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Investigating the effective factors on the non current claims of the banking system of the country (Iran) and ranking the share of each of them based on the Bayesian averaging approach

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Abstract

Today, banks are introduced as pillars of economic growth and development. Given the importance of banks in boosting economic growth, identifying the factors influencing non-current demands is essential. Therefore, in this article, we have studied the role of influencing factors on non-current claims. For this purpose, after identifying the variables affecting non-current claims, we have investigated the direction and intensity of the effect of these variables on non-current claims using the Bayesian Model Averaging method. The results obtained from the model estimation show that the growth of GDP and net exports harms the non-current claims of the banking system. Additionally, variables such as inflation growth, exchange rate growth, informal market real interest rate differential, official market interest rate, money supply, budget deficit to gross domestic product ratio, unemployment rate, bank size, past period loans growth, and deposit to cost ratio (as an efficiency measure) have a direct impact on the non-current claims of the banking system. Ultimately, variables such as the national savings to GDP, stock market return, management quality, and ethical risk have no significant influence on the non-current claims of the banking system, considering their low likelihood of inclusion.

Keywords: non-current claims of the banking system, Bayesian model averaging (BMA), weighted average least squares (WALS)
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1 Introduction

Today, one of the basic problems of banks and financial and credit institutions is the problem of pending claims and their uncollected facilities. In Iran, banks are the largest financial institution and credits are the lifeblood of the banking system and all economic units. Also, the distribution of credits for both sectors is affected by macroeconomic policies, especially in the financial and monetary fields. Since the country's banks are more state-owned in terms of capital, as a result, the first attention is directed towards the banks to provide resources. The increase in non-current

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claims causes the non-fulfilment of the goals of providing banking facilities for the country's economic growth and wasting resources [13].

The creation of non-current claims by banks and credit institutions is a natural and normal thing in all countries, but the point to consider is the amount of non-current claims. The violation of debt repayment or non-payment of debt is sometimes voluntary and sometimes beyond the control and will of the borrowers, and in any case, the occurrence of overdue claims is unavoidable. What is considered as one of the most important problems facing the country's banking system today is the ever-increasing non-current claims of banks and, as a result, the decrease in liquidity, disruption in the allocation of resources and ultimately the decrease in bank profits. This study examines the factors affecting the granting of bank facilities for 17 commercial banks in Iran between 2009 and 2016. Facility ratio, deposit ratio, liquidity ratio, capital ratio, non-current claims ratio, average deposit and facility rate, bank size, inflation rate, legal reserve ratio and economic growth rate are the study variables. The statistical method used in this research is panel data. The obtained results indicate the negative effect of the ratio of non-current claims, liquidity ratio, average interest rate of facilities and legal reserve rate on the granting of bank facilities and the positive effect of the deposit ratio and economic growth rate on the granting of bank facilities [6].

On the other hand, a comparative study of the state of non-current claims of banks in 2011 among 105 countries of the world shows that despite the use of non-usurious banking in Iran, the country's ranking is not in a good position. For example, the average ratio of non-current claims among 105 countries in 2011 was about 7%, which is far from Iran's ratio of 15.1%. According to the ratio of non-current claims, Iranian banks are ranked 94th in the world and ranked 27th among the 30 countries surveyed. They are also in the sixth place among the seven oil exporting countries. Considering the above, it can be seen that the country's banking system is not in good condition in terms of resources compared to other countries in the world, and it needs an immediate solution to the problem of non-current claims [2].

2 Theoretical framework

Today, one of the fundamental problems for banks and financial institutions is the problem of overdue claims and their uncollected facilities. Non-current claims reduce the bank's financial ability to grant new facilities, reduce the bank's profitability, impose the costs of collecting claims on the one hand, and have adverse effects on banks and various economic sectors and a wider scale for the people of each country through monetary and financial crises. In this regard, it is necessary to investigate the effect of some endogenous and exogenous factors on the ratio of non-current claims.

In Iran, banks are the largest financial institution and credits are the lifeblood of the banking system and all economic units. Also, the distribution of credits for both sectors is affected by macroeconomic policies, especially in the financial and monetary fields. Since the country's banks are more state-owned in terms of capital. As a result, the first attention is directed towards banks to provide resources. The increase in non-current claims causes the non-fulfilment of the goals of providing banking facilities for the country's economic growth and wasting resources [9].

In recent years, non-current claims and how to collect them have always been one of the most important and challenging issues in the country's banking system. In any dynamic economic system, especially in banks, the proper and efficient circulation of resources and expenditures is indicative of the effectiveness of operational methods. The timely recovery of granted facilities is a determinant of the correct use of resources to create the necessary facilities for the expansion of economic activities and the provision of the required resources for various sectors of production, trade, and services. Preventing the creation of overdue claims in the granted facilities or their collection in a potential and de facto way will increase the possibility of creating new income and will increase the bank's planning ability in spending resources and acquiring income. The high number of overdue claims indicates high credit risk in today's banking system, and this makes banks face market and liquidity risks. Examining the status of non-current receivables (sum of overdue, overdue and doubtful receivables) of banks in the country and comparing it with the global average, shows the unfavourable situation of Iranian banks in collecting their receivables. The increase in the level of non-current bank demands can not only threaten the safety of each of the banks and non-bank credit institutions in the country but also, on a macroeconomic level, lead to a reduction in the lending capacity of the banking network and consequently result in a credit squeeze for banks. Considering the banking-centric nature of the financial system in the country, this can lead to a reduction in economic growth. Overall, although many countries and Islamic financial institutions are facing delays in fulfilling their commitments, they have not been able to find a common solution to address this problem. Bank deferred claims are a part of banking literature in economics because just as all economic activities have a certain level of risk, banking activity also entails various risks. One of the risks is the non-repayment of debts by customers in the banking system or their unwillingness to repay. Therefore, in economic literature, delayed

demands are considered a common problem in banking activities, even though in Islamic banking, with the use of contracts, such claims are considered meaningless. However, due to its destructive effects on the efficiency of the banking system, it is very important to reduce this problem. What will be achieved as a result of this increase in the non-current claims figures is the hoarding of the bank's resources, the swelling of the reserve account and the more advanced cases of mismatch between the due dates of obligations and claims, which will reduce the rate of return on assets and the profitability of the bank. The adverse effect of the growth of these demands on the micro and macro economy has weakened and damaged the correct flow of financial circulation in the prevailing economic system, and from various aspects of this maladministration, it slows down the operations of banks and makes it impossible for the economic authorities to make accurate credit planning. At the macro level, the presence of unused financial resources in banks or the non-return of credits to banks are two negative trends, each of which leads to a decrease in profitability and a reduction in lending capacity, respectively, resulting in a reduction in the national gross domestic product and national income. This, in turn, leads to price increases and inflation in society. At the micro level, the increase in non-current claims has also forced banks to borrow from the central bank, which makes them forced to pay fines [3].

Factors affecting the creation and increase of overdue claims can be divided into intra-organizational factors (within banking) and extra-organizational factors (outside banking) as well as financial and economic factors. Financial and economic factors, and economic conditions in general, are among the most significant factors in the creation and growth of overdue demands. In many economic studies such as Louzis et al. [17] economic growth and prosperity have been mentioned as one of the influencing factors in reducing the volume of overdue claims because in economic prosperity, both households and companies can pay their debts. Based on the life cycle consumption model of Ando and Modgliani [1], and Hayek's theory of business cycles [8], an increase in economic growth has a negative and significant effect on the number of overdue claims, because economic growth and prosperity increases the debt repayment ability of economic agents [20].

On the other hand, it can be said that with the continued economic growth and prosperity, the provision of facilities at various income levels in society increases. Therefore, individuals who cannot repay loans will be able to receive facilities, while these borrowers will not be able to repay their debt in times of recession due to the devaluation of assets and financial incapacity [5].

The recession also leads to a lack of product and service sales, resulting in an increase in the collection period and ultimately the operational cycle. Consequently, the possibility of debt repayment decreases. Therefore, it can be said that economic recession is one of the factors influencing the increase in overdue demands. Another influential variable in the volume of overdue demands is the inflation rate. The emergence of inflationary conditions in the economy leads to the inability of economic agents to repay debts. The increase in inflation discourages debt repayment due to the general price level, and as a result, the expectation of a decrease in the value of debt arising from inflation increases overdue demands. With the increase in the inflation rate, the real value of the loans received from the banking system decreases, and the borrowers do not want to repay the loans because of the benefits, as a result of the postponement of the repayment of the loans, the volume of overdue demands increases; Therefore, it can be said that inflation is one of the main factors influencing the decrease in cash flow of commercial banks and the increase in credit risk [19].

Another macroeconomic factor affecting the behaviour of banks and the volume of their overdue demands is the amount of public sector debt. The effect of public sector debt on overdue demands can be investigated through two channels. The first channel is that as the debt increases and the financial situation of the government worsens, borrowing from the central bank increases as one of the ways of financing. With the increase in government borrowing from the central bank, the credit limit granted by this bank to other banks decreases, and as a result, banks face the problem of lack of liquidity. In response to this event, commercial banks are forced to reduce and cut off their loans to customers, and due to borrowers' inability to repay loans, the volume of overdue demands in the banking system increases. The second channel, the impact of government debt on overdue demands can be seen through the reduction of government social expenditures due to the increase in debt and as a result of the government's inability to pay the salaries of government employees. The government's inability to pay salaries has caused a financial shock and budget deficit for households, and as a result of the inability to repay loans, the volume of unrepaid loans in the banking system has increased. On the other hand, due to the decrease in purchasing power and the decrease in household demand, large companies are faced with a decrease in sales and a lack of liquidity, and as a result, the problem of not repaying the loans received from the bank [17].

Another of the most important factors influencing the overdue demands of banks are internal and external organizational factors. Internal factors, in brief, include: the absence of an accurate customer evaluation system at the bank, the slow pace of debt collection, the lack of effective asset management, the qualitative weaknesses in the process and stages of assessing granted facilities, insufficient accuracy in the financial and credit status of guarantors, the absence of a commitment targeting system at the bank, and the low delay penalty rate compared to the cost of

borrowing in the informal market. Among the external factors that contribute to the growth of overdue demands, one can mention: contingent facilities, the absence of an integrated information system, unexpected events, changes in laws and regulations, political-economic changes, problems in inheritance and more [13].

Therefore, examining the factors affecting non-current demands in the country's banking system and ranking the share of each of them significantly contributes to reducing these demands. Hence, this research focuses on investigating the factors and components influencing the increase in non-current demands in the country's banking system and ranks the share of each of them using the Bayesian averaging method. The main question of this article is: What factors, from the perspective of macroeconomics and specific factors of the banking system, impact the increase in non-current demands in the banking system?

3 Research background

In the economic and banking literature, many studies have investigated the non-current claims of banks, the factors affecting them and the effect of these claims on the micro and macroeconomic and performance indicators of banks. These studies usually use econometric methods. But among them, there are also studies with non-parametric methods. In the following, some of these studies are presented inside and outside the country. In their study, Radivojević et al. [23] investigated the applications of the GMM method in the field of non-current claims of Latin American banks. Using this method, they have investigated the effects of micro and macroeconomic indicators on non-current claims and have shown that there is no significant relationship between the inflation rate and microeconomic variables with non-current claims of banks. Patwary et al. [21] have investigated the effect of non-current claims on bank profitability. This article aims to investigate the effect of non-current claims ratio, capital adequacy ratio and asset return causes and adverse effects of non-current claims. The data of this study were collected from the annual reports of Bangladesh Bank and analyzed using the usual OLS method and Vector autoregressive models (VAR). The results of the study show that the ratio of non-current claims has a significant relationship with asset yield.

Kingu et al. [14] have investigated the impact of non-current claims of Tanzanian banks on bank profitability. This study has used the data of sixteen banks during the period from 2007 to 2015 and the panel data method. This study was conducted using descriptive statistics and multiple regression estimation methods. This study has shown that non-current claims have a negative relationship with the level of profitability of commercial banks in Tanzania. Sezavar et al. [24] stated in their article that banks as financial and service institutions in a society play a decisive role in the circulation of money and wealth and have a special place in the economy of every country. As society is developing and growing, the number of applicants for loans and facilities increases, and as a result, the requested amounts are higher, and in parallel, banks and credit institutions are more exposed to the risk of non-payment. Gooderzi et al. [7]. conducted research in an article entitled: "Designing a model for the collection of overdue bank claims (Sepah Bank case study)" using a descriptive survey research method. According to the main loads, the research model has good validity. It includes market and currency instability with a factor load of 0.68 as the most influential factor in recovering overdue bank debts Golzarianpour et al. [6] in their article entitled: "Factors affecting the granting of facilities by Iranian commercial banks with an emphasis on non-current claims" investigate the factors affecting the granting of facilities by banks for 17 commercial banks of Iran in 2009-2016. The obtained results indicate the negative effect of the ratio of non-current claims, liquidity ratio, average interest rate of facilities and legal reserve rate on the granting of bank facilities and the positive effect of the deposit ratio and economic growth rate on the granting of bank facilities.

4 Introducing the variables and presenting the model

4.1 Bayesian econometric model

One of the most important challenges that modelling researchers deal with is the difference of opinion regarding the potential variables that can be included in the relevant econometric model, especially when the range of explanatory variables is very wide. So far, econometricians have made a lot of efforts to solve this problem. For example, one of the solutions provided by them is to perform successive tests to remove extraneous variables or add the removed variables to the model, which has not been trusted by researchers due to the problems it had (For more information see Poirier [22]).

But in recent years, "Bayesian econometrics" has been able to provide appropriate solutions in areas such as reducing uncertainty regarding the determination of effective explanatory variables, choosing the correct model, and designing a mechanism to include the previous information of the researcher in determining the parameter values.

This is done by a method called "Bayesian Averaging Model". This approach was established by Jeffreys in [11] and later developed by others including Leamer [16], Hoeting et al. [10], Wasserman [25] and Koop and Potter [15]. This methodology has been widely used in many sciences, including economics, since the mid-1990s and with the advances in computer science and complex mathematical calculations. The basic principle in this method is that the models and related parameters are considered as random variables and their distribution is estimated based on the researcher's previous information and observable data and information.

Bayesian econometrics is based on probability laws. To explain, first consider two random events A and B, and based on the laws of probability, we can write:

$$P(A,B) = P(A/B)P(B) \tag{4.1}$$

where $P(A,B)$ is the joint probability of A and B occurring and $P(A/B)$ is the probability of A occurring subject to B and $P(B)$ is the marginal probability of B. We also have:

$$P(A,B) = P(B/A)P(A). \tag{4.2}$$

Based on this, the Bayesian law, which is the fundamental element of Bayesian econometrics, can be written as follows:

$$P(B,A) = \frac{P(A/B)P(B)}{P(A)}. \tag{4.3}$$

Now, with the assumption that Y is the data matrix (explanatory and dependent variables) and θ is the parameter vector, we can put A and B in Bayesian rule as $\theta = B$ and $Y = A$ and rewrite the equation as follows:

$$P(\theta,Y) = \frac{P(Y/\theta)P(\theta)}{P(Y)} \tag{4.4}$$

That is, in Bayesian econometrics, assuming that the parameters of the model are random variables (unlike conventional econometrics), we try to find the distribution of these random variables (including their mean and variance). Accordingly, $P(Y)$ can be omitted in the equation because it does not say anything about θ; that's mean:

$$(\theta|Y) \propto P(Y|\theta)P(\theta). \tag{4.5}$$

In this equation, $P(\theta)$ essentially represents a set of information related to the model parameters that we know before looking at the data. For instance, if we assume that θ is a parameter that signifies the returns to scale in the production process, because in many cases and under certain conditions, we can imagine that the production process has constant returns to scale, we can infer, without observing the data, that the parameter θ is likely to be equal to one. Hence, $P(\theta)$ is referred to as the Prior Function

$P(Y/\theta)$ represents the density of data on model parameters. In fact, everything we get about θ after seeing the data is from this function $P(\theta)$. Therefore, it is called Posterior Function.

After obtaining the posterior function, the average of the posterior density function can be considered as a point estimate for the coefficients of the independent variable. If θ contains k elements, the average of each element can be calculated as follows:

$$(\theta_i|Y) = \int \theta_i P(\theta|Y)d\theta \tag{4.6}$$

Also, to obtain the uncertainty of this point estimate, the variance of the posterior function can be used. Accordingly, we have:

$$var(\theta i|Y) = E(\theta_i^2|Y)(E(\theta_i))^2 \tag{4.7}$$

$$E(\theta_i)^2 = \int \theta_i^2 P(\theta|Y)d\theta \tag{4.8}$$

The result is that:

The Bayesian point estimate is the weighted average of the OLS estimate and the prior function.

The variance of the posterior function is also obtained from the average of the OLS variance and the variance of the prior function.

In recent years, Bayesian econometrics has succeeded in overcoming uncertainty about parameters and ending uncertainty about model selection. This has been done by a method called "Bayesian Averaging Model" where the desired values are often calculated through weighted averaging of possible model values. The weights depend on the degree of data support for the desired model, which is measured by the posterior probabilities of each model. The Bayesian averaging approach, unlike traditional econometric approaches, does not assume the existence of an optimal model among competing models that can be selected based on methods such as information criteria or hypothesis testing. In other words, traditional econometric methods categorize models into two polar categories: correct (optimal) and incorrect (non-optimal), and only report the results of the optimal model. However, in the Bayesian averaging approach, each model is assigned a weight or probability, and then all of these models are combined with each other based on their weights. The final model coefficients are obtained, considering the inclusion probabilities of variables. In the following, we will explain this model in more detail.

Average Bayesian model in the normal linear regression model, suppose we have R different models and M_r represents the rth model so that $(r = 1, 2, 3, ..., R)$. Each model contains a vector of parameters that we denote by θ_r. These parameters have prior functions $P(\theta_r|M_r)$ and likelihood function $P(Y|\theta_r, M_r)$ and posterior function $P(\theta_r|Y, M_r)$. that the posterior function will be as follows:

$$P(\theta_r|Y, M_r) = P(Y|\theta_r, M_r)P(\theta_r|M_r)/P(Y|M_r). \tag{4.9}$$

By having these functions in hand and calculating the probability ratio of the posterior function (PO),the probability of the posterior model $P(M_r|y)$ can be obtained. In order to make a general comparison of the models, we use the "probability ratio of the posterior function", which is represented by Po and calculated as follows. According to Bayes' law, the probability of any arbitrary model (such as M_r)) can be presented as follows:

$$(M_r|Y) = P(Y|M_r)P(M_r)/P(Y), \tag{4.10}$$

where $P(M_r)$ calculates the prior probability of the model M_r, i.e. the probability that the model is correct regardless of the data M_r. $(Y|M_r)$) is also the likelihood function of the $M_r$model, which is obtained by integrating both sides of the equation and knowing that $\int P(\theta_r|Y, M_r)d\theta_r = 1$, as follows:

$$(Y|M_r) = \int P(Y|\theta_r, M_r)P(\theta_r, M_r)d\theta_r. \tag{4.11}$$

With the given values, the probability ratio of the posterior function for comparing two models, i and j, is calculated as follows:

$$PO_{i,j} = \frac{P(M_i|Y)}{P(M_i|Y)} = \frac{P(Y|M_i)P(M_i)}{P(Y|M_i)P(M_i)}. \tag{4.12}$$

Now suppose that φ is a vector of common parameters in all models; That is, φ is a function of θ_r, in this case Bayesian econometric logic says that everything we know about these parameters can be summarized in its posterior function, $P(\varphi|Y)$:

$$P(\varphi|Y) = \sum_{r=1}^{R} P(\varphi|Y, M_r)P(M_r|Y). \tag{4.13}$$

In fact, the probability of the posterior function for these parameters is the weighted average of the probability of the posterior function of other models in which these parameters are present. Therefore, if the final likelihood and posterior function are calculated for all models, the average of the Bayesian model can be calculated. But considering that calculating these two values for all models is very time consuming if r is large, algorithms are usually used to calculate these values that do not need to be calculated for all models.

If the dependent variable affected by K is a potential explanatory variable, then by using the combinations of the existing explanatory variables, $R = 2^K$ of the econometric model can be specified for the dependent variable. All these models have the same width as the origin, but they have different combinations of explanatory variables. If the number of observations available to estimate these models is N, the general form of these econometric models with matrix symbols can be displayed as follows:

$$Y = \alpha L_N + X_r\beta_r + \varepsilon \tag{4.14}$$

L_N is a vector that is $N \times 1$ and X_r is an $N \times K_r$ matrix that contains a combination of K potential explanatory variables. The likelihood function of each model can be calculated using a suitable algorithm that can be written in

software programs. However, the parameters related to the distribution of the prior function cannot be determined for all 2^K models. Obviously, it is unlikely to have prior information about all possible parameters and models. Therefore, it is practically not possible to use the Informative prior function for the parameters in all the mentioned patterns. A solution to this problem is to use a non-informative prior distribution (uniform distribution) for all models. However, considering that using this type of prior distribution allows for calculating the likelihood ratio only for parameters that are present in all models, it is possible to use a non-informative prior (or uniform) prior distribution only for the intercept and variance (or parameter h (The h parameter is equal to the reciprocal of the variance of the disturbance term, which is called the estimation accuracy parameter. In Bayesian econometrics, this parameter is used instead of the variance of disturbance term σ^2)). In addition, the use of the previous function without information greatly increases the probability of wrong estimation of the coefficients. For this reason, another prior function called g-prior is used for other parameters β_r. One of the features of this previous function is that it can be automatically calculated and applied to all models by the algorithm. In the following, we will explain this type of prior function.

We consider the prior natural conjugate function as follows and we have:

$$\beta_r/h \sim N(\beta_r, h^{-1}V_r). \tag{4.15}$$

One of the features of this previous function is that it can be automatically calculated and applied to all models by algorithm. In the following, we will explain this type of prior function. Since it is possible to have a large number of potential explanatory variables, many of which maybe irrelevant and have no effect on the dependent variable, so we assume:

$$\beta_r = 0$$

But to obtain V_r, we use the g prior function with the following definition:

$$V_r = [g_r X_r' X_r]^{-1}. \tag{4.16}$$

Thus, to use g-prior, we only need to specify the value of g_r. This parameter is a number between zero and one, so that by setting $g_r = 0$, the desired prior distribution function is completely devoid of information. On the other hand, if we want to give the same weight to the information of the previous function and the information of the sample, it will be $g_r = 1$. Of course, most researchers believe that $g_r = 1$ is a very large value for this parameter, so people such as Fernandez et al. [4] and after conducting numerous simulations with fake data for large values of N, suggested g_r as follows:

$$g_r = \begin{cases} \frac{1}{K^2}, & N \leq K^2 \\ \frac{1}{N}, & N > K^2 \end{cases} \tag{4.17}$$

The above value is a number between zero and one and is the basis for determining g_r in the present research. But the parameters of the posterior function can be obtained by using the combination of likelihood functions and its prior distribution as follows. Here, β has a t distribution with the following mean and variance:

$$\begin{aligned} E(\beta_r|Y, M_r) &= \beta_r = \overline{V_r} X_r' Y \\ Var(\beta_r|Y, M_r) &= \frac{\overline{V_{sr}}^2}{\overline{V} - 2} \overline{V_r} \end{aligned} \tag{4.18}$$

where in:

$$\begin{aligned} \overline{V_r} &= [(1 + g_r) X_r' X_r]^{-1} \\ S_r^2 &= \frac{\frac{1}{g_r+1} Y' P_{xr} Y + \frac{g_r}{g_r+1} (y - \overline{Y}/N)'(Y - \overline{Y}/N)}{\overline{V}} \\ \overline{V} &= N P_{xr} = I_N - X_r (X_r' X_r)^{-1} X_r' \end{aligned}$$

The marginal likelihood function for each model is as follows:

$$P(y/M_r) \propto \left(\frac{g_r}{g_r + 1}\right)^{\frac{kr}{2}} \left[\frac{1}{g_r + 1} Y' P_{xr} Y + \frac{g_r}{g_r + 1} /(y - \overline{y} l_T)'(y - \overline{y} l_T)\right]^{-\frac{N-1}{2}}. \tag{4.19}$$

The posterior probability of each model can also be calculated using the following relationship:

$$P(M_r/y) = cp(y/M_r)p(M_r) \tag{4.20}$$

where c is a constant value and the same for all models and can be calculated according to the relationship $\sum_{r=1}^{R} P(M_r/y) = 1$. Also, we consider the prior probability to be equal for all models and set it to $P(M_r) = \frac{1}{R}$. In this case, if we ignore the prior probability of the model ($P(M_r) = \frac{1}{R}$), the posterior probability of any desired model (r) can be obtained as follows [2].

$$P(M_r/y) = \frac{p(y/M_r)}{\sum_{j=1}^{R} p(y/M_j)}. \tag{4.21}$$

4.2 Model description and estimation

Based on the proposed theoretical foundations, the factors affecting the non-current claims of the country's banking system in a general classification include the following:

Table 1: Factors affecting the non-current claims of the country's banking system

Row	Variable type	Variable
1	Extra banking variables (systematic)	GDP growth
2		Inflation
3		Exchange rate growth
4		The gap between the real interest rate of the informal market and the interest rate of the official market
5		Amount of money
6		The ratio of budget deficit to GDP
7		The ratio of national savings to GDP
8		The unemployment rate
9		Stock market yield
10		Net exports
11		Rate of return on assets
12		Profitability
13		Government debts
14	Intra bank variables (unsystematic)	Bank size
15		Management quality
16		Moral hazard
17		The growth of credits granted in the past period
18		Deposit to cost ratio (as an efficiency measure)
19		The percentage of obligation facilities

The functional relationship between non-current claims of the country's banking system and its determining factors is as follows:

$$Y_i = \beta_0 + \sum_{j=1}^{19} \beta_j X_{ji} \tag{4.22}$$

As can be seen, based on theoretical foundations, a wide range of variables affect the non-current claims of the country's banking system; Therefore, in this research, due to the variety and breadth of variables affecting the non-current claims of the country's banking system, we use the Bayesian model averaging method to investigate the effect of these variables on the non-current claims of the banking system. These methods are used when we intend to investigate the effect of a wide range of independent variables on the dependent variable (in this research, non-current claims of the banking system).

Also, with these methods, explanatory variables can be ranked based on the probability of their presence in the model. We have used "STATA" software to analyze and estimate the results using the Bayesian model averaging method. We have used information and statistics from the years 2001 to 2019 to investigate the factors affecting the non-current claims of the banking system. The existence of similar structures, data quality and access to them was the reason for this work. It should be noted that the observations used in this research are unbalanced panel data. All data is collected from the World Bank's World Development Indicators statistical source.

The model of non-current claims of the banking system is estimated with the Bayesian Model Averaging (BMA) method and its results are reported in the following table:

4.3 Analysis of weighted average coefficients of variables

One of the most important advantages of Bayesian analysis is the high reliability of the estimated coefficients for its explanatory variables. In this method, all possible patterns are estimated with different combinations of variables (considering that the pattern includes 19 explanatory variables, 524288 patterns are estimated with all different

Table 2: Estimating the non-current claims of the banking system with the BMA method

Variable name	**Weighted average of posterior distribution of coefficients**	**Standard deviation of posterior distribution of coefficients**	**The probability of variable presence in the pattern**
Fixed sentence	-23.88746	1.542956	1
GDP growth	-0.6767661	0.133494	0.99
Inflation	0.63462	0.084541	0.99
Exchange rate growth	0.8492413	0.0961432	1
The gap between the real interest rate of the informal market and the interest rate of the official market	1.876709	0.1314289	1
Amount of money	0.6334835	0.1613727	0.99
The ratio of budget deficit to GDP	0.640406	0.126132	0.99
The ratio of national savings to GDP	-0.0042886	0.0041526	0.18
The unemployment rate	0.8958209	0.0110328	0.99
Stock market yield	0.02661	0.2600686	0.99
Net exports	0.665090	0.12823	0.16
Rate of return on assets	-0.090323	0.091238	0.99
Profitability	-0.546090	0.112309	0.99
Government debts	0.440908	0.1165789	1
Bank size	1.540900	0.0008193	1
Management quality	0.657448	0.090890	0.18
Moral hazard	0.0901821	0.0054678	0.09
The growth of credits granted in the past period	1.332432	0.6780321	1
Deposit to cost ratio (as an efficiency measure)	1.5567090	0.998022	1
The percentage of obligation facilities	1.657899	0.184435	1

combinations of explanatory variables) and coefficients are averaged; Therefore, the coefficients are not estimated based on a single model, but are obtained from the weighted average of the estimated coefficients of each of the variables in the repetition or effective sampling of the models. As can be seen in Table 1, the second column from the right side of the weighted mean of the posterior distribution of the coefficients of each variable, the third column of the standard deviation of the posterior distribution of the coefficients and the fourth column also shows the probability of inclusion of each of the 19 variables in 524288 times of effective sampling of the models. Concerning the probability column of each of the explanatory variables, we find that among the explanatory variables considered, some variables have a definite effect on the non-current claims of the banking system (the probability of their belonging to the pattern of non-current claims of the banking system is certain). According to the results, we will interpret the results:

- The asset return rate, with the weighted average of the posterior distribution coefficients, is -0.090323, Gross Domestic Product (GDP) growth, with the weighted average of the posterior distribution coefficients, is 0.6767661, and net exports with the weighted average of the posterior distribution coefficients, is 0.1102836, and profitability with the weighted average of the posterior distribution coefficients is -0.546090, which are present in the model with a 99% probability, and have an inverse effect on the non-current demands of the banking system.
- The variables of inflation growth, exchange rate growth, the gap between the real interest rate of the informal market and the interest rate of the official market, the amount of money, the percentage of debt facilities, the ratio of the budget deficit to the GDP, the unemployment rate, the size of the bank, the growth of loans granted in the past period and the ratio of deposits to Cost (as an efficiency measure) that is present in the model with a probability of 99% and 100% and has a direct effect on the non-current claims of the banking system.
- Other explanatory variables, including the ratio of national savings to GDP, stock market returns, management quality and moral hazard, do not affect the non-current claims of the banking system due to their low probability of inclusion. The very low probability of these variables indicates that these variables cannot explain the fluctuations of non-current claims of the banking system; Therefore, these variables do not have the expected effects based on standard patterns on non-current claims of the banking system.

4.4 Weighted average least squares (WALS)

Bayesian model averaging method has many advantages but also limitations. One of the limitations of the Bayesian method is the length of its calculations; such a way that simulation and approximation methods or algorithms are

needed to perform its calculations. Magnus et al. [18] have solved all these problems by providing the weighted average least squares and also providing the Laplace prior scaling function instead of the normal prior distributions in the Bayesian method. Unlike the Bayesian method, the weighted average least squares is based on the initial orthogonalization of auxiliary regressors and their parameters; Therefore, the volume of calculations is greatly reduced by this estimator. Also, it allows the use of a prior distribution consistent with a more explicit notion of uncertainty about the role of covariates. To interpret the statistical significance of the coefficients, following Kass and Raftery [12], according to the value of the posterior probability of occurrence (PIP), if $PIP < 0.5$, the influence of the variable under investigation is insignificant. To analyze the robustness of the model results, an analysis of the model's strength is presented in the table below with 2^{19} models using all possible combinations of the explanatory variables listed. Estimating the model using both the BMA and WALS methods shows the sensitivity of the results to the prior distribution of coefficients. If the quality of the results in the WALS method is similar to the results of Bayesian model averaging, the robustness of the results and their insensitivity to the prior distribution of coefficients are confirmed. In this method, the basis for evaluating the importance of explanatory variables in influencing the dependent variable is the t statistic. As can be seen, the results are qualitatively similar to the results of the Bayesian model averaging method.

Table 3: Estimating the non current claims of the banking system with the WALS method

Variable name	**Coefficient**	**t statistic**
Fixed sentence	5.768	0.98
GDP growth	4.784	1.09
Inflation	5.090	0.78
Exchange rate growth	5.612	1.023
The gap between the real interest rate of the informal market and the interest rate of the official market	8.644	1.87
Amount of money	4.709	1.98
The ratio of national savings to GDP	1.112	5.23
The unemployment rate	9.670	1.76
Stock market yield	0.908	6.54
Net exports	0.221	9.01
Rate of return on assets	5.896	0.98
Profitability	5.657	0.87
Government debts	5.650	1.34
Bank size	6.630	1.12
Management quality	0.342	8.990
Moral hazard	0.768	7.09
The growth of credits granted in the past period	6.091	1.98
Deposit to cost ratio (as an efficiency measure)	5.114	1.67
The percentage of obligation facilities	6.367	1.49

5 Conclusion and suggestions

The use of variables and traditional patterns in explaining the non-current claims of the banking system has faced many challenges in the literature. This article tries to fill this gap by considering different variables in the context of traditional and new business theories by using Bayesian econometrics. First, we theoretically explained the determinants of non-current claims of the banking system, then we estimated the non-current claims model of the banking system by using Bayesian econometrics and applying the "Bayesian model averaging" method by Stata software. The dependent variable in this research is non-current banking system claims. Non-current claims of banks and financial and credit institutions are the result of two fundamental factors, which are: internal organizational factors related to the banking system itself, resulting from improper and inefficient management, especially the bank's size, the growth of past loans, and the deposit to cost ratio (as a measure of efficiency), and the second factor is external organizational factors that are beyond the control of the banking system and include gross domestic product (GDP) growth, net exports, inflation, exchange rate growth, the gap between the real interest rate in the informal market, and the official market interest rate, money supply, and the budget deficit to GDP ratio, and the unemployment rate. This study shows that the factors that are under the control of the banking system (internal factors) have a greater effect on the non-current claims of banks than external factors. It is hoped that this article can take a step towards solving one of the problems of the banking system and cause more economic growth to bring about the excellence of the banking system; Therefore, according to the brief analysis and exploration that we have had in this article regarding overdue demands, it must be said that the growth of this part of claims in the financial statements of banks and credit institutions is not a pleasant situation. Failure to pay attention to it and failure to reform the regulatory structure can make the country's banking system face a bankruptcy crisis in the not-so-distant future; In

addition, one of the very key points of the interest-free financial system is that there is a direct relationship between its implementation and the amount of debt. That is, the more real and informal this system is implemented, the lower the amount of debt in the financial system. So it can be claimed that when there is no debt in the financial system, the financial system is well and truly implemented. Additionally, the solutions implemented in other countries, as mentioned in the previous section, emphasize the necessity of increasing regulatory standards, creating motivation by encouraging prudent behaviour and penalizing reckless behaviour, implementing management reforms in the banking system, and enhancing the transparency of information flows. Furthermore, in similar studies, the recommendations include creating comprehensive and up-to-date software for the credit records of customers in the country's banking network, eliminating directive lending, and establishing electronic monitoring processes beyond the authority of the personnel of the banks' credit committees. In general, this study considers the risks associated with the expansion of non-current bank loans in past years to be very serious. It has the potential to severely affect the financial stability of the national economy, leading to the bankruptcy of many banks. With the increase in the general price level, other macroeconomic variables, especially income distribution and poverty in society, will also expand. Therefore, it is essential to quickly reform the country's banking system and provide financial and non-financial support to the productive sectors.

Finally, some solutions adopted in several countries are presented in the form of the following table:

Table 4: Solutions adopted in several countries

Country	**Preventative tools**	**Actions taken**
Pakistan	Incorporating contractual terms in contracts Receiving a late fine based on financial punishment Selling bail without court permission	Banks should use the fines received for charitable purposes, so banks keep funds for this purpose.
Bahrain	Forcing the debtor to pay alms to charities	Banks charge a late payment penalty equal to 1.25% of the overdue amount from debtors for charitable purposes.
Malaysia	Loss and fines for delay	Granting discounts and arrangements to creditworthy customers in order to remove any doubts and uncertainty related to the rights of customers to receive such discounts, all conditions are included in the form of a legal article (condition) in the contract.
Kuwait	Receiving the costs incurred by the creditor to sue and recover the principal of his money.	
China	Creating incentives such as tax discount and exemption from administrative costs	Increasing disclosure standards and management reforms, passing the necessary laws, taking necessary measures to reduce risk
Korea	Establishment of Asset Management Company of Korea and a fund related to non-current assets	Strengthening the rules related to saving loans and standards related to the classification of bank capital restructuring facilities
Japan	Passing laws on improving information flows, improving accounting standards	In addition to amending the laws, the Japanese government has used government funds to deal with the weaknesses of the banking sector

By summarizing the results, the best way to reduce the non-current claims of banks is to include contractual conditions in the contracts, receive late fines based on financial penalties, sell collateral without court permission, and pass laws on improving information flows and improving accounting standards.

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