLs [6, 7, 15, 27]. The explanation of positive relation is that with the increase in interest rate the difference between deposits rate and lending rate increases. Only low quality borrowers show willingness to pay high interest rate, thus banks in order to earn lend more funds to the low quality borrowers. Low quality borrowers by using bribes to bank officials and other corruption practices do not repay the loan, consequently results in the growth of NPLs.

Babihuga [22]; and Dash and Kabra [26] found negative association between inflation and NPLs and concluded that with the increase in inflation the equity value of the banks declines results in the growth of banks credit risk.

Fofack [17] has suggested the positive association of real effective exchange rate with NPLs and concluded that the inflationary pressure and increase in real effective exchange rate contributes to the growth in NPLs.

The existing literature has suggested empirically positive association between CPI and NPLs [14, 15, 18]. The explanation of positive relation is that with the increase in CPI funds left with borrowers after meeting their every day needs declines as compared to the funds left at the time of lower CPI, thus borrowers are not able to repay their loans and consequently NPLs of the banks grows.

Borio and Lowe [28]; Babouèk and Janèar [18] and Festiæ *et al.* [2] found negative impact of exports on the NPLs, illustrating that growth in exports results in the improvement of NPLs ratio.

Kalirai and Scheicher, [14]; Zeman and Jurèa [18] and Festiæ *et al.* [2] concluded that industrial production is negatively related with NPLs. The explanation for the negative relation is that the increase in demand for the industrial products increases the investments in industrial sectors, which is mainly financed through lending; because of high demand firms have stable cash flows to repay loans. Thus the growth in industrial production results in the decline of NPLs.

Calvo and Mendoza [29] and Festić *et al.* [2] found positive influence of FDI on the NPLs. The justification of the positive association is that with the increase in FDI, economic activities and credit in the country increases, with the passage of time when foreign investors confidence in the economy declines or they anticipate depreciation of currency, lowering of interest rate after large inflow of money or expect financial crisis in the country, they suddenly withdraws their investments leaving banks illiquid. This also results in the slowing down the pace of economic activities in the country, which results in the inability of the borrowers to repay loans. Due to the increase in FDI, domestic lending increases more than the income of the households and firms and results in the growth of NPLs on the withdrawal of foreign investments.

The macroeconomic variables used in current study, supported literature and literature supported relation with NPLs are given in Table 1.

Data and Procedures: The data used for nine macroeconomic variables and NPLs ratio is the time series data. For each variable 22 years data was collected. The data relating the NPLs ratio for Pakistani banking sector is collected from the Pakistan financial sector assessment analysis 1990-2000 and World Bank database. Similarly the data relating all nine macroeconomic variables is also collected from World Bank data base. The annual data of all variables are used over the period of 1990-2011.

The methods used in the existing literature for investigating the empirical association between NPLs and macroeconomic variables are panel regressions analysis [26], dynamic panel models [27], cross-country regressions analysis [2], correlation and VAR methodology [20]. Most of the existing studies have used regression model, the current study uses time series data therefore OLS was used.

In most econometric analysis before applying models variable are converted into log forms to remove heteroskedicity from the analysis and this process is known as log transformation. Where as, Lütkepohl and Xn [30] demonstrated that log transformation is accurate in some special cases. Here the main aim is to capture the dynamics of NPLs; thus log transformation can produce downward bias during estimation. Therefore to capture the dynamics in NPLs, variable series are first converted into differences and then expressed as percentage change. After that unit root test is conducted to check for the stationarity of the variables. The stationarity of data

Table 1: Macroeconomic variables, relation with NPLs, data source and supported literature

Variables	Relation with NPLs	Data source	Literature
Growth in GDP	-	World Bank	Sales and Saurina, 2002; Kalirai and Scheicher, 2002; Shu, 2002; Rajan and Dhal, 2003; Quagliarillo, 2003; Jimenez and Saurina, 2005; Fofack, 2005; Babouèek and Janèar, 2005; Gerlach <i>et al.</i> , 2005; Männasoo and Mayes, 2009; Dash and Kabra, 2010; Louzis <i>et al.</i> , 2010; Festić <i>et al.</i> , 2011
Unemployment rate	+	World Bank	Babouèek and Janèar, 2005; Jakubík, 2007; Louzis <i>et al.</i> , 2010
Interest rate	+	World Bank	Keeton and Morries, 1987; Sinkey and Greenwalt, 1991; Shu, 2002; Gerlach <i>et al.</i> , 2005; Jakubík, 2007; Louzis <i>et al.</i> , 2010
Inflation	-	World Bank	Babihuga, 2007; Dash and Kabra, 2010
Real effective exchange rate	+	World Bank	Fefock, 2005
Consumer price index	+	World Bank	Shu, 2002; Kalirai and Scheicher, 2002; Babouèek and Janèar, 2005;
Exports	-	World Bank	Borio and Lowe, 2002; Babouèek and Janèar, 2005; and Festiæ <i>et al.</i> , 2011
Industrial production	-	World Bank	Kalirai and Scheicher, 2002; Zeman and Jurèa, 2008; and Festiæ <i>et al.</i> , 2011
Foreign direct investment	-	World Bank	Calvo and Mendoza, 2000; and Festić <i>et al.</i> , 2011

means that most of the time series have constant mean and variance, which results in the false regression analysis with high R-squared value and few significant relationships between variables. Therefore this problem is solved by checking the time series for the unit root by using stationarity tests of Augmented Dickey Fuller (ADF), Dickey-Fuller GLS and Phillips-Peron (PP) unit root tests. If series are stationary at level then OLS is conducted by using the same values of the series but when series are stationary at first difference or second difference then OLS is also applied by using the first or second difference of the time series.

Before applying OLS explanatory variables are checked for the multicollinearity by using correlation matrix. The multicollinearity problem arises because of the high correlation between any explanatory variables. The multicollinearity problem makes the significant variables insignificant by increasing the p-value; the increase in p-value lowers the t-statistics value. Thus the OLS results with multicollinearity will show significant variables as insignificant variables. The multicollinearity problem is solved by dropping the high correlated variables and then regression is run after dropping highly correlated variables.

After getting results from the OLS, model is checked whether it can be used to predict the future results or the OLS model is best or not. There are certain features or characteristics of model through which it can be concluded that the model is good or not. First is the high R-squared value with maximum number of significant relation and F-statistics value with p-value less than 5%. Second, residual are not serial correlated, third, residual are not heteroskedastic but are homoskedastic and fourth, that residuals are normally distributed. When any OLS has above four features than such model is considered best model and has forecasting power to predict future

changes in dependent variable. The correlation of the model can be checked with Breusch-Godfrey Serial Correlation LM Test. The heteroskedasticity in the residual is tested with Breusch-Pagan-Godfrey test and for checking the normality of the model Jarque-Bera statistics is used with its p-value.

The macroeconomic variables model is given below:

$$NPLS_t = \beta_0 + \beta_1 GDP_t + \beta_2 UNEMP_t + \beta_3 ITR_t + \beta_4 INF_t + \beta_5 REER_t + \beta_6 CPI_t + \beta_7 EXP_t + \beta_8 IP_t + \beta_9 FDI_t + \mu_t \quad (1)$$

where,

- $NPLS_t$ Is the dependent variable, banks riskiness (NPLs to gross loans ratio) in time period “t”
- GDP_t Is the growth in GDP in time period “t”
- $UNEMP_t$ Is the unemployment rate in time period “t”
- ITR_t Is the interest rate in time period “t”
- INF_t Is the inflation rate in time period “t”
- $REER_t$ Is the real effective exchange rate in time period “t”
- CPI_t Is the consumer price index in time period “t”
- EXP_t Is the exports in time period “t”
- β_0 Is the intercept
- $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ and β_9 are the respective coefficient terms
- “ μ_t ” Is the error term
- “t” is the time period (1990 to 2011)

RESULTS AND DISCUSSION

The analysis of the macroeconomic variables started with the selection of nine macroeconomic variables (i.e. annual growth in GDP, unemployment rate, real interest rate, inflation rate, consumer price index, real

Table 2: Unit root test results of macroeconomic variables

		ADF	ADF GLS	PP
Levels				
Intercept	NPLs/total gross loans	-8.099254*	-5.841237*	-1.912335***
	GDP growth rate	-3.580366**	-4.749650**	-10.58747**
	Unemployment rate	-9.523652*	-1.378701**	-8.756709*
	Interest rate	-4.377676*	-3.063832*	-4.378810*
	Inflation rate	-5.865505*	-5.451573*	-10.04801*
	Real effective exchange rate	-4.587981*	-4.721635*	-4.587959*
	Consumer price index	-2.304008***	-2.338316**	-2.282810***
	Exports	-2.786068***	-3.177241	-2.786068***
	Industrial production	-2.470993**	-2.534045**	-2.446495***
	Foreign direct Investment	-3.424256**	-3.492060*	-3.418294**
Intercept and trend	NPLs/ total gross loans	-8.099254**	-4.898758*	0.031671
	GDP growth rate	-5.723036*	-5.905481*	-13.21548*
	Unemployment rate	-8.611289*	-5.219090*	-7.961443*
	Interest rate	-3.433566**	-3.115714***	-6.008510*
	Inflation rate	-5.701065*	-5.676511*	-9.671837*
	Real effective exchange rate	-5.185743*	-5.482103*	-5.185743*
	Consumer price index	-2.241532***	-2.357089***	-2.217029***
	Exports	-2.509517*	-4.062455**	-3.827872**
	Industrial production	-2.401492***	-2.536820**	-2.375761***
	Foreign direct investment	-3.323097***	-3.518790**	-3.315950***

where * represents significance level of 1%, ** represents significance level of 5% and *** represents significance level of 10%

Table 3: Correlation matrix of macroeconomic variables

	GDP growth rate	Unemployment rate	Interest rate	Inflation rate	Real effective exchange rate	Consumer price index	Exports	Industrial production	Foreign direct investment
GDP growth rate	1								
Unemployment rate	-7.83E-05	1							
Interest rate	0.07071	-0.12404	1						
Inflation rate	-0.07928	0.378543	-0.02396	1					
Real effective exchange rate	0.057352	-0.02742	0.054984	0.058246	1				
Consumer price index	-0.13076	0.09137	-0.13359	0.092239	0.152516	1			
Exports	-0.2566	0.278481	-0.01174	0.116715	0.357253	-0.03792	1		
Industrial production	-0.07086	-0.17929	-0.03959	-0.28753	0.231251	-0.13546	0.255037	1	
Foreign direct investment	0.055905	-0.11418	0.132239	-0.18237	-0.17485	-0.4321	0.229992	0.526211	1

Table 4: OLS results of macroeconomic variables

Variable	Co-efficient	Standard error	t-Statistic	Probability
GDP growth rate	-0.22149	0.059763	-3.7062	0.0657
Unemployment rate	0.449258	0.330277	1.360245	0.3068
Interest rate	-0.58162	0.171515	-3.39109	0.077
Inflation rate	-0.14324	0.042484	-3.37158	0.0778
Real effective exchange rate	-1.17884	0.758582	-1.554	0.2604
Consumer price index	3.619125	0.603131	6.000567	0.0267
Exports	-1.41496	0.372612	-3.79742	0.0629
Industrial production	-2.48014	0.685834	-3.61624	0.0068
Foreign direct investment	-0.0543	0.075871	-0.71564	0.4946
C	0.125253	0.089762	1.395378	0.2004
R-squared	0.837939	F-statistic	3.447014	
Adjusted R-squared	0.594848	Probability (F-statistic)	0.043821	
		Durbin-Watson statistics	1.822541	

exchange rate, industrial production, exports and FDI). The 9 explanatory variables and NPLs/total loans ratio are converted into differences and then expressed as percentage change. The percentage change of the variables is taken to capture the dynamics of the variables over the period of time [30]. The unit root tests are conducted to check for the stationarity of the variables, current study used ADF, Dickey-Fuller GLS and PP stationarity tests. The results of unit root tests are given in Table 2, suggesting that all the variables are stationary at level. Thus OLS can be applied by using the original percentage values of the variables.

Before applying OLS explanatory variables were checked for the multicollinearity by using correlation matrix. The multicollinearity problem arises because of the high correlation between any two explanatory variables. The multicollinearity problem makes the significant variables insignificant by increasing their p-value; the increase in p-value lowers the t-statistics value. Thus the OLS results with multicollinearity will show significant variables as insignificant variables. The multicollinearity problem is solved by dropping the high correlated variables. The correlation matrix between 9 explanatory variables is given in Table 3.

The results in Table 3 suggest that there is no correlation between any of the explanatory variables, therefore all the variables can be used in further analysis.

The OLS is applied by using 9 explanatory variables; the results of OLS are given in Table 4. The fitness of the model is predicted with the help of R-squared, F-statistics and number of significant relationship between NPLs and explanatory variables. The R-squared value for the model is 0.837939, suggesting that almost 84% variance in NPLs are explained by 9 explanatory variables. The F-statistics of the model has a p-value of 0.043821, rejecting the null hypothesis and suggesting that 9 explanatory variables can influence the NPLs jointly.

The results in Table 4 suggested that six macroeconomic variables (i.e. GDP growth, interest rate, inflation rate, CPI, exports and industrial production) has significant association with NPLs, whereas three variables (i.e. unemployment and real effective exchange rate and FDI) are insignificantly associated with NPLs.

The Table 4 shows statistically significant relationship between NPLs and growth in GDP. The results of OLS for growth in GDP are consistent with the existing studies findings and confirms the negative relationship between NPLs and growth in GDP [2, 10, 14, 15, 16, 11, 17, 25, 26, 27]. The negative relation suggests that growth in GDP increases the income of

individuals, resulting in the increase in debt paying ability of individuals and decline in the NPLs ratio. The results confirm the validity of H1 of current study.

The results in Table 4 provide insignificant positive association of NPLs with unemployment rate, suggesting that growth in unemployment rate results in the growth of NPLs ratio. The relation is insignificant therefore unemployment rate has no significant influence in increasing unemployment rate.

The Table 4 provides negative association between NPLs and interest rate. The relation between NPLs and interest rate is statistically significant, suggesting that interest rate has significant negative influence in decreasing the level of NPLs. The negative association rejects the H3 of current study. The results rejects that findings of existing studies that interest rate has significant positive impact on the NPLs [6, 7, 15, 19, 23, 27]. The theoretical justification for the significant negative association is that with the increase in interest rate, deposits and lending rates of the banks increases. Individuals with the funds starts savings with banks to earn on their funds and investors with the profitable business projects feel reluctant to borrow and invest in projects whereas opposite is valid in case of decline in interest rate when individual and investors are more keen borrow for consumption and invest in risky projects. Thus savings in the economy increases and borrowing declines. Only those investors and individuals borrow, those are sure about the returns and success of their investments. Therefore, only those individuals and investor borrow that can return the principle plus interest of the bank, hence leading to the decline in borrowing and also in the NPLs level.

The other main reason for the decline in NPLs as increase in the interest rate is that existing borrowers pay back their full loans to keep their credit rating good and to get loans in future at discounted rates. As the current borrowers has to pay interest on which they received loans, which is less than the existing interest rate therefore they pay back their loans, thus NPLs declines in the economy.

The current study provides the validity of H4 by proving negative significant association between inflation and NPLs. The results suggest that with the inflation, the level of NPLs in the economy declines. The results of current study support the findings of Babihuga, [22]. The theoretical justification for the negative association is that with the inflation the equity value of the banks declines, resulting in the growth of banks riskiness. Banks in order to improve their equity value start

extensive lending to show short run profitability and declines its expenditures on credit evaluation, allocation, monitoring and controlling to achieve short run cost efficiency. This results in the allocation of funds to the low quality borrowers and leads to the growth in NPLs.

The current study provides insignificant negative association between NPLs and real effective exchange rate. The results rejects the H5 of study that real effective exchange rate is positively associated by NPLs [17]. The results suggest that international competitiveness has negative influence on the NPLs.

The results in Table 4 provide the positive significant relationship between NPLs and CPI and are consistent with the findings of existing studies [15, 14, 18]. The positive relation confirms the validity of H6 and suggests that with the refraction interest rate declines and money supply in the economy increases, because of which individuals and firms are more interested in investment and consumption as compared to savings, resulting in the growth of borrowing by the firms and individuals. As interest rates are low and money supply is high therefore banks in order to utilize funds do extensive lending. Banks even start lending to the low quality borrowers without investigating their current debt status or credit rating and debt repayment ability. As credit is easily available in the market, low quality borrowers borrow from many banks and defaults by using corrupt practices, resulting in the growth of NPLs.

The co-efficient value for the relationship between NPLs and exports is negative. The results in Table 4 suggest that the relationship is statistically significant, which is consistent with findings of Borio and Lowe [28]; Babouèek and Janèar [18] and Festiè *et al.* [2]. The justification of the negative relation is that with the increase in exports firms have cash flows to pay back their loans. With the increase in exports economic activities in the country also increases resulting in the stable cash flows for the individuals, firms and banks, thus resulting in the decline of NPLs.

The results in Table 4 suggest that industrial production is negatively associated with the NPLs and are consistent with the findings of existing studies [2, 14, 24]. Thus, it can be concluded from the results that industrial production increases the earnings of the firms and individuals, resulting in the increase in debt paying ability of individuals and firms.

The current study rejects the H9 by suggesting insignificant negative association between FDI and NPLs. The negative association suggest that foreign investors whenever expects the decline in the future prospects of the economy they withdraw investments, resulting in the

decline in the economic activity of the country, cash flows of businesses and inability of the individuals and businesses to repay loans.

At the end of the analysis the residual of the model was checked for the existence of serial correlation, heteroskedasticity and normal distribution. Current study has used Breusch-Godfrey Serial Correlation LM test to check for the serial correlation in the residual, the results of the test is given in Table 5.

In Breusch-Godfrey Serial Correlation LM test the observed R-squared value and its probability is used to either accept or reject the null hypothesis of existence of serial correlation in the residual. The results in Table 5 reject the null hypothesis because the p-value is less than 5 %, suggesting that there is no serial correlation in the residual, which is desirable for a good regression model.

The heteroskedasticity of the residual was checked by using Breusch-Pagan-Godfrey test. In this test observed R-squared value and its probability is used to either accept or reject the null hypothesis of no existence of heteroskedasticity or existence of homoskedasticity. The results in Table 6 accepts the null hypothesis because the p-value is greater than 5 %, suggesting that there is no heteroskedasticity in the residual and residuals are homoskedasticity, which is desirable for a good regression model.

At the end residuals are checked whether they are normally distributed or not. For this purpose Jarque-Bera statistics is normally used with its p-value to either accept or reject the null hypothesis of existence of normal distribution. The Jarque-Bera statistics and its p-value is given in Table 7. The results suggest that the p-value of Jarque-Bera statistics is greater than 5% thus the null hypothesis is accepted, suggesting that residuals are normally distributed.

Findings, Policy Related Implications and Future Research:

The main aim of the current study is to investigate the determinants of NPLs by using the Pakistani banking data. In the current study OLS is applied by using nine macroeconomic variables; results proved that six macroeconomic variables (i.e. GDP growth, interest rate, inflation rate, CPI, exports and industrial production) are significantly associated with NPLs, whereas three variables (i.e. unemployment, real effective exchange rate and FDI) are insignificantly associated with NPLs. This suggests that six macroeconomic variables have significant influence in affecting the level of NPLs whereas three macroeconomic variables have no impact on NPLs. The study proved significant negative association of GDP growth, interest rate, inflation rate,

Table 5: Breusch-Godfrey Serial Correlation LM test

Observed R-squared	2.396159	Probability Chi-Square	0.0318
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Table 6: Breusch-Pagan-Godfrey test

Observed R-squared	10.86382	Probability Chi-Square	0.5406
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Table 7: Jarque-Bera normality test

Jarque-Bera	0.569927	Probability	0.752042
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exports and industrial production with NPLs; whereas CPI is significantly positively associated with NPLs. The macroeconomic variables model fulfills the features of good regression model. The model has high R-squared value of 84%, six out of 9 variables are significant and can explain changes in NPLs jointly, residuals are not serially correlated, residuals are homoskedasticity and residuals are normally distributed.

The significant negative relation between growth in GDP and NPLs suggest that increase in economic growth results in the increase debt paying ability of individuals and firms because of the greater economic activities and earnings of the individuals and firms, consequently resulting in the decline of NPLs. The significant negative association between interest rate and NPLs suggest that because of the high interest rate only those borrower and investors borrow from the banks that have the ability to pay back their loans form future income and earnings of the projects. Similarly, banks also lend only to those individuals and investors that have good credit rating and can pay back the principle and interest. Furthermore, the negative relation between inflation and NPLs suggests that with the inflation the equity value of the banks declines, resulting in the growth of banks riskiness. Banks in order to improve their equity value show short term profitability by extensive lending and cost efficiency by reducing their expenses on loan allocation, monitoring and controlling, which leads to the growth in NPLs.

The positive association of CPI with NPLs suggests that with the reflation, interest rate declines and money supply in the economy increases. The investors and individuals prefer to consume and investment as compared to savings and withholding their investments. Furthermore availability of funds at low rates stimulates individuals and investors to borrow for consumption and investment. The banks also do extensive lending during the low interest rate time. As the interest rate increases in the economy, the low quality borrowers (both individuals and investors) have no income and profit to pay back there loans and defaults leading to the growth in NPLs.

The negative association of exports with NPLs suggests that with the increase in exports, economic activities in the economy increases, resulting in the income growth of individuals and profits of investors. Thus individuals and investors have the funds to repay the loans, resulting in the decline of NPLs. The negative association of industrial production suggests that increase in industrial production increases the earnings of the firms and individuals, resulting in the increase in debt paying ability of individuals and firms.

The findings of the macroeconomic variables have policy related implications for the commercial banks. The commercial banks can use the findings of macroeconomic model to predict changes in the NPLs to take precautionary measures to prevent any financial crisis [3]. The commercial bank can use the performance of economy, interest rate level, inflation rate, CPI, exports and industrial production while extending their lending or allocating loans. The commercial banks can look for the growth in economy while extending their loans or at the time of extensive lending because during the downturn of economy the level of NPLs can increase.

The commercial banks should do regular loans supervision and review of the interest rate charged on the loans because with the increase in real interest rate lending of the banks declines. In order to prevent any bad loan banks should strictly follow standard procedures of credit allocation and lend only to good credit history borrowers in order to prevent NPLs. Furthermore, banks do extensive lending during reflation to utilize the funds but lend also to the low quality borrowers, who defaults when interest increases. Thus banks should not go for extensive lending during reflation in order to prevent the future NPLs; further more banks should follow credit allocation process during allocations of funds.

Finally, banks can lend to the investors during the high exports because of the high economic activities, industrial production and earnings of the individuals but should not lend at the time of low or no exports and low industrial production time period. The SBP should

develop a framework which can include the macroeconomic variables such as GDP growth, real interest rate, inflation, CPI, exports and industrial production to monitor the stability and soundness of the banking sector.

The government can also play important role in improving the level of NPLs in the economy by influencing the macroeconomic variables. For instance, governments can overcome the current energy crisis by starting new power projects to provide regular and low cost power supply and natural gas to the industry, which will result in the increased production, low level of unemployment, economic activities in the economy and high exports. In order to increase the exports of the country government can provide incentives to the manufacturer by developing basic infrastructure, reducing taxes, providing low cost loans and can help exporters in exploring new international markets. The government can increase the economic activities, employment rate, production level and exports by doing special agreements with the neighboring countries for free trade. Recently government has done the free trade agreement with India relating some specific products.

The current study has used nine macroeconomic variables to investigate their impact on NPLs, whereas future studies can use other macroeconomic variables to investigate the NPLs behavior. Few of the variables that can be used in the future studies are gross fixed capital formation [28]; net foreign currency assets [2, 31]; real estate prices [13, 19]; growth in investment and consumption [15]; growth in M2 [15]; imports [15]; output gap [20, 24]; and loan to GDP ratio [23]. The results of such studies will be beneficial for the policy makers, because it can help to anticipate any adverse effect of each variable on the level of NPLs.

The finding of current study and future studies by using above mentioned variables can be helpful in predicting and controlling banking crisis in the country [3]. Furthermore, current study provides the impact of each variable on the NPLs, but does not provide any evidence relating the impact of each variable during banking crisis. Thus future studies can investigate the impact of each variable during the crisis period on NPLs.

The current study used OLS to test the macroeconomic variables, corruption and information sharing; future studies can use the dynamic or advance models to overcome the data related problems and to get more accurate results. This study used data of Pakistan only, therefore the findings of current study are not

applicable in other countries; future studies can use the data of other developing or developed countries or panel of developing and developed countries [2] to investigate the determinants of NPLs. This will facilitate the use of advance panel data models and will provide more detailed, more applicable results on other countries and accurate information relating the impact of macroeconomic variables on NPLs [2, 27].

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