

A Study on the Instability of Banking Sector in Iran Economy

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Abstract: It is well-known fact that any country's economic stability depends on financial issues. Among the various issues involved, the stability of banking sector as core of financial and monetary affairs is of prime importance. The present paper intends to study the factors affecting the stability of this sector of Iran economy in both state owned and private banks on the basis of already existing research on banking in Islamic countries. The study is done based on the assumption that the banking system of Iran has the features of Islamic banking and findings indicated that all banks in Iran had a low level of financial stability within the years 2001 to 2008. It must be noted that the factors affecting financial stability in the case of state owned and private banks are not identical. The macro-variables of net gross domestic product and national currency value have diverse impacts on banking sectors, as the development of the former leads to financial stability and reduction in the case of latter brings financial stability. The balance between the volume of loans and the net assets of the banks is also a variable to be considered, as the increase in loans causes financial instability. It is also found that private banks are prone to be affected by these variables more often when compared to state owned banks.

Key words: Financial Stability, Z-Score, Islamic Banking, Financial Ratio, Rational expectations, Macro Economic variables.

INTRODUCTION

In last 25 years, the developing countries all over the world, specially the east and southeast Asian countries that entered the competitive global market witnessed 69 instance of banking crisis that proved to be costly in process of their economic growth. The financial instability of banking system leads to the reduction of the funding loans and credits, the economic hardship as well as financial imbalances in families and institutions, losing customers' trust - which would be followed by considerable reduction in deposit volume- a production volume and national revenue downturn and even bankruptcy in some cases. All these negative and undesirable effects are to be studied by researchers who work on the issues related to banking instability and its impacts on the national economics in both developed and developing countries.

The advocates of Islamic banking believe that Islamic financial system unlike the traditional banking systems will not lead to such problems. Economists such as Irving Fisher and Hyman Minsky believe that economic recession is the due outcome of providing loans with high interest rates which in the long run turn out to be outstanding debts on the behalf of clients and leads to speculation. It is why the advocates of Islamic banking believe that the elimination of interest and speculation in addition to "Kali to Kali bargaining" (debt business) puts the financial sector and economic activities in a one- to-one relationship. This is to say that the financial sector cannot move ahead of other sectors in the real world, thus, the economic growth depends on real and legal trade processes.

The supporters of Islamic banking are of the belief that the Islamic system of banking unlike the traditional ones is intrinsically stable in nature. However, it cannot be denied that the usual risks, such as credit risk, displaced commercial risk, market risk, operation risk, and governance risk, are still involved in the Islamic banking system. Moreover, the failure in implementing the monetary policies of the central bank, as the only source of capital generation, as well as partial realization of Islamic law of contracts may introduce financial instability in this non-tradition banking system. The present researchers intend to study the banking sector of Iran to answer the following questions:

- Is there any financial instability in Iran banking system?
- What is the extent of the possible financial instability in Iran banking system?
- What are the factors that affect the stability of Iran banking system?

In the following sections the concept of z-score is introduced and defined and its application in the analysis of financial stability in the banking system of Iran in three levels (overall, government owned, and private banking) is explained; there is also a review of the literature on this topic.

The statistical data for the years 2001 to 2008 are used to calculate the z-index for Iranian banks then the method of panel data is used to measure the impact of variables such as asset, loan to debt ratio, income to cost

proportion, the asset of private banks, inflation rate, exchange rate, and gross domestic product on financial stability of the banking system.

Z-score:

Altman z-score model (1987) is used to measure the risk involved in industrial ventures. This index helps researchers to predict the risk of failure in any given business through measuring quantitative data and predicting cooperation risk. This index is also applicable in assessing bankruptcy risk as banks become investors by offering credits and funding development projects. Credit scoring in which the loan takers (both consumers and companies) are ranked is the simplest method of assigning loans to different risk classes. In this method the possibility of loan repayment can be predicted. The z-index for the loans that are not to be paid equals one ($z=1$) and for the payable loan z index ($z=0$).The framework of this model that is based on Altman *et al* (1977) is known as multiple discriminate analysis which enables experts to distinguish between two types loans by a set of variables. He found that there are seven discriminating keys in identifying the bankruptcy risk of companies. These seven factors are: return to assets, stability of earning, debt service, cumulative profitability, liquidity, capitalization and size. The following formula shows the linear relationship between these variables and z index.

$$z = \sum_{i=1}^7 \alpha_i x_i \tag{1}$$

However, the process of data gathering for the above variables is difficult and time consuming and there is a lack of theoretical explanation for ranking loans up on risk. An alternative model that has a theoretical underpinning is “risk of ruin”, which bears a resemblance to option pricing models of Black schools (1973) and Metron (1974). Based on this model, a firm is on the brink of bankruptcy when the asset market value of that firm falls below its debt obligations. In this model the risk of bankruptcy depends on the assets value in the period A, short term debt in period B, and the market value of assets σ_A . A commercial application of this is Moody’s KMV model which estimates the probability of default from A, D and σ_A , as is shown in the following formula.

$$d = \frac{A - D / A}{\sigma_A} = \frac{A - D}{A \sigma_A} \tag{2}$$

In this formula d shows the distance to default .d is equivalent to a Z score in the standard normal distribution. The higher Z index is an indication that there is a longer distance to default it means that the risk non-repayment is low; the low Z index shows a strong probability of default. This index is highly applicable to financial and banking research contexts. In this paper Z score /index is used to calculate the financial stability of the banking system in Iran.

A Review of Literature:

Goodhart, C. (2006) states that financial instability of banks lead to a major economic crisis in any country. Davis, E.P. (2001) believes that “Financial stability is the absence of financial crises, and a financial crisis is defined as a sequence of events, or the risk thereof, that impairs credit intermediation or capital allocation.” The evidence in this respect shows that the financial stability of any banking system is affected by both macroeconomic and financial variables. In the majority of researches the impact of variables such as economic growth, inflation, national income, exchange rate, balance payments are considered as macroeconomic variables. Experts believe that asset price bubbles also play an effective role in increasing the risk of financial crises. Allen and Gale (1999) in a study on the subject of asset price bubbles showed that asymmetric information between lender and borrower is the prime reason behind financial crises. According to Kaminsky’s and Reinhart’s (1996) study on the relation between financial crises and balance payments crises in 20 countries the variables that were identified as “early warning signals” for crises appeared to be real high interest rate, losses of foreign exchange reserves ,low output growth, and the decline in stock prices.

Gavin and Haussmann(1998)states that lending booms and the portfolio of adopting risky lending practices will grow at the expense of more conservative banks; therefore, banking system as whole becomes more fragile.

The monetary policies devised by government authorities and central bank officials concerning interest rate may have an impact on financial stability. Changes in regulatory structures, modifying or shifting the bureaucratic regimes have an impact on interest rate and the overall financial stability of banking system.

Therefore, it can be concluded that the monetary and banking decisions have a direct effect on lenders, borrowers, deposit volume, cost, profitability, efficiency and financial proportions and tends bring about changes in the trends of financial stability or instability in the banking systems. Moreover, the macroeconomic variables are the most effective factors at work in case of the economic crises.

The Islamic banking experts (Mehta2008, Ahmed2002, Saddiqi, 2004) stated that this banking practice is based on profit/or loss sharing. Thus the real value of assets and liabilities remains equal at all times. In Islamic system the linking of returns on deposits with returns on bank assets serves as a disciplinary device which increases efficiency of the bank and brings financial stability to the banking system. It is also believed that the profit loss/or sharing between lenders and borrowers enables Islamic banks to invest in the high risk ventures that in part contributes to economic growth.(Chapra1992, Millis and Presely 1999).

Čihák and Hese (2008), studying the banking system of 20 countries (77 Islamic banks, 397 commercial banks) in the years 1993 to 2004 through applying pooled ordinary least squares, concluded that currency devaluation has a meaningful impact on the banking risks but inflation and economic growth affect financial stability. In this study the banks are divided in to two major groups of traditional and non-traditional as well as large and small ones. The study showed that the large traditional banks have a more stable financial situation as compared to large Islamic banks, while small Islamic banks when compared to small banks in traditional banking system show more stability in their financial affairs. Therefore, on the basis of this study, it is not easy to pass a definite judgment on the question of which one of banking systems has a higher financial stability than the other.

The next section of the article deals with the issue of stability in the Iranian banking system based on the assumption that it is run through Islamic model.

The Analysis of the Model:

The banking system of Iran included 19 banks between the years 2001-2008, among them 11 banks were state owned and 8 were private banks. All these banks’ performance and transactions were done based on interest free policies. In this study the financial stability of state banks and six of private banks -as there is no data on two of them(Sarmaye and Pasargad)-is calculated based on the data published by the central bank of Iran. The data is analyzed using pooled data model to determine the functioning of financial variables (financial ratios) as well as macroeconomic variables in relation to stability of banking system.

As mentioned earlier Z index is used in studying financial stability. In Z formula this stability for the years 2001 to 2008 is calculated. K where is equity capital as a percentage of assets, μ is average return as percentage of assets, and σ is standard deviation of return on assets as a proxy for return volatility. (Table 1 shows the Z index for each one the banks studied.

$$Z = \frac{K + \mu}{\sigma} \tag{3}$$

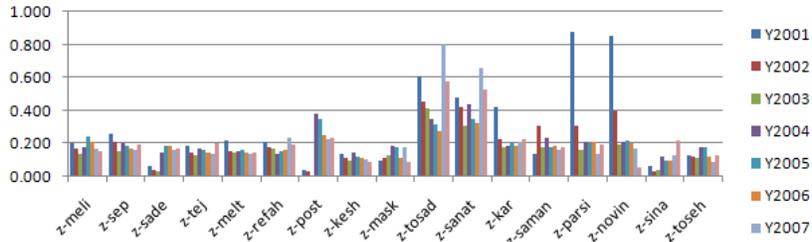
The interpretation of Z-score is straightforward: the lower the score, it is more likely that a bank will run out of capital, which means that such a bank tends to be financially weaker.

As the table 2 indicates Z index for Iranian bank is small figure between 0.01to 0.2 in most cases and only a few instances it is bigger than 0.2 and equals 0.87. The table also shows that Iranian banks (both private and state owned) had not a high degree of financial stability between the years 2004 to 2008, while there hadn’t been almost the same condition during these years. The most financially stable banks among the state owned ones were Toseyeh Saderat (Export Development Bank), and Sanat- va -Madan (Mine and Industrial Bank). Among the private banks there had been a downturn in regard to financial stability with the exception of Sina Bank. This trend is most obvious first in case of Parsian bank, Eghtesad-e-Novin Bank, and then in Karafarin and Saman Banks. The average Z index for this eight years period makes it understood that Parsian and Eghtesad-e-Novin Banks had some degree of financial stability.

The next stage of the study is a detailed analysis of the impact of macroeconomic variables (such as GDP, Inflation Rate, and Exchange Rate) and financial variables (such as Loan to assets ratio, cost to income ratio, Asset, Private sector asset to the total asset ratio) on Z index. The following equation is used in calculating this impact in regard to all banks, private banks and state owned banks.

$$z = \alpha + \beta_1(A) + \beta_2(LA) + \beta_3(CI) + \beta_4(PBA) + \beta_5(Inf) + \beta_6(GDP) + \beta_7(Exr) \tag{4}$$

In the equation 4, A stands for assets, LA for Loan to assets ratio, CI for cost to income ratio, PBA for the ratio of Private sector asset to the total asset of banking system, Inf represents inflation rate, GDP is The Real Gross Domestic Product and finally Exr is used for year to year change in the nominal Exchange Rate. In all three assessments, the method of pooled ordinary least squares is applied. Equations 5 to 7 refer to state owned banks, private banks, and total banks respectively.



Source: authors' calculations based on Central Bank of Islamic Republic of Iran Data

Fig. 1: Comparison of the Z scores (financial stability index) among the total banks of Iran (2001-2008).

Table 1: The Z scores among total banks of Iran (2001-2008).

bank	year	Zscore	bank	year	Zscore	bank	year	Zscore	bank	year	Zscore	bank	year	Zscore
meli	2001	0.205	mlat	2001	0.216	maska	2001	0.099	saman	2001	0.138	toseh	2001	0.128
meli	2002	0.174	mlat	2002	0.157	maska	2002	0.117	saman	2002	0.311	toseh	2002	0.119
meli	2003	0.142	mlat	2003	0.144	maska	2003	0.132	saman	2003	0.181	toseh	2003	0.117
meli	2004	0.180	mlat	2004	0.158	maska	2004	0.183	saman	2004	0.239	toseh	2004	0.181
meli	2005	0.245	mlat	2005	0.161	maska	2005	0.178	saman	2005	0.180	toseh	2005	0.177
meli	2006	0.212	mlat	2006	0.144	maska	2006	0.118	saman	2006	0.185	toseh	2006	0.123
meli	2007	0.171	mlat	2007	0.140	maska	2007	0.176	saman	2007	0.164	toseh	2007	0.092
meli	2008	0.157	mlat	2008	0.143	maska	2008	0.090	saman	2008	0.175	toseh	2008	0.132
sep	2001	0.257	refah	2001	0.213	tosade	2001	0.606	parsi	2001	0.874			
sep	2002	0.211	refah	2002	0.183	tosade	2002	0.458	parsi	2002	0.306			
sep	2003	0.154	refah	2003	0.169	tosade	2003	0.414	parsi	2003	0.165			
sep	2004	0.203	refah	2004	0.141	tosade	2004	0.352	parsi	2004	0.208			
sep	2005	0.186	refah	2005	0.154	tosade	2005	0.316	parsi	2005	0.203			
sep	2006	0.171	refah	2006	0.160	tosade	2006	0.277	parsi	2006	0.210			
sep	2007	0.161	refah	2007	0.235	tosade	2007	0.804	parsi	2007	0.140			
sep	2008	0.199	refah	2008	0.199	tosade	2008	0.576	parsi	2008	0.199			
sader	2001	0.065	post	2001	0.041	sanat	2001	0.481	novin	2001	0.851			
sader	2002	0.042	post	2002	0.031	sanat	2002	0.421	novin	2002	0.397			
sader	2003	0.033	post	2003	0.012	sanat	2003	0.313	novin	2003	0.199			
sader	2004	0.145	post	2004	0.380	sanat	2004	0.435	novin	2004	0.210			
sader	2005	0.189	post	2005	0.353	sanat	2005	0.348	novin	2005	0.216			
sader	2006	0.184	post	2006	0.255	sanat	2006	0.323	novin	2006	0.203			
sader	2007	0.163	post	2007	0.231	sanat	2007	0.658	novin	2007	0.171			
sader	2008	0.173	post	2008	0.239	sanat	2008	0.532	novin	2008	0.060			
teja	2001	0.187	kesha	2001	0.134	karaf	2001	0.423	sina	2001	0.063			
teja	2002	0.147	kesha	2002	0.116	karaf	2002	0.224	sina	2002	0.036			
teja	2003	0.133	kesha	2003	0.096	karaf	2003	0.176	sina	2003	0.039			
teja	2004	0.172	kesha	2004	0.143	karaf	2004	0.189	sina	2004	0.119			
teja	2005	0.165	kesha	2005	0.118	karaf	2005	0.199	sina	2005	0.095			
teja	2006	0.144	kesha	2006	0.110	karaf	2006	0.185	sina	2006	0.097			
teja	2007	0.142	kesha	2007	0.103	karaf	2007	0.208	sina	2007	0.128			
teja	2008	0.207	kesha	2008	0.088	karaf	2008	0.226	sina	2008	0.223			

Source: authors' calculations based on Central Bank of Islamic Republic of Iran Data

$$z = 0.48 - 7.34E - 07A(-1) - 0.26LA(-1) - 0.1CI(-1) + 8.26PBA(-1) - 0.00Inf(-1) + 0.007GDP - 0.01Exr(+1) + 0.7AR(1) \\ R^2=61.4\% \tag{5}$$

$$z = -0.13 - 2.43E - 07A(-1) - 0.24LA(-1) - 0.2CI(-1) + 12.7PBA(-1) - 0.02Inf(-1) + 0.01GDP - 0.01Exr(+1) \\ R^2=68.2\% \tag{6}$$

$$z = -0.6 - 4.74E - 07A(-1) - 0.32LA(-1) - 0.04CI(-1) - 1.01E - 0.5PBA(-1) - 0.006Inf(-1) + 0.007GDP - 0.01Exr(+1) + 0.82AR(1) \\ R^2=55.5\% \tag{7}$$

The appendices 1 to 3 sum up all findings of this analysis.

Table 2 give the summary of the statistical validity of the analysis and shows the relationship between the descriptive variables of the model and financial stability model. It is evident that the real gross domestic product, as expected, is the only variable that affects the banking system financial stability in all three cases. Although this is a weak relationship and is not statistically valid in respect to state banks, it cannot be denied that the increase in the real GDP leads to more financial stability in all three cases. The inflation rate as a

variable is not statistically valid despite the fact that it reduces the financial stability of the banking system. Contrary to what was expected the increase in inflation rate has given stability to the banks in private sector.

According to the existing literature on the subject states that the increase in the nominal exchange rate or positive change in the nominal exchange rate (the devaluation of national currency) affects financial stability in a negative manner and the present study has confirmed this finding. The only exception is that the exchange rate increase has given a higher degree of stability to the private banks, but this is not a valid statistical finding. It is also found that the capital of previous period as a variable has reverse relationship with the financial stability of banking in all three cases, contrary to what was expected. This relationship is statistically valid only for state owned banks, but as the index is very small, it can be ignored.

It is shown that within each period, the financial stability has a reverse relation with the increase in the proportion of loan to asset in the previous period and this is a logical and statistically valid relationship in case of private banks and the banking system in its totality.

In all three cases, with the increase in cost to income ratio (with one lag-in previous period) reduces the financial stability of banks as indicated in theory of banking economy; but this impact has only statistical validity in regard to the private banks. The other variable, the proportion of private banks assets to banking system asset, contributes to the financial stability of the private and state banks in the case of any possible increase. The relationship is only statistically valid in private banks. Moreover, this reverse impact on the banking system stability is not in accordance to economic logic. Therefore, this relation can be ignored while being valid statistically.

Table 2: The summary results of estimation (statistical validity and the relationship of descriptive variables coefficients with financial stability).

Variable	A(-1)	LA	CI	PBA	Inf	GDP	EXR
Equation	<i>Assets with one lag</i>	<i>Loan to Assets</i>	<i>cost to income ratio</i>	<i>The ratio of Private sector asset to the total asset of banking system</i>	<i>Inflation rate</i>	<i>The real Gross domestic product</i>	<i>year by year change in the nominal Exchange Rate</i>
State owned banks	Valid	No statistical validity	No statistical validity	No statistical validity	No statistical validity	No statistical validity	Valid
	Reverse And weak	Reverse	Reverse	Direct and strong	Reverse	Direct	Reverse
Private banks	No statistical validity	valid	valid	Valid	Valid	Valid	No statistical validity
	Reverse And weak	Reverse	Reverse	Direct and strong	Direct and weak	Direct and weak	Direct and weak
Total banks	No statistical validity	valid	No statistical validity	Valid	No statistical validity	Valid	Valid
	Reverse And weak	Reverse	Reverse And weak	Reverse And so weak	Reverse And weak	Direct and weak	Reverse And weak

Source: The results of estimation in this study (Appendices).

The summary of the research findings:

The study of financial stability of banks between the years 2001-2008 has pointed to the following issues:

- During the period studied, the average index of financial stability has been a figure smaller than 0.2 in all three cases.
- The financial stability of state owned banks is more than the private banks
- The whole banking system stability in Iran will be affected negatively after the increase in the proportion of loan to asset of previous year and any possible increase in the exchange rate which leads to devaluation of national currency. The increase in real GDP increases the financial stability of banking system. On the whole the banking stability in Iran is highly influenced by the devaluation of national currency in the next period (as a macroeconomic variable) as well as real GDP. Among the financial variables the ratio of loan to asset has the real impact.
- The stability of the private banks decreases whenever there is an increase in volume of proportion of loan to asset and the change in cost to income ratio. The private banks are more stable when the proportion between their asset and the banking system asset increases; similar change in regard to real GDP also affect private banks stability positively as it is the only macroeconomic variable at work. The financial variables, with the expectation of asset, affect the stability of private banks.
- The only variable affecting state owned banks is the future fluctuation of nominal exchange rate.
- Among these variables, the real GDP and the fluctuation of nominal exchange rate (among macroeconomic variables) and the proportion of debt to asset (among financial variables) are the most important ones.

Conclusion:

It is believed that financial problems that are caused by improper functioning of banking system (for example, instable banking system, bankruptcy, shortage of funds, defaults, the lessening of trust between banks and customers, the reduction of volume of deposits) will affect the volume of GDP and in the long run hamper the economic growth of any country facing these challenges. Economists state that high volume loan contracts with high interest rate play a very important role in this regard. The advocates of Islamic banking hold the view that this banking system is stable by nature. In this system the financial sector cannot move ahead the real sector and there is no possibility of financial instability because of eliminating speculation and non-existence of the interest. However, slow economic growth and other problems caused by money and banking system are noticed in the countries that have implemented Islamic banking system.

In this paper the question of banking instability in Iran is studied based on the concept known as Z-score. The study included all the Iranian banks in the years between the years 2001 to 2008 and it was found that these banks had a low degree of financial stability (<0.2). A number of these banks (Parsian Bank, Eghtesad-e-Novin Bank, Karafarin Bank and Saman Bank) had financial stability in the early years after their establishment, but the later instability especially between the years 2004 to 2008 had made the financial condition of the private and state banks almost the same. Sina Bank has been the only bank showing steady financial stability. Furthermore, the average of Z-score for this eight years period showed that Parsian Bank and Eghtesad-e-Novin Bank had a higher degree of financial stability than the other banks of Iran. Among state owned banks Toseyeh Saderat (Export Development Bank) and Sanat- va- Madan (Mine and Industrial Bank) have a higher degree financial stability the other state banks.

According to the empirical evidences which show that the financial stability of any banking systems is affected by both macroeconomic and financial variables it was decided that three macroeconomic variables were GDP, inflation rate, and exchange rate fluctuations, while the financial variables were asset, the proportions of loan to asset, cost to income, private bank asset to the whole banking system (equation 4). The three cases of private banks, state owned banks, and the whole banking system were taken into consideration. The analysis done through pooled ordinary least squares estimation method showed that mentioned variables do not affect both private and state banks in same degree. This is to say that the variables which cause stability in state banks are not showing the same function in respect to private banks. The financial stability in state owned banks is affected mainly by changes in the exchange rate in the coming period; this means that the devaluation of national currency reduces the financial stability of these banks. In private banks, their stability is affected by financial ratios. This means that the increase in the loan to asset and cost to income ratios the financial stability decreases, but the increase in the private bank asset to the whole banking system asset brings stability to this sector of banking. The only macroeconomic variable that contributes to financial stability is real GDP. The increase in the ratio of loan to debt decreases the degree of the banking system. Moreover, the devaluation of national currency in the next period reduces financial stability and the increase in the real GDP brings stability to the banking system.

To sum up it must be mentioned that the banking system of Iran, despite being based on Islamic banking, has a low degree of financial stability. The research implicitly indicated that the exchange rate and monetary policies play an important function in this regard as there is all the time a possibility of national currency devaluation. However, the increase in the ratio of loan to asset and failure in implementing international financial standards reduce the banking system stability. There are other destabilizing factors such as partial implementation of Islamic contracts, which must be studied in other researches. There is a need to reduce credit risks through more careful offering of loans and facilities, ensuring the repayments of loans, observing international standards and regulations in the Islamic banking system of Iran. In addition it must be kept in mind that the monetary policies which increase the economic growth and preclude the devaluation of national currency increase financial stability of banks in Iran.

This fact that the private and state banks of Iran are not affected by the same set of variables and to the similar extent for both macro and financial factors indicated that similar banking policies and strategic decision to increase their financial stability must not be applied to these sectors. These policies can be similar only if they work in the same way. The other factors that may affect the stability of banking system in Iran other than the ones studied in the paper can be the topic of further research in the area of banking industry.

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Appendix 1: The results of estimation of model for state banks of Iran

Dependent Variable: ?Z

Method: Pooled Least Squares

Date: 10/20/10 Time: 12:37

Sample (adjusted): 1382 1386

Included observations: 5 after adjustments

Cross-sections included: 11

Total pool (balanced) observations: 55

Convergence achieved after 9 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.483824	0.325164	1.487938	0.1436
?A(-1)	-7.34E-07	3.30E-07	-2.220834	0.0313

?LA(-1)	-0.268347	0.187060	-1.434549	0.1582
?CI(-1)	-0.107749	0.084621	-1.273316	0.2093
?PBA(-1)	8.267712	8.687366	0.951694	0.3462
?INF(-1)	-0.001356	0.011535	-0.117600	0.9069
?GDP	0.007609	0.004295	1.771459	0.0831
?EXR(+1)	-0.016378	0.008285	-1.976790	0.0541
AR(1)	0.702586	0.139733	5.028068	0.0000
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R-squared	0.614268	Mean dependent var	0.213255	
Adjusted R-squared	0.547185	S.D. dependent var	0.134991	
S.E. of regression	0.090838	Akaike info criterion	-1.810907	
Sum squared resid	0.379567	Schwarz criterion	-1.482435	
Log likelihood	58.79995	F-statistic	9.156737	
Durbin-Watson stat	1.698465	Prob(F-statistic)	0.000000	

Appendix 2: The results of estimation of model for private banks of Iran

Dependent Variable: ?Z

Method: Pooled Least Squares

Date: 10/02/10 Time: 13:37

Sample (adjusted): 1381 1386

Included observations: 6 after adjustments

Cross-sections included: 6

Total pool (unbalanced) observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.138221	0.190599	-0.725192	0.4746
?LA(-1)	-0.240454	0.050545	-4.757260	0.0001
?CI(-1)	-0.202367	0.037976	-5.328825	0.0000
?A(-1)	-2.43E-07	4.20E-07	-0.577872	0.5681
?PBA(-1)	12.70284	4.301419	2.953174	0.0064
?GDP	0.014840	0.004226	3.511492	0.0016
?EXR(+1)	0.013482	0.008558	1.575338	0.1268
?INF(-1)	0.020492	0.009541	2.147716	0.0409
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R-squared	0.682078	Mean dependent var	0.180000	
Adjusted R-squared	0.599654	S.D. dependent var	0.069958	
S.E. of regression	0.044265	Akaike info criterion	-3.199625	
Sum squared resid	0.052903	Schwarz criterion	-2.844117	
Log likelihood	63.99344	F-statistic	8.275205	
Durbin-Watson stat	2.094827	Prob(F-statistic)	0.000022	

Appendix 3: The results of estimation of model for baking system of Iran

Dependent Variable: ?Z

Method: Pooled Least Squares

Date: 10/02/10 Time: 13:49

Sample (adjusted): 1382 1386

Included observations: 5 after adjustments

Cross-sections included: 17

Total pool (unbalanced) observations: 84

Convergence achieved after 5 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.606821	0.169149	3.587490	0.0006
?A(-1)	-4.74E-07	3.07E-07	-1.545346	0.1265
?LA(-1)	-0.326441	0.102881	-3.173010	0.0022
?CI(-1)	-0.043854	0.054706	-0.801630	0.4253
?PBA(-1)	-1.01E-05	5.03E-06	-1.999695	0.0492
?INF(-1)	-0.006554	0.005755	-1.138818	0.2584
?GDP	0.007584	0.002868	2.644877	0.0099
?EXR(+1)	-0.012855	0.005200	-2.471957	0.0157
AR(1)	0.821609	0.098647	8.328770	0.0000
R-squared	0.555499	Mean dependent var		0.198048
Adjusted R-squared	0.508086	S.D. dependent var		0.113931
S.E. of regression	0.079907	Akaike info criterion		-2.114941
Sum squared resid	0.478889	Schwarz criterion		-1.854496
Log likelihood	97.82752	F-statistic		11.71609
Durbin-Watson stat	1.697810	Prob(F-statistic)		0.000000