

Financial Soundness Indicators with Emphasis on Non-performing Loans in Iran's Banking System

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Abstract

This paper analyzes the financial soundness indicators in Iran's banking system. In the first part it emphasis on asset quality measure by the non-performing loans ratio. The non-performing loans grew rapidly in last decade in Iran's banking system and it reached higher than 25 percent of total loans in 2010. We conclude that NPLs increase have impact on real part of economy in the concept of credit crunch and bank lending decline when NPLs exceeds a specific level of total loans. This paper also analyzes the relationship between three financial soundness indicators (asset quality, capital adequacy and profitability) and key macroeconomic, bank-specific, and structural variables. The results show that asset quality and capital adequacy are influenced by business cycle. Lending interest rate over two previous years has a negative effect on asset quality. Capital adequacy is affected by short term deposit interest rate and changes in the exchange rate. Profitability fluctuates with inflation rate and NPLs ratio.

Keyword: financial soundness indicators, non-performing loans, capital adequacy, profitability, credit crunch

JEL Classification: G21, G33

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1. Introduction

Financial soundness indicators (FSIs) were introduced after financial crisis in the late 1990s. FSIs provide better tools to assess the strengths and vulnerabilities of financial system. In 2001 the IMF Executive Board endorsed a list of core and encouraged Financial Soundness Indicators. IMF and World Bank have promoted the measurement and use of FSIs, particularly in the context of the Financial Sector Assessment Program (FSAP).

There are many studies which analyze the determinations of banking crises and they focus on the endogenous relationship between macroeconomic indicators and the financial sector¹. Some other empirical works focus on the relationship between macroeconomic variables and indicators of financial instability, in the period of time including the time of banking crises, over a sample of countries (but not necessarily limited to crisis time)². Rita Babihuga (2007) analyzes the relationship between selected macroeconomic and financial soundness indicators (FSIs) using a newly assembled panel dataset of FSIs for 96 countries covering the period 1998-2005. This analysis shows that FSIs fluctuate strongly with both the business cycle and the inflation rate. Short term interest rates and the real exchange rate also emerge as important determinants.

One of the most important financial soundness indicators is asset quality and usually in the literatures it is measured by the NPLs ratio and the first part of this paper is focused on NPLs ration in Iran`s banking system. The banking system in Iran has faced rapid growth of non-performing loans over the past decade. According to official statistics, from 2004 NPLs raised well

1. Caprio and Klingebiel (1996), Gonzalez-Hermasillo, Pazarbasioglu and Billings (1997), Demircuc-Kunt and Detragiache (1998), Eichengreen and Rose (1998), Hardy and Pazarbasioglu (1998) and Kaminsky (1999) consider the role of macroeconomic variables in explaining specific time of banking crises.

2. Radelet and Sachs (1998), Chang and Velasco (1998) consider the adverse consequences of macroeconomic stabilization on a weak financial sector.

over 10 percent of total loans and in 2010 it reached up to 50 billion dollars (more than 25 percent of total loans).

There are many empirical evidences showing that the percentage of non-performing loans is often associated with bank failures and also financial crisis¹. In the case of Iran, NPLs growth had no explicit sign of turmoil on banking sector (or creates no bank runs) because of the government supports. However it can be early sign of serious vulnerability in banking indicators that is to say to bring a serious challenge about banks management and asset quality in Iran. Moreover, when NPLs increase, the real economy can be affected through the context of the credit crunch. This paper shows that the deterioration of balance sheets acted to reduce bank lending when NPLs exceeds a specific level of total loans in Iran.

This paper also focuses on three financial soundness indicators (FSIs), asset quality, capital adequacy and profitability. FSIs are modeled as a function of bank specific, macroeconomic and structural variables in Iran during the period 1979-2009. The core FSIs reflect asset quality and are measured by the ratio of non-performing loans, capital adequacy (the ratio of capital to assets), and profitability (the return on assets, ROA). In fact this paper tries to show which factors among the bank-specific, macroeconomic and structural variables determine the FSIs in Iran.

We found that the cyclical component of real GDP has a positive relationship with capital adequacy and asset quality. Inflation, imports, and management instability have also significant and positive effect on non-performing loans. Loans interest rate over the previous two years has a negative effect on NPLs. The changes in exchange rate have a negative effect on capital adequacy. NPLs and deposit interest rate have a negative and significant effect on profitability.

Section II is divided in five parts; 1. NPLs definition, 2. The determinant of NPLs, 3. NPLs in Iran's banking system, 4. NPLs and banking crisis, and

1. A. Demirgüç-Kunt and E. Detragiache (2005).

5. The effect of NPLs in real economy. Section III discusses empirical methodology and estimation results of three financial soundness indicators. Section IV is the conclusion.

2. Non-performing Loans

2.1. Definitions of NPLs

Non-performing loan is defined as a loan that is not earning income when the bank can no longer anticipate the full payment of principal and interest which are past due by 90 days or more, or at least 90 days of interest payments have been capitalized, refinanced or delayed by agreement. According to IIF and BIS¹ report NPLs are categorized:

- Substandard: Payment in doubt (over due by more than 3 months up to 6 months). Banks make 10% provision for the unsecured portion of loans.
- Doubtful: Payment improbable (over due by more than 6 month to 1 year). Banks make 50% provision for doubtful loans.
- Loss: Virtually uncollectable (over due by more than 1 year). Banks make 100% provision for loss loans.

This classification is based on the BIS documents and this system has been changed over different countries and they chose other approaches to classify their loans. Some countries are shortening the period for unpaid loans when they become past due, in order to prevent the losses starting to aggravate.

In Iran the loans classification has been made in four levels; passed, matured loans (over due more than 2 months to 6 months), substandard (principal and interest loan become past due more than 6 months to 18 months) and doubtful loans (principal and interest loan become past due more than 18 months). The two last levels are considered as non-performing loans

1. Institute of International Finance and Bank for International Settlements

and as we can see, in Iran, non-performing loans classification is less rigid from the BIS criteria.

2.2. The Determinants of NPLs

There are many literatures in order to analyze the determinants of NPLs in different countries. Keeton and Morris (1987) examine the losses by 2,470 insured commercial banks in the United States (US) over the period 1979-85. They find that local economic conditions along with the poor performance of certain sectors explain the variation in loan losses recorded by the banks. The study also reports that commercial banks with greater risk appetite tend to record higher losses.

In 1991, Sinkey and Greenwalt investigate the loan loss-experience of large commercial banks in the US from 1984 to 1987. They argue that both internal and external factors explain the loan-loss rate (defined as net loan charge offs plus NPLs divided by total loans plus net charge offs) of these banks. They show a significant positive relationship between the loan-loss rate and internal factors such as high interest rates, excessive lending, and volatile funds. Keeton (1999) analyze the impact of credit growth and loan delinquencies in the US from 1982 to 1996. It shows a strong relationship between credit growth and impaired assets. This paper finds that rapid credit growth, associated with lower credit standards, contributed to higher loan losses in certain states in the US. Bercoff et al. (2002) study the fragility of the Argentinean Banking system over the 1993-1996 period and they find that NPLs are affected by both bank specific factors and macroeconomic factors. Salas and Saurina (2002) investigate the determinants of problem loans of Spanish commercial and saving banks covering the period 1985-1997. They find that real GDP growth, rapid credit expansion, bank size, capital ratio and market power explain variation in NPLs. Moreover, Jimenez and Saurina (2005) study the Spanish banking sector from 1984 to 2003. It provides evidence that NPLs are determined by GDP growth, high real

interest rates. In commercial banks in India, meanwhile, Rajan and Dhal (2003) use panel regression analysis and they show that macroeconomic conditions which is measured by GDP growth and financial factors (such as maturity, cost and terms of credit, banks size, and credit orientation) have significantly impact on NPLs. Inaba et al. (2003)¹ examine the interrelationship between the increase in NPLs and real economic performance in Japan since the 1990s. This study shows that the deterioration in firms balance sheets due to the collapse of land prices was responsible for the increase in NPLs and they argue that the increase in NPLs, in its turn, distorted real economic performance via malfunctioning in the banking sector. Both a credit crunch and forbearance lending took place, and these caused a decline, through the banking sector, in the efficiency of economic resource allocation. For several Sub-Saharan African countries, Fofack (2005) attributes the strong association between the macroeconomic factors and non-performing loans to the undiversified nature of some African economies. The result shows that economic growth, real exchange rate appreciation, the real interest rate, net interest margins, and inter-bank loans are significant determinants of NPLs in these countries. Hu et al. (2006) examine the relationship between NPLs and ownership structure of commercial banks in Taiwan covering the period 1996-1999. They show that banks with higher government ownership recorded lower non-performing loans. Khemraj and Pasha (2009)² attempt to ascertain the determinants of non-performing loans in the Guyanese banking sector. They find that the real effective exchange rate has a significant positive impact on non-performing loans. This shows that an appreciation in the local currency leads to higher non-performing loan portfolios of commercial banks. They show that GDP growth is inversely related to non-performing loans and banks with relatively

1. Nobuo, Inaba, Takashi Kozu, Takashi Nagahata, and Toshitaka Sekine (2003) Non-performing Loans and the Real Economy: Japan's Experience, presented at the BIS Central Bank Economists Meeting, October 2003.

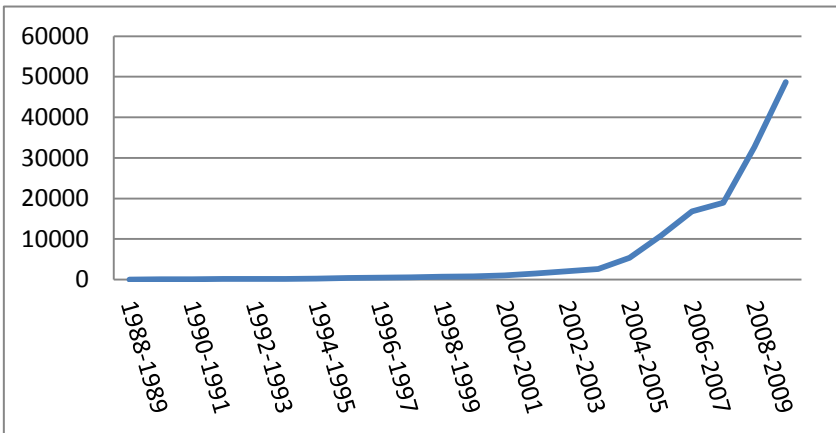
2. Tarron, Khemraj, and Sukrishnalall Pasha, (2009).

higher interest rates and excessive lending is likely to incur higher levels of non-performing loans.

2.3. NPLs in Iran's Banking System

Non-performing loans growth accelerated to 104 percent in 2004-05 from 30 percent in 2002-03 and it reached 50 billion dollars in 2009-2010 (figure 1, 2). The growth of NPLs in Iran in last five years was around 70 percent and it has exceeded to more than 10 percent of total loans between 2004 -2006. As we can see, the accumulation of NPLs is still high and NPLs maintain its upward trend.

Figure 1: Non-performing Loans

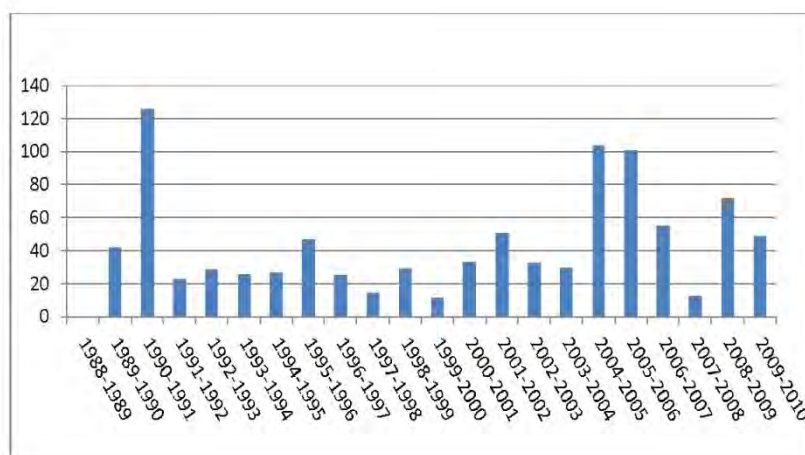


2.4. Non-performing Loan and Banking Crisis

The direct consequence of large amount of NPLs is banks failure. In fact the asset quality is a statistically significant predictor of insolvency (e.g. Dermirguc-Kunt, 1989; Barr and Siems, 1994). The failing banking institutions always have high level of non-performing loans prior to failure (Hou, 2007). Even if the exceed of NPLs above the critical point doesn't lead to bank failure, there is negative relationship between the non-performing

loans and performance efficiency [Kwan and Eisenbeis (1994), Hughes and Moon (1995), Resti (1995)].

Figure 2: Non-performing Loans Growth (%)



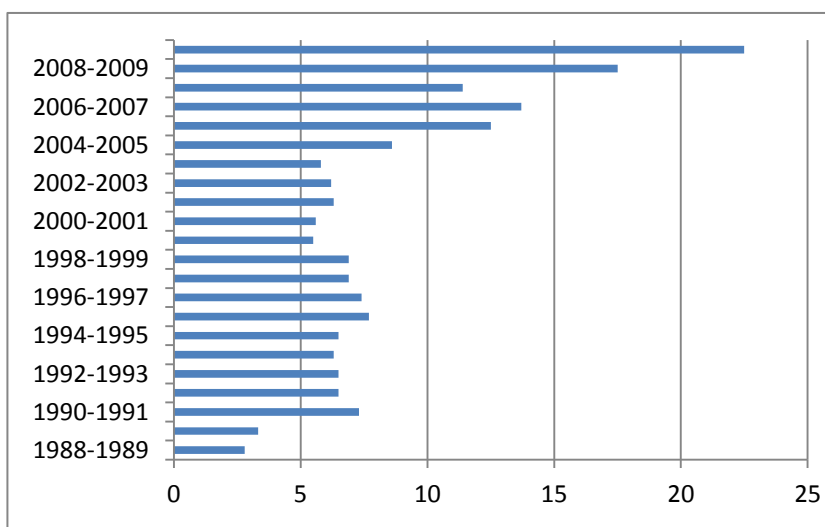
The beginning of a banking crisis can be indicated by two types of events, I) bank run lead to closure, and II) there is no bank run but there is merging, takeover or large scale government assistance to financial institute.¹ Demirguc-Kunt and Detragiach (2005) present two other conditions as single of banking crisis; when the ratio of non-performing assets to total assets in the banking system exceeded 10 per cent and the cost of the rescue operation was at least 2 per cent of GDP.

Other literatures also widely accept that the percentage of NPLs is often associated with bank failures and financial crises in the developing and developed countries. In East Asia and Sub-Saharan African countries high non-performing loans lead to several financial and banking crises. The recent financial crisis in United State was also attributed to the rapid default of sub-prime loans/mortgages.

1 .Reinhart and Kaminsky (1999).

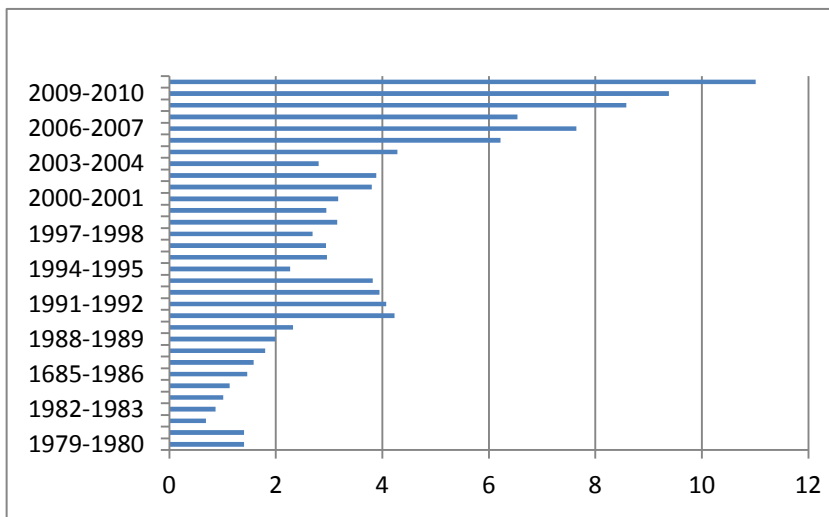
In order to determine the banking crisis, many studies focus on the role of the macroeconomic variables and its impact on banking system.¹ Some studies analyze the banking crisis through the link between macroeconomic variables and financial soundness indicators. Cihak and Schaek (2005) integrate financial soundness indicators in an early warning model of banking crises to assess if FSIs may have impact in predicting banking crises.² As we can see in figures 3 and 4, in Iran, non-performing loans to total loans has been exceeded from 10 percent in 2003-04, and NPLs to total asset has been exceeded from 10 percent in 2008-09.

Figure 3: Non-performing Loans to Total Loans



1. Caprio and Klingebiel (1996), Gonzalez-Hermasillo, Pazarbasioglu and Billings (1997), Demircuc-Kunt and Detragiache (1998), Eichengreen and Rose (1998), Hardy and Pazarbasioglu (1998) and Kaminsky (1999).

2. Podpiera (2004), Wong (2005) and Cihak et al. (2005).

Figure (4) Non-performing Loans to Total Assets

NPLs increase seems to have no great impact such as bank run or merging in Iran s banking system, but it cans show the fragility of banking system and the lack of efficient banking supervision. Consequently it s important to analyze NPLs because it can be considered as an indicator of financial vulnerability and can be a good sign for the future turbulence in banking system.

2.5. Effect of NPLs on Real Economy

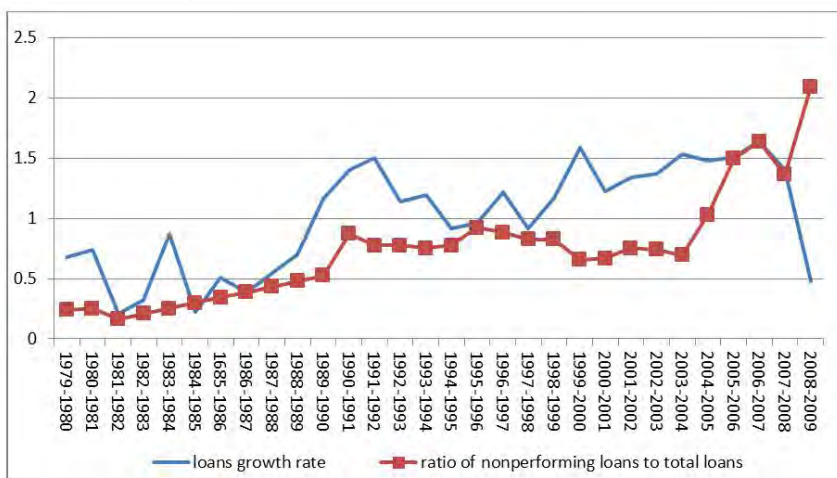
Non-performing loans can cause economic stagnation problems. NPLs growth in the real economy can be sign of unprofitable or inefficient enterprises, hence the sign of improvement in economic situation could be decline of NPLs. Otherwise, if NPLs increase, the resources are locked up in unprofitable sectors and consequently it has a negative impact on the economic growth and decline the economic efficiency (Hou, 2007).

Credit crunch could establish a link between NPLs and real part of economy. In this situation, banks don't accept to take new risks and credit crunch could happen. A credit crunch is a disequilibrium phenomenon and it leads to credit rationing where loans are allocated via non-price mechanism. If this situation continues, eventually, it could impose additional pressure on the performance of the monetary policy.

The theoretical models try to explain the conditions that banks squeeze their credits. Krueger and Tornell (1999) analyze the credit crunch in Mexico after the 1995 crisis. They argue that banks with bad loans reduce their capacity to provide fresh fund for new projects. Krugman (1998) and Kobayashi and Kato (2001) show that a change in bank's risk preferences makes them softer about providing additional loans. Agung et al. (2001) use the macro and micro panel data analyzes to study credit crunch in Indonesia after the crisis. They show that credit crunch happened in August 1997, one month after the contagion effects of the exchange rate turmoil in Thailand spreading to Indonesia. Sakuragawa (2002) argues that a bank without sufficient loan loss provision has an incentive to cover its true balance sheet in order to assure the minimum capital requirement. Hou (2007) uses the threshold regression technique on the large panel data set of commercial banks from 19 countries. He found that there are some evidences that NPLs have non-linear effects on banks lending behavior.

In general, NPLs increase makes the banks to decrease their lending and decline their asset with higher risk. Consequently, this situation has direct impact on investors who need fund in order to develop their business, and then has indirect impacts on economic growth.

In Iran even the NPLs has been exceeded more than 10 percent of total loans in the past few years and it seems necessary to analyze whether NPLs have negatively affected banks.

Figure 5: Loan Growth and NPLs (normalized)

Between 1977 and 2005 the trend of the NPLs to total loans and the trend of credit growth are smooth and almost change in the same direction. After 2007-2008 this trend has been changed. From 1990 to 2007 the average credit growth rate was more than 32 percent. This rate have started to decline after 2007- 2008 and it decreased to 12 percent in 2009.

The empirical model is specified to capture the credit supply side factors. Normally, the supply of loans is determined by banks lending capacity and factors that influence banks willingness to provide credit. In this paper, non-performing loans are also taken into consideration. Based on credit crunch view, the NPLs should have a negative effect on loans, implying that the higher NPLs in a bank portfolio, the less credit that the bank can and is willing to supply.

In order to see whether the NPLs can cause any lending squeeze, we study the Iran s banking system balance sheet. In the balance sheet, assets are mainly composed of commercial loans and other earning assets; while on the liability side, deposits and capital are the main components. Thus, the loan growth is affected by deposit, capital and other earning assets growth and also non-performing loans to total loans.

Before estimation of the model we use the granger causality test in order to see whether NPLs is useful to determined banking loans.

Sample: 1979-2009			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Probability
NPL does not Granger Cause Loans growth	30	3.55170	0.04807
Loans growth does not Granger Cause NPL		0.30037	0.74318

Simple test using NPLs and loans growth show that the null hypothesis is rejected in the first row and it would seem that values of NPLs help to predict loans growth rate.

In order to analyze the role of NPLs on real part of economy and to check for the credit crunch in Iran`s banking system, we adopt combination of the framework used by Hou et al. (2007) and Inaba et al. (2005). The basic model is as follows:

$$Lgr = \alpha_1 + \alpha_2 D + \alpha_3 OEA + \alpha_4 NPL^2 + \alpha_5 NPL + \alpha_6 Ir + \alpha_7 C$$

Lgr is the loan growth rate, D is the deposit growth rate, C is the capital growth, OEG is the other assets growth rate, Ir is the weighted rate of loans according to their allocations to different sectors and NPL is the ratio of non-performing loan to total loans.

NPLs square have a significant and negative relationship with bank lending growth. That means when NPLs increase from specified limit, it has negative effect on the bank`s lending. Mathematical calculations show that the critical point for NPLs is 11.25, when it starts to have a negative effect on banks' lending level. Loans interest rate has no significant effect on banks lending. As we can see in the figure 6, the real loans interest rate (and also

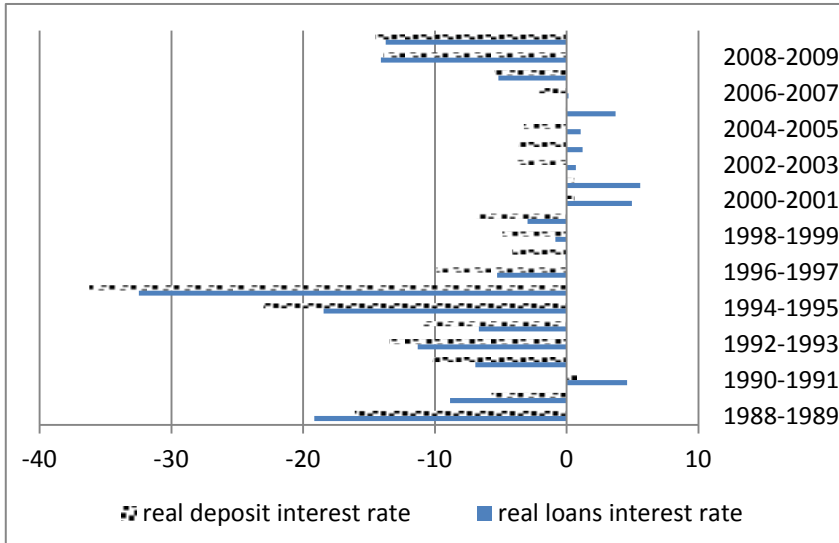
real deposit interest rate) is almost negative¹. This fact can explain why there is no significant relationship between credit growth and loans interest rate.

Table 1: Estimation¹ Results for Bank Lending Growth Function (1979-2009)

Independent Variables	Estimation 1	Estimation 2	Estimation 3
constant	-4.278 (-1.04)	-2.66 (-0.77)	-2.916 (-0.99)
deposit growth rate	0.2707 (2.05)*	0.2878 (2.01)**	0.288 (2.02)**
capital growth	0.0017 (0.20)	0.0035 (0.38)	0.0028 (0.35)
nonperforming loans	3.104 (2.02)*	3.6738 (3.109)***	3.6721 (3.08)***
nonperforming loans ²	-0.136 (-2.14)***	-0.1633 (-3.35)***	-0.159 (-3.17)***
loan _(t-1)	0.246 (1.81)*	0.2496 (2.06)*	0.262 (2.04)*
interest rate	0.337 (0.64)		
other assets growth rate		1.959e-05 (0.17)	
R-sq	0.76	0.81	0.80
DW	1.938	1.872	1.89

1. GMM method of estimation. T-statistic in the parentheses; *significant at 10%, ** significant at 5%, ***significant at 1%.

1. It is interesting to mention that due to the difficulties to access public banks facilities with the low fixed rate, there is tendency toward the private banks in the past years. In 2005 the interest rate approved by central bank was 17 percent for private banks but in reality the private banks gain more than 22 percent with new formula in their calculation method.

Figure 6: Real Loans and Deposit Interest Rate

3. Financial Soundness Indicators

In order to analyze the financial soundness indicators in Iran's banking system we consider banking, macro and structural variables. Three core soundness indicators are asset quality measured by ratio of nonperforming loans to total loans, capital asset measured by the ratio of capital to asset and profitability measured by return on asset. Before our estimation we examine the stationarity of the time series used in our estimation. We use the GMM estimation and the idea is to choose the parameter estimates so that the theoretical relation is satisfied as closely as possible. The theoretical relation is replaced by its sample counterpart and the estimates are chosen to minimize the weighted distance between the theoretical and actual values. GMM is a robust estimator in that it does not require information of the exact distribution of the disturbances. To achieve more appropriate and reliable results we consider three estimations for each financial indicator based on

significance of each independent variable and if the independent variable is not significant in the first estimation it has been eliminated in the further assessments. In our estimation, we pay special attention to two target variable, business cycle and inflation, in order to see the effect of the financial indicators on the macroeconomic.

3.1. Asset Quality

This paper analyzes the relationship between NPLs and key macroeconomic, structural and bank specific variables in Iran in the period 1979-2009. In order to model the determinants of NPLs we employ combination of reduced form model of Jimenez and Sausina (2005) and also the approach adopted by Demirguc Kunt and Huizinga (2000).

The equation is as follows:

$$NPL = \beta_0 + \beta_1 bcycle + \beta_2 p + \beta_3 ir + \beta_4 unemr_{-1} + \beta_5 m + \beta_6 ms + \beta_7 cr + \beta_8 la$$

The nonperforming loans as a ratio of total loans (NPLs) is a function of business cycle (bc), annual changes in the inflation rate (P), loans interest rates (ir) (is the weighted rate of loans according to their allocations to different sectors), imports (m), unemployment rate (unemr) and total loans to asset (la). We also create a variable for quality of banking management, called management instability (ms)¹, and measured as the number of changes in the chairman of the board and managing director in 11 banks in Iran through one year)². As instruments we choose second lag of NPLs and first lag of business cycle and imports.

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1. We control two other dummies such as the corruption perception index and the high inflation (when its rate rose by more than 20 percent) accompanied with large budget deficit as index of central bank independence.
 2. Rita. Babihuga (2007) use BCP index (measuring the quality of regulatory supervision) from FSAP reports, IMF as industry variable (this data isn t available for Iran).

**Table 2: Estimation¹ Results for Non-performing Loans Function
(1979-2009)**

Independent Variables	Estimation 1	Estimation 2	Estimation 3
Constant	8.8707 (1.21)	0.2032 (-1.24)	0.4559 (0.717)
Business cycle	-8.64E-05 (-2.41)**	-5.54E-06 (-4.08)***	-5.59E-05 (-4.36)***
Import	0.0002 (10.39)***	8.46E-05 (4.40)***	8.41E-05 (4.48)***
Management instability	0.2050 (1.83)*	0.241 (2.09)*	0.1249 (2.32)**
Inflation	0.0173 (0.39)	0.0133 (0.42)	
Unmpl	-0.6828 (-1.63)		
Interest rate	-0.7359 (0.53)		
Interest rate ₍₋₂₎		-0.144 (-2.92)***	-0.1505 (3.32)***
Npl ₍₋₁₎		0.9605 (10.80)***	0.969 (11.7)***
R-sq	0.76	0.94	0.94
DW	1.7	1.86	1.82

1. GMM method of estimation. T-statistic in the parentheses; *significant at 10%, ** significant at 5%, ***significant at 1% .

Our estimations show that business cycle has negative effect on NPLs and confirm that the Asset quality will improve in economic booms. The effect of the inflation is ambiguous and it depends on whether inflation is anticipated or not. Our result shows that inflation has no significant effect on asset quality. The average annual inflation between 1979 and 2009 was 19.36 in Iran and this shows that economy has faced mostly high inflation rate in these years. Therefore inflation rate in Iran is mostly predictable for the

borrowers. There is no significant relationship between unemployment and NPLs¹ in Iran. Loans interest rate over the previous two years has negative and significant effect on NPLs. Loan interest rate would make loans repayments more difficult for the borrowers. The imports show strong, significant and positive effect in our three estimations which mean that it has negative effect on asset quality. In other words, it shows how higher imports deteriorate the domestic product which leads to inability of producer to pay back their debts. The management instability (measured as the number of changes of chairman of the board and managing director) is associated with lower asset quality. We also control for exchange rate fluctuation but we haven't seen any significant relationship between asset quality and exchange rate changes.

3.2. Capital Adequacy

To assess the determinant of the bank capital ratio, we employ the methodology developed by Shrieves (1992) and used also by many researchers as Babihuga (2007). The changes in the bank capital ratio is composed of two components, a prudential adjustment and factors exogenous to the bank and each bank has aimed at a certain target capital ratio.

$$\Delta CR_t = \Delta^d CR_t + \epsilon_t \quad (1)$$

where ΔCR is the observed change in the capital ratio; $\Delta^d CR$ is the prudential change, and ϵ is the exogenous random shock. The banking system may not be able to adjust their aimed capital ratio and risk levels rapidly; therefore, the prudential changes in capital ratio are proportional to the difference between the objective level and the level existing in period $t-1$.

$$\Delta^d CR_t = (\Delta CR^*_t - \Delta CR_{t-1}) + \epsilon_t \quad (2)$$

1. Higher unemployment rate in many countries has negative effect on borrower ability to repay and affecting negatively asset quality.

In the long run, CAR tends to the optimal CAR^* , λ is the speed of adjustment and CAR_t^* indicates the target capital ratio in period t , which is not directly observable. When we replace equations (1) into equation (2) the observed changes in the bank capital ratio can be written as:

$$CR_t = (CR_t^* - CR^{t-1}) + \lambda \epsilon_t \quad (3)$$

The equation (3) shows that observed changes in the capital ratio in period t are a function of the target capital ratio, lagged capital and any random shocks.

Therefore, in order to estimate capital adequacy we control certain macroeconomic variables and a range of bank specific determinants. We also include a control variables, such as the size of banking system (size) measured as the log of total assets in the banking system. The equation is as follows:

$$\Delta CR = \beta_0 + \beta_1 Ca_{-1} + \beta_2 bc + \beta_3 P + \beta_4 \Delta ir + \beta_5 \Delta ex + \beta_6 la + \beta_7 size$$

The capital ratio variation (CR) is a function of business cycle (bc), annual changes in the inflation rate (P), the annual changes in exchange rate (ex), deposit interest rate (ir) and lagged capital ratio (CR_{-1}). As instruments we choose second lag of capital and changes in capital and first lag of business cycle.

One period lag of capital ratio means the cost of increasing capital or adjustment cost, therefore higher cost of adjusting capital means that banks will hold a capital buffer. Our results show the positive relationship between business cycle and capital ratio, despite of the theories which emphasis that in recession banks take precautionary measures and they hold more capital and higher capital to asset ratio to maintain regulatory requirement. Short term interest rate has positive and significant effect on capital ratio which means the effect of loans interest rate is dominate. The changes in exchange rate

have negative and significant effect on capital ratio. Inflation and size of banking system show no significant relationship with capital ratio.

Table 3: Estimation¹ Results for Capital Adequacy Function (1980-2009)

Independent Variables	Estimation 1	Estimation 2	Estimation 3
Constant	-0.009 (-1.03)	-0.017 (-1.30)	-0.015 (-1.23)
Business cycle	8.12E-07 (1.79)*	1.33E-07 (1.80)*	1.17E-07 (2.18)**
Inflation	-3.54E-5 (0.74)	-8.28E-05 (-0.95)	
Long term deposit interest rate	-0.0001 (-0.20)		
Short term deposit interest rate		0.004 (2.04)*	0.002 (1.82)*
Ca(-1)	0.748 (13.62)***	0.699 (12.65)***	0.7202 (13.25)***
Exchange rate	-2.14E-06 (-3.27)***	-2.23E-6 (-3.15)***	-1.02E-6 (-2.75)**
Size			0.0004 (0.71)
R-sq	0.76	0.80	0.80
DW	1.92	1.80	2.11

1. GMM method of estimation. T-statistic in the parentheses; *significant at 10%, ** significant at 5%, ***significant at 1% .

3.3. Profitability

We considered our model on the base of framework which was used by Babihuga (2007), Abreu and Mendes (2002) and Demirguc-Kunt and Huizinga (1999). Profitability is modeled as a function of macroeconomic variables, bank specific determinants and credit risk. We also include the annual changes in banking system loans.

The equation is as follows:

$$prof = \beta_0 + \beta_1 CR + \beta_2 bc + \beta_3 P + \beta_4 ir + \beta_5 npl + \beta_6 \Delta L + \beta_7 D$$

The capital ratio variation (CR) is a function of business cycle (bc), annual changes in the inflation rate (P), changes in total loans (ΔL), annual changes in non-government deposit (D), nonperforming loans (NPLs) and deposit interest rate (ir). As instruments, we choose first lag of loans interest rate and non-government deposit interest rate.

Our results show no significant relationship between business cycle and profitability which means that there is no relationship between economic booms and higher profitability. The effect of inflation on profitability is strongly positive. Higher inflation brings higher interest margins and consequently more profitability and banking system profit from the inflationary situation. Interest rate has strong negative effect on profitability. It means lending rate, comparing to deposit rate, has dominate effect on profitability. Higher NPLs means higher exposure to risk, can lead to lower profitability. Capital ratio and changes in exchanges rate have no significant effect on banks profit.

Table 4: Estimation¹ Results for Profitability Function (1980-2009)

Independent Variables	Estimation 1	Estimation 2	Estimation 3
Constant	0.32 (5.80)***	0.34 (8.73)***	0.3 (4.72)***
Business cycle	4.24E-08 (0.17)	-1.59E-07 (-1.16)	1.17E-07 (0.43)
Inflation	0.0021 (7.41)***	0.0024 (6.87)***	0.0023 (10.11)***
deposit interest rate	-0.024 (-6.820)***	-0.025 (-10.51)***	-0.227 (-5.37)***
CR	0.41 (1.15)	0.281 (0.67)	
NPL	-0.0047 (-2.043)*	-0.00667 (3.85)***	0.0038 (1.80)*
Exchange rate		4.77E-07 (0.36)	
Deposit			1.39E-07 (2.18)*
Loans	9.94E-07 (1.91)*		2.02E-07 (1.99)*
R-sq	0.84	0.75	
DW	1.81	1.76	

1. GMM method of estimation. T-statistic in the parentheses; *significant at 10%, ** significant at 5%, ***significant at 1%.

4. Conclusion

This study attempted to analyze NPLs in Iran's banking system which have grown rapidly in the past decade. From 2003, NPLs have started to rise and it arrived at 23 percent of total loans and 10 percent of total asset in 2009. This increasing trend has continued, and according to official statistics in 2010 it reached up to 50 billion dollars which means more than 25 percent of total loans. According to the official statistics, more than 23 billion dollars of NPLs belong to the four major banks of Iran in 2009 (Melli, Melat, Tejarat and Saderat banks) and in the same year Melli bank financial report confirms that 30 percent of NPLs in Iran's banking system belong to this bank (Donyayeh Eghtesad, 2 August). As we can see a major part of NPLs belong to semi-public sectors.

NPLs growth had no explicit sign of banking turmoil but it can be early sign of serious vulnerability in banking indicators that is to say to bring a serious challenge about banks management and asset quality in Iran. NPLs can also have impact on real part of economy through credit crunch. The results show that the deterioration of balance sheets acted to reduce bank lending when NPLs exceed a specific level of total loans. This situation can decline the economic growth and leads to economic stagnation.

We also focused on three financial soundness indicators (asset quality, capital adequacy and profitability) and their relationship with selected macroeconomic, bank specific determinants and structural variables in Iran from 1979 to 2009.

As our results showed, beside the macroeconomic variables, the management instability (as proxy for central bank independence) is also one of the important determinants of the asset quality measured by NPLs ratio in Iran's banking system. The unsuccessful implementation of the loans scheme for early return projects (started in 2005 and still unfinished in 2010), go along with higher growth rate of imports, and growth of rent-seeking in Iran's banking system can be considered as important factors in rapid increase of

NPLs. The effect of loans interest rate over the previous two years on asset quality has positive effect on asset quality. Business cyclical and short term interest rate has a positive relationship with capital adequacy. The annual changes in exchange rate have negative effect on capital adequacy. NPLs and deposit interest rate have a negative and significant effect on profitability.

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