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# Evaluation of the SMEs' Loans in the Iranian Banking System: An Application of a Logit Model

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## Abstract:

One of the main problems of SMEs is how to finance their investments. The role of banks in this regard is crucial, since they can be a type of sources of financing through lending credits directly to SMEs. The key role of the paper thus relies on analyzing the effect of SMEs financing by the Iranian banking system.

The objective of this paper is to determine the influence of loans demanded by the SMEs on finance performance of the various Iranian banks. In addition, it studies the role of other important characters related to lending, bank efficiency, and economic performance in finance to SMEs through the banking system.

It is motivated by the hypothesis that macroeconomic-cyclical indicators and bank-specific variables influence the nonperforming loans in the banking system. This is carried out by an application to a logit model. Our findings indicate that several variables have significant effects on nonperforming loans in the Iranian banking system. Return of asset, equity return, SME loan to total loan ratio, inflation, current asset to current liabilities ratio, total SMEs' loans to total liabilities ratio and total SMEs' loans to total assets ratio have the pronounced significant impacts on nonperforming loans of the Iranian banking. The coefficient of loans to SMEs is significantly positive, which implies that a loan to SMEs increases nonperforming loans method while raising risks to the banking system.

**Keywords:** Small and Medium Enterprises (SMEs), Logit Model, Nonperforming Loans, Banking System.

**JEL Classification:** C35, D22, E51

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## 1. Introduction

The financing of small and medium sized enterprises (SMEs) has attracted great interest from academics and policy-makers around the world. SMEs play an essential role in building a competitive private sector and contributing significantly to employment and economic activity (Ayyagari et al., 2007).

The role of financing is important in supporting small firms. SMEs tend to be more financially constrained than large firms. In particular, SMEs find it difficult to obtain external financing from banks and capital markets given their size and characteristic opaqueness. Banks financing SMEs face financial constraints due to the lack of accurate reliable information on the financial condition and performance of small firms. In particular, banks usually stopped to finance start-ups and young firms, those with insufficient collateral, or firms which demonstrate the possibilities of high returns but at a significant risk of loss. Despite efforts by financial institutions and public-sector bodies to close funding gaps, SMEs continue to experience difficulty in obtaining needed capital (Kravchenko, 2011).

This paper aims to investigate the determinants of nonperforming loans in the Iranian banking sector by Logit model. The dependent variable is defined as the ratio of nonperforming loans to total loans. This paper has used Nonperforming loans as the metrics to assess the vulnerability of the banking system. A rise in non-performing loans will therefore negatively impact the banking system. Consider the following Logit model which describes the determinants of non-performing loans in the Iranian banking system.

The paper is organized as follows: Section 2 presents a lack of finance for SME. Section 3 presents the empirical literature that attempts to define the determinants of nonperforming loan in banking system. Section 4presents the definition of SMEs and how lending condition to SME in Iran. Section 5 discusses the Nonperforming loans deterministic factors in the Iranian banking system. The paper concludes with Section 6.

## 2. Lack of Finance for SMEs

SMEs are essential for sustainable economic growth. In high-income countries, SMEs constitute 67 percent on average of the formal employment in the manufacturing sector. In developing countries, this number is lower at about 45 percent. Similarly, SMEs contribute a sizeable share to formal GDP, 49 percent on average in high-income countries and 29 percent on average in low-income countries.

Empirical research indicates that lack of finance is negatively correlated with SME growth. Access to finance for SMEs remains low. In the World, Only about 32 percent of SMEs had a loan with a financial institution, compared with 56 percent of large firms. Most countries have comprehensive SME finance programs, many of which trace their history to the 1950s and 1960s. Governments around the world have used interest rate subsidies, directed lending, guarantee funds, and a variety of other approaches to get SMEs financed. However, the gap between SMEs and larger businesses remains. With the recent financial crisis, many countries are looking to SMEs to provide much needed jobs, putting SMEs back into the attention of development and political programs (Financial Access, 2010).

Definitions vary greatly across countries, and financial regulators in 68 countries reported that their SME definition is based on number of employees, sales volume, or loan size. Number of employees and sales volume seem to be the most used measures. Often, the definition relies on multiple criteria and depends on the industry. In Pakistan, for example, SME refers to an entity that employs no more than 250 persons in manufacturing or service sectors or 50 persons in the trade sector, as well as sales criteria of up to $590,000 for trade and industry firms, $1.2 million for manufacturing firms, and no more than $3.5 million for any industry of operation. In addition, some countries use alternative criteria such as total assets, fixed assets, and turnover, and another countries report that no official definition exists. Number of employees and sales volume are probably the most perfect parameters to define SME, but this information is not always available. Banks may collect this information at the time of evaluating loan applications but do not keep it in their systems and as a result are not able to report lending volumes. Thus, some countries choose to rely on loan size as a proxy when gathering information on SME finance from financial institutions. Extracting information on loans to firms a certain size and loans to individual entrepreneurs can be a reasonable approximation for SMEs lending volume. High-income countries tend to have higher loan size in their definition of SMEs. Canada, the United States, Estonia, and Australia set the loan value limit for SMEs above $1 million. In the long term, encouraging financial institutions to gather and maintain information on employee numbers and sale volumes will allow for more

accurate monitoring of SME lending. The data may also be useful to banks themselves for segmentation and development of SME scoring models. In the short term, collecting data using loan size criteria as a proxy may provide a reasonable estimate of SME volumes for regulators monitoring (Financial Access, 2010).

## 3. Empirical Literature Review

More recently, the new Basel Accord for bank capital adequacy (Basel II) has seen many analysts focus on the SME segment (see e.g., Schwaiger, 2002; Saurina and Trucharte, 2004; Udell, 2004; Jacobson et al.2005; and Altman and Sabato, 2005; Berger, 2006).The first empirical research on default prediction for SMEs was conducted by Edmister (1972) applying the model on 42 firms consisted of balanced observations. He used balance sheets and profit-loss statements as the only source of information, and found that seven financial ratios were significant as default predictors; the most significant were liquidity and leverage categories.

Demirgüç-Kunt and Detragiache (1998) show that that banks face insolvency due to falling asset values when bank borrowers are unable to repay their debt as a result of adverse shocks to economic activity. Using a multivariate logistic model for a large sample of developing and developed countries during 1980–1994, the authors find that inflation and the real interest rate are positively associated with a banking crisis whereas the GDP has an inverse relationship.

As mentioned before, two World Bank surveys were conducted in recent years as part of an effort to investigate the status of bank lending to SMEs. These surveys share some important common elements, but also have important differences. Both surveys provide some measurement of SME lending, investigate the main drivers and obstacles to further SME lending, the main business models developed and the main risk management techniques adopted, but with different emphasis on each of these components. The two surveys are also based on very different samples, regarding their size, the types of bank surveyed, and the regional coverage. Beck, Demirguc-Kunt and Martinez Peria (2008 and 2009) with 91 large banks in 45 countries provided the basis for two separate studies and an overall assessment of the survey results while the second provides an econometric analysis of the dataset. This survey included a quantitative component, obtain measures of the share of SME loans in total loans, the share of investment loans in SME loans, percentages of applications approved, and loan fees and interest rates. Besides comparing SME lending in developed and developing countries, and investigating drivers and obstacles, the two studies also made comparisons between government, private, and foreign banks.

Schiffer and Weder (2001), and Beck et al. (2005, 2006 and 2008) show SMEs perceive access to finance and cost of credit to be greater obstacles than large firms and these factors affect their growth.

Beck, Demirguc-Kunt and Martinez Peria (2008) show that the average share of SME lending is smaller in developing countries (16 percent of total lending) by comparison with the average share in developed countries (22 percent of total lending). Banks in developing and developed countries are primarily attracted by the potential profitability of the SME sector and serve SMEs primarily through dedicated SME units. Government programs are considered favorable and prudential regulations are not perceived as burdensome. Scoring models are used by most banks but they are just one of the inputs in loan decision. Banks in developing countries report that macroeconomic instability is the main obstacle to SME lending, rather than flaws in the legal and contractual framework. Beck, Demirguc-Kunt and Martinez Peria, 2009, based on the statistical analysis of the dataset concludes that the differences in SME lending between developing and developed countries are actually explained by differences in the quality of the legal and contractual environment (weaker in developing countries). Overall, their analysis suggests that the enabling environment is more important than firm size or bank ownership in shaping bank financing to SMEs.

Altman and Sabato (2007) used data of 2.000 SMEs in the US over the period of 1994-2002 to develop SMEs default prediction model applying logistic regression. They tested ten financial ratios representing liquidity, leverage, profitability, coverage, and activity ratios; which they selected two ratios from each category that were considered as the best predictors for the SMEs default. This research did not consider any possible multicollinearity among financial ratios. Using two-step forward stepwise estimation procedure8, they found some financial ratios as the most significant predictors of SMEs default. Those ratios were EBITDA/Total Assets, Short Term Debt/Book Value of Equity, Retained Earnings/Total Assets, Cash/Total Assets, and EBITDA/Interest Expenses. The optimal logit

model constructed from those five ratios, either using their original or logged values, had higher prediction power than the Altman Z-score model.

De la Torre, Martinez Peria and Schmukler (2009) rely on on-site interviews with 37 banks in Argentina, Chile, Colombia and Serbia. This survey focus on the questions that coveringthe strategic approachto SME lending, business models, and risk management. The authors complement the information from the interviews with a survey by the International Finance Corporation (IFC) across 8 developed and developing countries and annual surveys undertaken 7 countries.

Beck, Demirguc-Kunt, and Peria (2008 and 2009), and De la Torre, Peria, and Schmukler (2010)provided the first measures of the extent of bank lending to SMEs, as well as the drivers and obstacles to further SME lending. These studies were based on two surveys, the first covering 45 developing and developed countries and the second three Latin American countries and one Central European Country. The results of research indicate that most banks increasingly see SMEs as an attractive business, in contrast with the traditional view that SME lending is dominated by small banks and based on relationship lending. However, the studies also show that institutional obstacles to SME lending remain and SME market is still far from saturated.

There is a wide range of default prediction models, i.e. models that assign a probability of failure of credit. The literature on this topic has developed especially in connection with Basel II, which allows banks to set up an internal rating system, which is a system to assign ratings to the obligors and to quantify the associated PDs. As for SMEs, for which market data are generally not available, either heuristic (e.g., neural network) or statistical models can be applied. Beaver (1966) and Altman (1968) first used discriminant analysis (DA) to predict default. In order to overcome the limits inherent in DA (e.g., strong hypotheses on explanatory variables, equal variance covariance matrix for failed and not failed firms), Logit and Probit models have been widely adopted. An important advantage of the latter models is the immediate interpretation of the output as a default probability.

## 4. SMEs Lending in Iran

The term SME refers to the size of company, though the characteristics of a firm does not necessarily adjustment considerably through change in size. But, the firms of various sizes are different in the technology used, the pattern of employment, nature of products, market orientations, regulations and financial resources. Hence, the literature of small units is widespread and it has caused various definitions in different countries occur; these definitions are different according to age structure, demographic and cultural structure and developmental level (Keshavarz, 2005).

In this study, the term small and medium industries refers to the definition mentioned by Ministry of Industries and Mines and Trade in the National Industrial Strategic Development Plan (2006 - 2025), through which, the firms with less than 50 employees are small industries, from 50 to 150 people are medium industries and the enterprises with more than 150 employees are large industrial firms.

There is little unanimity regarding the definition of SMEs in Iran. Various ministries, institutions and organizations connected to SMEs in one way or another have their own criteria to describe, categorize or define SMEs. As defined by the Ministry of Industry and Mines and Trade, the Ministry of Agricultural Jihad, SMEs are (rural) industrial and service enterprises with less than 50 employees, whereas the Ministry of Cooperatives alternately uses the criteria of the Ministry of Industry and Mines, or of the Statistical Office of Iran in defining SMEs. According to the Iranian Statistical Yearbook for 1999, categorizes businesses into four classes, i.e. businesses with 1-9 employees, 10 to 49 employees, 50 to 99 employees, and more than 100 workers. Although this categorization bears some resemblance to the definitions used by the EU, the Statistical Office of Iran only considers businesses with less than 10 employees to be SMEs; all others are regarded as "Large Manufacturing Establishments". Similarly the Central Bank of Iran defines establishments with less than 10 workers as SMEs. By contrast, SMEs in the EU are defined as non-primary enterprises employing less than 250 employees. They are sub-divided into:

- Micro enterprises (0-9 employees)
- Small enterprises (10-49 employees); and
- Medium-sized enterprises (50-249 employees).

In addition, their turnover should be less than € 40m. With a balance sheet total of less than € 27m.; finally they should be economic independent, i.e. more than 50% privately owned. (Iran Strategy Document, 2003)

This section provides a role of SMEs in Iran with regard to various important variables. Activities of SME in Iran show that 98.4% of all businesses are micro enterprises with 1-9 employees, whereas the total of small businesses with 10-49 employees amounts to only 1.42%. There is an imbalance between the large number of micro enterprises and the marginal number of small and medium sized businesses. It may be noted that the absence of a reasonable number of medium-sized enterprises, which amounting to only 0.1% of the total number of enterprises, is negatively affecting Iran's ability to produce for the export market.

The Bank of Industry and Mines, which is the major financial agency for SMEs, provides financial standing of such firms. An analysis of the allocation of the loans, other financial facilities and business services provided by this bank suggested that these services were provided primarily to enterprises with a good market and growing sales. The volume of loans of Bank of Industry and Mines to pay to SMEs has increased continuously since 1996/97. Most of the loans went to the metalworking industries (33%), with the chemicals (21%) and food (19%) industries also receiving substantial shares. Importantly, moreover, 67% of the loans provided by the Bank of Industry and Mines went to small industrial enterprises (employing 10 to 49 workers), while a further 23% went to micro enterprises. Medium sized businesses only received 10% of the total volume. As it is the bank's policy to provide loans to profitable companies with a good market share, it follows that small sized businesses perform to be more profitable than medium sized companies.

Based on the executive by law for supporting the expansion of SMEs, the end of 2007/08, 573,913.8 Rls. billion projects were referred to banks, 263,149.0 Rls. billion were approved. 45.3 percent were related to enterprises with less than 10 employees and 54.7 percent to enterprises with 10 to 49 employees. Total loan paid out of this source 168,819.9 Rls. billion in the end of 2007/08. Among the sectors, manufacturing and mining, with 49.2 percent, had the highest share in receiving these loans. Comparing the 2007/08 with 2006/07 discloses that 247,889 Rls. billion projects were referred to banks, 128,407 Rls. billion were approved. In this year, 94,556 Rls. billion loans were extended which will create 693,364 job opportunities. The share of SMEs as allocated by the CBI remained relatively unchanged at 467,680 Rls. billion in the end of 2009/10. The government stabilization policy measures, the lack of availability of funds for some projects, limitation of banks' loans, high overdraft of banks from CBI, and large amount of banks credit debts were the reasons behind the freezing of SMEs' facilities. In this year, the value of projects denoted to banks show that 4.8 and 5.5 percent increase, compared with end-2008/09 (Central Bank of Iran, 2009).

The share of SMEs as allocated by the Central Bank remained unchanged at 467.7 Rls. trillion till March 2011. The government stabilization policy measures, the lack of availability of funds for some projects, limitation of banks' loans, high overdraft of banks from the Central Bank, and large amount of arrears were the reasons behind the freezing of SMEs' loan. In March 2011, the value of projects referred to banks was 672.4 Rls. trillion, of which 312.1 Rls. trillion projects were approved, indicating 6.4 and 5.0 percent increase compared with the previous yearend. Outstanding facilities paid by banks increased 9.7 percent to 250.8 Rls. trillion, with each employment opportunity enjoying 141.1 Rls. million. Meanwhile, the non-performing loans of banks increased 39.7 percent (Annual report, Central Bank of Iran, 2011and Figure 1).

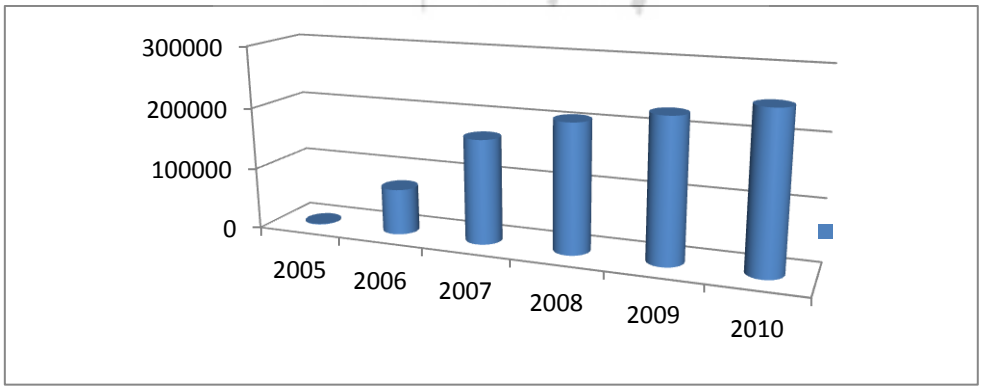


**Figure 1: Bank Loans to SMEs in Iran**

*Source*: Authors

## 5. Data and Models

Financial institutions typically cover expected losses through appropriate provisioning) is sensitive to macroeconomic, cyclical, financial markets and bank-related factors. Therefore, the variables' selection for the empirical part of the study is based on the indicators presented in related studies to ensure comparability of results. The dependent variable is defined as the ratio of nonperforming loans to total loans. Several studies have used Nonperforming loans, loan loss provisions, or composite indices as the metrics to assess the vulnerability of the financial system over time.

We start our model specification from the premise that banks dominate and directly influence the banking through changes in lending practices. A rise in non-performing loans will therefore negatively impact the banking. Consider the following linear model which describes the determinants of non-performing loans in the Iranian banking.

$$y_{it} = \beta_1 + \sum_{j=2}^{k} \beta_j x_{jit} + \alpha_i + \varepsilon_{it}$$

where $y_{it}$ is the ratio of bank *i*'s non-performing loans at year *t* to total loans at year *t-1*. $B_1$ is the intercept, and $B_j$ is the vector of coefficients $\beta_2$ to $\beta_k$. $X_{jit}$ is the vector of explanatory variables of bank *i* at year *t*. $\varepsilon_{it}$ in the model is the error term which will capture any variations in the model that cannot be observed to independent variables used in the equation. The variables are converted into natural logarithmic form. We specify a logistic model to establish a relationship between the binary outcome variable *Y* and the set of explanatory variables.

$$logit(y) = ln\frac{p_i}{1-p_i} = \beta_1 + \sum_{j=2}^{k} \beta_j x_{jit} + \alpha_i + \varepsilon_{it}$$

where the odds ratio is equal to $\frac{p_i}{1-p_i}$

$p_i$ is the probability that stands for $Y = 1$ i.e. the probability of financial stability, subject to the impact of independent variables *X*, while 1 - *pi* is the probability of being $Y = 0$, standing for the probability of financial crisis. An alternative formulation of the probability of financial stability as specified in Equation (2) is:

$$pi(yt = (1|x)) = \left(\frac{\exp\left(\beta_1 + \sum_{j=2}^{k} \beta_j x_{jit} + \alpha_i + \varepsilon_{it}\right)}{1 + \exp\left(\beta_1 + \sum_{j=2}^{k} \beta_j x_{jit} + \alpha_i + \varepsilon_{it}\right)}\right)$$

Consistent with the large number of studies discussed above, we choose fourteen accounting ratio categories describing the main aspects of a company's financial profile: Δloans to SMEs % , facility revenue to income, return on asset, return of equity, SMEs' loans to total loans, total loan to total asset, total liabilities to total asset, Inflation rate, total deposits to total asset, current asset to current liabilities, SMEs' loans to deposit, total SMEs' loan to total liabilities and total SMEs' loans to total assets (See Table1).

**Table1: Model variables and the related ratios**

| Variables and ratios | Code |
|---|---|
| Δloans to SME (%) | ΔLSME |
| Facility revenue to income | Facility Rev. Income |
| Return on asset | ROA |
| Return of equity | ROE |
| SMEs' Loan to total loans | LSME.Tloan |
| Total loan to total asset | Tloan.Asset |
| Total liabilities to total asset | Liabilities.Asset |
| Inflation rate | Inflation |
| Total deposits to total asset | Deposit.Asset |
| Current asset to current liabilities | CAsset.CLiabilities |
| Loan SMEs to deposit | LSME.Deposit |
| Total loan SMEs to total liabilities | LSME.Liabilities |
| Total loan SMEs to total asset | LSME.Asset |

*Source*: Authors

The coefficients in Equation (1) serve a completely different role to the coefficients in Equation (2). In Equation (1), the coefficients indicate the extent of changes in non-performing loans given unit increases in any of the corresponding independent variables i.e. the linear model predicts the value that $y_{it}$(non-performing loans to total loans) should take. In Equation (2), the coefficients indicate an increase in the probability of a financial crisis

given a unit increase in independent variables at time *t*. $\beta 1, \beta_2 \ldots \beta_k$ are parameters that can be estimated by maximum likelihood method i.e. the logistic model predicts the probability of *Y* taking a specific value.

Table 1 exhibits a set of variables as explanatory variables used by this paper. Dependent variable is defined as the risk and financial instability in banking system. Furthermore, the risk and financial instability explain non-performance loans (NPL) in banking system in our model. In the first model, we estimate the model with ten variables (Equation 1). The second step, we develop the model by adding the four variable in Equation 2.

$$\begin{aligned} logit(y) &= ln\frac{p_i}{1-p_i} \\ &= \beta_0 + \beta_1 LSME \\ &+ \beta_2 2FacilityRev.Income + \beta_3 ROA \\ &+ \beta_4 ROE + \beta_5 LSME.Tloan \\ &+ \beta_6 Tloa.Asset + \beta_7 Liabilities.Asset \\ &+ \beta_8 Inflation + \beta_9 Deposit.Asset \\ &+ \beta_{10} CAsset.CLiabilities \end{aligned} \quad (1)$$

and

$$\begin{aligned} logit(y) &= ln\frac{p_i}{1-p_i} \\ &= \beta_0 + \beta_1 LSME \\ &+ \beta_2 2FacilityRev.Income + \beta_3 ROA \\ &+ \beta_4 ROE + \beta_5 LSME.Tloan \\ &+ \beta_6 Tloa.Asset + \beta_7 Liabilities.Asset \\ &+ \beta_8 Inflation + \beta_9 Deposit.Asset \\ &+ \beta_{10} CAsset.CLiabilities \\ &+ \beta_{11} TLoan.Asset + \beta_{12} LSME.Deposit \\ &+ \beta_{13} LSME.Liabilities + \beta_{14} LSME.Asset \end{aligned} \quad (2)$$

## 6. Results

First, we run the logistic regression using the variables that defined and Wald test for each of the predictors is statistically significant. The Wald test is a way to test whether the parameters associated with a group of explanatory variables are zero, or not. The results display that the model is used to understand whether using an appropriate statistical technique (in this case the logic regression), is statistically significant (P-value equals to 0.038).

Also the Log-likelihood test is statistically significant, that is, we can argue that there is a significantly strong relationship between the selected predictors and the default event. The Log-likelihood test is used to ascertain whether all the parameters together are useful to estimate the dependent variable. It is comparable to the multivariate F-Test in the linear regressions (or MDA) and it is also often used to compare the fit of different models.

Table 2 shows coefficient values and Wald statistics that indicates significance at the 1% level. The likelihood ratio test is significant at the 1 % level; Cox &Shell R Square is 68%.

**Table2: Significance of the Model**

| | Wald Statistic | Sig. |
|---|---|---|
| Constant | 3.002 | 0.08 |
| | Log likelihood | Cox & shell R Square |
| Step 1 | 76.58% | 68% |

*Source*: Authors

Table 2 presents the overall test statistics for the estimated logit model. The likelihood ratio test is statistically significant at the 1% level; Cox & Snell R Square is 68%. The performance of the estimated logit model can also be evaluated according to the classification achievements. Considering the cutoff point as 0.500, our null hypothesis is that a bank will fail, and the alternative hypothesis is that it will not fail. The summary of the classification results are presented in Table 3. Here, overall classification accuracy is very high (73%).

**Table3: Classification results for the sample**

| Actual observed | Predicted | | |
|---|---|---|---|
| | Non failure (1) | Failure (0) | Percentage correct |
| Non failure (1) | 0 | 4 | 0% |
| Failure (0) | 0 | 11 | 100% |
| Overall percentage | | | 73% |
| The cut value is 0.5 | | | |

*Source*: Authors

We estimate the Equation 1 with including ten explanatory variables: loans to SMEs, facility revenue to income ratio, return of asset, return of equity, loans to SMEs to total loans, total loans to total asset ratio, total liabilities to total assets ratio, inflation, total deposits to total asset ratio, and the ratio of current assets to current liabilities. In practice, we run the model 1 in the form of logit regression, while the results are reported in the Table 3.

$$ogit(y) = ln\frac{p_i}{1-p_i}$$
$$= \beta_0 + \beta_1 LSME + \beta_2 2FacilityRev.Income$$
$$+ \beta_3 ROA + \beta_4 ROE + \beta_5 LSME.Tloan \quad (l1)$$
$$+ \beta_6 Tloa.Asset + \beta_7 Liabilities.Asset$$
$$+ \beta_8 Inflation + \beta_9 Deposit.Asset$$
$$+ \beta_{10} CAsset.CLiabilities$$

**Table 4: The Results of Estimation of Equation 1**

| Variables | Code | score | sig |
|---|---|---|---|
| Δloan to SMEs | Per.LSME | .626 | .429 |
| Facility revenue to income ratio | Facility Rev. Income | .019 | .890 |
| Return of asset | ROA | 12.160 | .000 |
| Return of equity | ROE | 11.777 | .001 |
| SMEs' Loans to total loans | LSME.Tlending | 5.064 | .024 |
| Total lending to total asset ratio | Tlending.Asset | 1.404 | .236 |
| Total liabilities to total asset ratio | Liabilities.Asset | .016 | .900 |
| Inflation | Inflation | 3.139 | .076 |
| Total deposits to total asset ratio | Deposit.Asset | .771 | .380 |
| Current asset to current liabilities ratio | CAsset.CLiabilities | 9.839 | .002 |

*Source*: Authors

The results demonstrate that the significant variables are return of asset, return of equity, SMEs loans' to total loan ratio, inflation and current asset to current liabilities ratio. These ratios affect non-performing loans in banking system. According to the empirical results, return on asset and return on equity have influenced significantly non-performing loans. Inflation has had an effect on non-performing loans delivered to the Iranian SMEs. Hence, it implies various risks on finance to SMEs due to a higher rate of inflation in Iran. The share of SMEs' loans to total loans indicates that an increase in loans to SMEs can lead to an increase in volumes of non-performing loans. The ratio of current assets to current liabilities measured ability of pay-back of such liability. According to the results, the relevant ratio has indicated an effect nonperforming loans.

In the second step, we estimated the Equation 2, adding four variables to explain SME's nonperforming loans. Table 4 reports the estimated coefficients and significance levels of variables that we used them in Equation 2.

$$logit(y) = ln\frac{p_i}{1-p_i}$$
$$= \beta_0 + \beta_1 LSME + \beta_2 2FacilityRev.Income$$
$$+ \beta_3 ROA + \beta_4 ROE + \beta_5 LSME.Tloan$$
$$+ \beta_6 Tloa.Asset + \beta_7 Liabilities.Asset \quad (2)$$
$$+ \beta_8 Inflation + \beta_9 Deposit.Asset$$
$$+ \beta_{10} CAsset.CLiabilities$$
$$+ \beta_{11} TLoan.Asset + \beta_{12} LSME.Deposit$$
$$+ \beta_{13} LSME.Liabilities + \beta_{14} LSME.Asset$$

**Table 5: The Results of Estimation of Equation 2**

| Variables | Code | Coef. | Sig. |
|---|---|---|---|
| Percent of Changes in loan to SMEs | Per. LSME | .626 | .429 |
| Facility revenue to income ratio | Facility Rev. Income | .019 | .890 |
| Return of asset | ROA | 12.160 | .000 |
| Return of equity | ROE | 11.777 | .001 |
| loan SME to total loan | LSME. Tlending | 5.064 | .024 |
| Total loan to total asset ratio | Tlending. Asset | 1.404 | .236 |
| Total liabilities to total asset ratio | Liabilities. Asset | 0.016 | 0.900 |
| Inflation | Inflation | 3.139 | 0.076 |
| Total deposits to total asset ratio | Deposit. Asset | 0.771 | .380 |
| Current asset to current liabilities ratio | CAsset .CLiabilities | 9.839 | .002 |
| loan SME to deposits | LSME. Deposit | 0.644 | 0.422 |
| Total loan SME to total liabilities ratio | LSME. Liabilities | 12.656 | 0.000 |
| Total loan SME to total asset ratio | LSME .Asset | 12.651 | 0.000 |

*Source*: Authors

According to estimates obtained through estimation process of model 2, total SMEs' loans to total liabilities and total SMEs' loans to total assets are statistically significant. The ratio of total SMEs' loans to total assets implies volumes of SMEs loans to total assets in banking system affecting significantly nonperforming loans. It is thus evident that if the volumes of loans to SMEs increase, the probability of default loan increases. The variable of total SMEs' loans to total liabilities affects non-performing loans by long term and short term deposits in banking system. Loans to SMEs increase the probability of default loan by explicit deposits in banking system.

The significant variables which affect significantly non-performing loans have been shown in Table 5. The results show that eight variables have significant effects on nonperforming loans. There are return of asset, return of equity, the share of loans to SME to total lending in banking networks, inflation, current assets to current liabilities ratio, the ratio of total lending to SMEs to total liabilities, and the share of total lending to SMEs to total asset ratio, which affect significantly non-performing loans to SMEs by the Iranian system.

**Table 6: The Final Results of Model Estimation**

| Variables | Coef. | Prob. |
|---|---|---|
| Constant | -140.11 | .000 |
| Return of asset | 8.5 | .000 |
| Return of equity | 7.7 | .001 |
| Loan SME to total loan | 461.38 | .024 |
| Inflation | 3.22 | .076 |
| Current asset to current liabilities ratio | -1.3 | .002 |
| Total lending to SME to total liabilities ratio | 219.11 | .000 |
| Total lending to SME to total asset ratio | 206.78 | .000 |

*Source*: Authors

From Table 6, as expected, current asset to current liabilities ratio has negative effect on nonperforming SMEs loan, while return of asset, return of equity, SMEs' loan to total loan, Inflation total lending to SMEs to total liabilities ratio and total lending to SMEs to total asset ratio have positive effects on nonperforming loan. However, the negative effect implies that SMEs with lower liquid assets or higher liabilities will have higher probability of default, while the positive effect indicates that SMEs with higher quantity loan that measured with ratios will have higher probability of default.

We have also investigated the linearity between variables of Model with running the ANOVA test and with statistic Chi-square shown in Table 7.

**Table 7: the Results of ANOVA Test**

| ANOVA Test | Chi-square | Sig. |
|---|---|---|
| Step | 17.397 | .004 |
| Block | 17.397 | .004 |
| Model | 17.397 | .004 |

*Source*: Authors

According to Table 6, the results represent the test of the estimated coefficients of the logit model. Overall, all of the coefficients of the estimated logit model are statistical significant, implying the rejection of linearity relationship between dependent variables.

## 7. Conclusion

Based on the results obtained, SMEs' loans to total liabilities and total SMEs' loans to total assets were significant in the Iranian banking system, explaining the nonperforming loans. This implied in fact SMEs' loans increased the probability of default loans by observable deposits in the banking system.

According to the results, asset and equity, the ratio of total lending to SMEs in banking networks, inflation, the ratio of current assets to current liabilities, the share of total SMEs' lending to total liabilities and total SMEs' lending to SMEs were other indicators, which explained significantly the Iranian SMEs' nonperforming loans in different way.

The ratio of current assets to current liabilities had negative effect on non performing loans; while returns of assets, returns of equities, SMEs' loans to total loans, Inflation and the ratio of SMEs' total lending to SMEs to total assets had positive effects. The indirect effects imply that SMEs with lower liquid assets or higher liabilities should have higher probability of default, while the positive effects indicate that SMEs with higher quantity loans that measured by ratios should have higher probability of default. The significance of current asset to current liabilities ratio as SMEs default predictors is indeed consistent with the previous studies done by Edmister (1972) and Altman & Sabato (2007), although the number

of significant explanatory determinants have been different from those of previous studies.

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