




## Shadow Banking and Risk: the Case of Iran<sup>1</sup>

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### ARTICLE INFO

#### Article history:

Date of submission: 09-02-2024

Date of revise: 03-03-2024

Date of acceptance: 09-03-2024

#### JEL Classification:

E44

G28

G32

#### Keywords:

Risk Management

Shadow Operation

Capital Structure

Panel Data

Iran

### ABSTRACT

Banks and financial institutions face various risks. The effective management of these risks plays a vital role in the efficiency and effectiveness of these banks. One of these risks is shadow banking in the financial institutions. This paper conducts the research to discuss the effects of shadow banks on banking risk. The research problem of the paper is how the operations of Iranian state banks affects risk. We analysis this risk with a selection of state banks namely: Agricultural, Housing, Post Bank, Industry and Mining, Sepah, Export Development and Cooperative Development banks from 2016 to 2022. Capital structure, asset quality, liquidity, capital adequacy and banks' size are considered as explanatory and control variables. We used the ratio of off-balance sheet items to total asset, bank claims from subsidiaries and bank investment in securities as the indicators of shadow banking respectively in three models estimation based on Panel Data. The results show that shadow banking, with the three indicators which used, significantly increase the risk, while capital structure offset part of such an effect. In other words, increasing the ratio of off-balance sheet items to assets, bank claims from subsidiaries and bank investment in securities leads to higher risk. However, a perfect capital structure can offset part of increasing effect of shadow banking on the risk. Results also indicate an increase in asset quality, liquidity, and capital adequacy lead to a decrease in the risk, while expansion of banks' size increase the risk.

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DOI: <https://doi.org/10.48308/jep.5.1.83>



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## 1. Introduction

The term shadow banking was coined by the American economist Paul A. McCulley<sup>1</sup> in 2007 and was used for the first time in a speech at the annual financial symposium at the Federal Reserve Bank of Kansas City (Kodres, 2013). He was mainly referring to non-banking financial institutions that were involved in asset conversion before and during the financial crisis of the first decade of the 21st century. In his approach, the financial system included two parts: the supervised banking system and the parallel banking system. Commercial banks, which are part of the supervised banking system, were traditionally engaged in asset change and used short-term deposits to secure long-term loans. By creating a parallel system, shadow banks have operated in a similar manner, except that they collected short-term funds from the money markets and used them to purchase long-term assets. A few researchers consider shadow banking equivalent to market-oriented financing or market-based credits.

Shadow banking can impose potential risks to the financial system. The most important risks caused by shadow banking have been stated in four groups: 1- Maturity mismatch: meaning short-term financing for investing in long-term assets. For example, shadow banks pay loans by relying on almost non-transferable assets such as securities or short-term assets for long-term loans. 2- Liquidity manipulation or in better words liquidity risk: it means using IOUs<sup>2</sup> to buy assets with low liquidity asset. 3- Leverage: Using methods such as borrowing to buy fixed assets in order to magnify the potential profit in an investment. 4- Transferring credit risk: primary lender passing the risk to the next lender or purchaser of the IOU. The most common definition of shadow banking is the Financial Stability Board (FSB). Regarding the description of FSB, shadow banking raises to credit intermediation which covers activities outside the banking system (FSB,

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1. McCulley adheres to Keynesian economics, and was particularly influenced by Hyman Minsky.

2. An IOU, a phonetic acronym of the words "I owe you," is a document that acknowledges the existence of a debt.

2015). While banks are supported by central banks and safety nets (such as deposit insurance and debt guarantees), shadow banks operate without access to central bank resources or public credit guarantees, which increases their risk. The Financial Stability Board (FSB, 2014) warns that shadow banks in emerging markets pose the greatest risk to the global economy, as shadow banking widely increases the spread of risk in financial markets. Due to the lack of access to the resources of the central bank, in the event of a problem and lack of liquidity, along with the lack of reliable insurance for unstable economic conditions, it can lead to national or even international economic crisis. In fact, the stability board's warning is aimed at increasing systematic risk through shadow banking activities (Adrian & Shin, 2009).

The 2007-2009 global financial crisis highlighted the role of shadow banking in financial stability (Huang, 2018, Voellmy, 2019). Since then, the term shadow banking is associated with risk which can front-runner to financial instability. Although most shadow banks are supervised someway, they are not normally subject to practical supervision, which is the main objective of regulating the usual banking system (Adrian, 2014). In addition to the emergence of non-bank financial intermediaries, shadow activities by traditional banks led to the expansion of the shadow banking system. Indeed, the shadow activities of banks have grown in Iran in recent years. There is a large number of financial and credit institutions, capital supply companies, investment funds, and small and large Qarzul Hasan foundations in Iran. Detail information of these institutions on the volume of transactions, financial circulation, and their assets is not transparent and available. However, due to the large number of such institutions, a significant financial turnover in them cannot be exactly estimated. The report of the Monetary and Banking Research Center of the Central Bank of Iran shows that the desire for shadow banking activities in the country is increasing in recent years. This reports states that the size of shadow banking assets in the country has grown 20 times in the last 4 years. The share of shadow banking

in the GDP has also increased to about 75% during recent years. This ratio for US economy is about 80% (Asr-e Bank, 1402).

Iranian Central Bank's strict rules and regulations prevents balance sheet flexibility and therefore creates incentives for shadow banking. Considering the rising trend of shadow banking in Iran, which is expected to continue in the coming years, investigating the consequences of shadow banking activities becomes more important. For example, the weakness in the control of some credit institutions in the past years has led to crises for the country's money market. Therefore, identifying the effects of shadow banking on banking risk can help policy makers to better organize the country's monetary system. In this regard, the problem of the present study is to investigate the effects of shadow banking on risk in a selection of Iranian state banks. So, in this article the relationship between shadow banking operations and risk transfer of such activities will be investigated. To this end, we employed cross-banked data, including seven state banks, during the period of 2016 to 2022 in Iranian financial system.

For this purpose, this paper is presented in the following sections. After the introduction, the second part, devoted to the theory of shadow banking. In the third part some of the studies carried out in the field are introduced in order to emphasize the necessity of addressing the issue. In the fourth section, the measurement of shadow banking and model specification is presented. The fifth part is dedicated to empirical analysis and findings. Finally conclusion and suggestions are given in the sixth part of the research.

## **2. Theoretical Literature**

The shadow banking system is a term for the collection of non-bank financial intermediaries that legally provide services similar to traditional commercial banks but outside normal banking regulations. Shadow banking is a term used to describe bank-like activities (mainly lending) that take place outside the traditional banking sector. It is now commonly referred to internationally as non-bank financial intermediation or market-based

finance. Shadow bank lending has a similar function to traditional bank lending. However, it is not regulated in the same way as traditional bank lending. In traditional lending, the volume of lending by a bank is linked to the volume of deposits the bank receives and what it can borrow on the markets. Shadow banking works on the same principle. So, for example, an investment fund takes in money from investors, issuing shares in the fund in return. In order to earn a return on the investment for its investors the fund uses this money to buy securities (for example, a bond issued by a country or company). Just as the bank acts as the "middleman" between savers and borrowers to earn a specified interest rate, the investment fund acts as the channel linking investors and countries/companies to earn an investment return. By raising funds from investors and then lending this money to countries/companies, shadow banking entities act like banks.

The Financial Stability Board (2011) defines the shadow banking system as credit intermediation involving institutions and activities outside the banking system. The International Capital Markets Association's European Repo Council acknowledges that the term shadow banking is inherently ambiguous and presupposes that traditional banking is more transparent. However, the Financial Stability Board (2011) believes that shadow banking is actually "market-based financing" that is carried out by specialized non-banking units who break down the credit intermediation process into a detailed sequence or chain of separate operations, while they rely on an active secondary market for asset pricing. Buiter (2008) has provided a performance-based definition in which he likens the shadow banking system to a large number of highly leveraged non-depository institutions that, under normal circumstances, have the necessary liquidity, but they do not have the necessary liquidity in times of market turmoil. These financial institutions hold little capital, which is inconsistent with prudential requirements of liquidity, leverage, assets, or liabilities. After the financial crisis of 2007-2009, shadow banking and its consequences were the focus of many studies. By reviewing these studies, it is clear that the expansion of shadow banking

has destructive effects on the economy and the banking system, one of the most important of which is the increase in risk in the banking system. The link between shadow banking and financial risk is done through financial regulation. Since shadow financial intermediaries are not regulated by the central bank, on the one hand, they can create unnecessary credit. On the other hand, their lending is likely highly risky (as happened in the 2007-2009 financial crisis). Financial institutions are usually involved in shadow banking to break banking regulations such as regulations on capital requirements. In this way, they can increase their leverage, which increases their expected returns (FSB, 2013).

The lack of adequate supervision by financial regulators increases the risks associated with the shadow banking system, especially in the context of imitating many banking activities. Shadow banking institutions are exposed to credit risk, liquidity risk, bankruptcy risk, and excessive leverage risk when conducting transactions based on shadow banking operations. Meanwhile, the liquidity risk, which is reflected in the unexpected mass withdrawal of funds, is of particular importance. While commercial banks finance their lending activities mainly through deposits obtained from customers, shadow banking institutions operate mainly on the basis of short-term financing from the market, including conditional repurchase transactions and short-term securities. In this financing structure, even for a unit that is in a good financial position, it becomes bankrupt with a sudden and unexpected withdrawal of funds. During the financial crisis of 2007-2009, several similar cases occurred regarding shadow banking activities by traditional banking institutions. The mass withdrawal of funds can be due to the loss of confidence in the quality of assets, which is caused and the lack of guarantees from the government or the central bank (Roubini and Mihm, 2011).

Although Shadow banking increases credit availability, it increases risk exposure of financial risk. In fact lending and liquidity creation are necessary for the economy, but if this liquidity creation expands too much, it will be detrimental to financial risk. It can be said that a stable financial

system is a prerequisite for a decent monetary policy. But, the problem is that in the modern financial systems, shadow banks create debt in excessive quantities. This credit does not finance the new investment, but funds consumption or real estate purchase. Credit and money generated by banks increase purchasing power. Much of this purchasing power is spent on purchasing existing assets. However, the result is not a new investment but rising asset prices as we see in the Iranian economy. As a result, banks make the economy risky unless central bank policy regulations constrain them. Even monetarists, who advocated free markets policies and were suspicious of government intervention, believed that credit and money creation processes were so different in nature that free market principles should not be applied to them. They believed that credit creation was very vital and could not be left-hand to bankers which leads the financial system to be risky.

In 2012, the Financial Stability Board published the results of an extensive supervisory review of bank and non-bank credit intermediation in 25 countries in the Euro zone. Results showed that domestic shadow banking activities are not significant in most countries, but if cross-border activities and communication through different types of institutions are considered, the results will be different. Four main activities of shadow banking (maturity conversion, liquidity conversion, credit risk transfer, and leverage) identifying activities that determine the risk. However, the scale of risk associated with shadow banking activities is considered lower than the actual scale (FSB, 2013). The increase of the scope of shadow banking activities is one of the concerns of the European Central Bank, as from the point of view of the European Central Bank, the rapid growth of the shadow banking activity is considered a potential source of risk for financial stability in the Euro zone. In this regard, the European Central Bank identifies a wide range of institutions engaging in banking operations, such as investment funds or money market funds, as the potential source of future systemic events due to their expansion and impenetrability (FSB, 2013).

Pseudo-banking, unsecured funds, lack of access to central bank resources, use of leverage and off-balance sheet items are among the important features of shadow banking. In shadow banking, keeping assets off-balance sheet items is widely used, which was one of the main reasons for the growth of the shadow banking system in the years before the 2007 crisis. With the reform of accounting standards in the United States in the 1980s, secured loans and related liabilities were moved off the banks' balance sheets and into special book for off-balance sheet items, developing the structure of shadow banking and its instruments. Off-balance sheet items are activities that lead to the creation of obligations or claims off the balance sheet, but again become an asset or liability on the balance sheet in case of planned or previously agreed events. In other words, these items create a conditional asset or liability in exchange for a fee for the banks, which can affect the financial statements of the banks in the future. Off-balance sheet activities are generally carried out with the aim of achieving high profit margins, risk coverage, and liquidity management, but they can affect various aspects of banks' performance. Off-balance sheet items can increase banks' profitability through service diversification, and subsequently, income diversification, but it should be noted that these activities create contingent liabilities that are usually not backed up. Therefore, more use of these items will increase the risk for banks. If the bank transfers these items to the balance sheet, it affects the bank's ability to fulfill its obligations and exposes the bank to credit risk. Also, the increase of off-balance sheet items causes the bank to decrease liquidity and leads to an increase in liquidity risk through the decrease of banks' liquidity reserves. Off-balance sheet activities are very diverse and only some of them are used in Iran, including guarantees, letters of credit, credit lines, managed funds, and commitments to guarantee issued partnership bonds.

According to this theoretical basis, the focus of the current research is to evaluate the effect of Iranian state banks' shadow operation on banking risk with regard to the role of capital structure in a selection of government



owned banks (including: Agricultural, Housing, Post Bank, Industry and Mining, Sepah, Export Development and Cooperative Development Banks) from 2016 to 2022. Calculating shadow banking indicators requires obtaining statistical data, and in this research, three main indicators including the ratio of off-balance sheet items, claims from subsidiary companies, and investment in securities have been used and the relative data provided for the progress of this research.

### **3. Research Background**

Adrian is a forerunner in addressing the idea of shadow banking. Adrian and Shin (2009) argue that financial intermediaries are central to monetary policy transmission and financial stability policies. They examined the role of shadow banking in the 2007-2009 financial crisis. They illustrated that shadow banking results from asset securitization and the mixing of banking to the capital market. Securities were initially intended as a way to transfer credit risk to those who were able to bear it but eventually gave rise to the instability of the whole financial system by letting banks and other intermediaries to leverage up by buying one another's securities.

Millán (2014) evaluated Shadow Banking in Different Countries in 2013 and showed that in terms of the size of shadow banking to GDP, United States, England and China were the leaders, and in terms of the size of shadow banking to the financial system, China, the Netherlands, and England were ahead. Hsu et al. (2014) in a study titled Shadow Banking and Systematic Risk in China, investigated the relationship between shadow banking and systematic risk in China during 2007-2012. The analyses were based on the risk transfer matrix and the Markov process model. These researchers concluded that shadow banking leads to the concentration of risk in the financial system and banks absorb a large part of this risk. Avkiran et al. (2015) in a study titled Monitoring Transmission of Systematic Risk from Shadow Banking to Regulated Banking analyzed US banks in 2013. Researchers used structural equation modeling by the Partial Least Squares

method to analyze the data and showed that about 75% of systematic risk changes in formal banking were caused by shadow banking. Tang & Wang (2016) in a study titled the Effects of Shadow Banking on Profitability - an Empirical Study Based on Banks in China, analyzed the relationship between shadow banking and profitability in China during 2001-2007. For controlling the effect of bank characteristics, operational quality, and asset quality, they used two separate models for asset return and risk-adjusted asset return (Sharpe Ratio). Using Generalized Least Squares regression, they concluded that as banks move towards shadow banking, banks' income increases and shadow banking has a positive relationship with risk-adjusted returns (the Sharpe Ratio). In general, the study shows that shadow banking is associated with higher returns and risk. Turner (2016) argues that the central of financial uncertainty in recent economies is the interaction between the ability of banks to create credit, money, and purchasing power on the one hand, and the limited supply of urban land on the other hand. The outcome of this interaction is the self-reinforcing cycles of growing asset prices (such as land and housing) and credit. Shadow banks that are not regulated play a vital role in these cycles. Ji et al. (2019) in a study titled Financial Structure and Systematic Risk in Banks: Evidence from China's Reforms analyzed banks in China in 2006-2014. Researchers used the Vector Auto-regression method with Distributed Lags and showed that changing the financial structure towards a market-oriented structure through improving the debt repayment capacity of banks and also strengthening the credit monitoring of borrowers by banks lead to a reduction in risk. Wu & Shen (2019) in a study titled The Effects of Shadow Banking on Bank Risk from the Perspective of Capital Adequacy, investigated the relationship between shadow banking, capital adequacy, and bank risk. In their model, researchers used total assets, the ratio of loans to deposits, the ratio of cost to income, net profit margin, and the ratio of short-term deposits to total deposits and GDP growth as control variables. By examining banks in China during 2010-2016 with the regression method of Least Squares concluded

that shadow banking leads to an increase in risk and good governance reduces that risk. Feve et al. (2019) explored the interaction between traditional and shadow banking using a DSGE model for the US economy. Their findings indicate that increasing shadow banking activities strengthens the transmission of shocks to the real sector of the economy because it increases regulatory evasion. The results of their study support the recent alteration in banking regulation toward a more global approach, as encouraged in Basel three (3). Zhou & Tewari (2019) conducted a study titled *Shadow Banking, Risk-taking and Monetary Policy in Emerging Economies: A Panel Co-integration Approach* analyzing banks in emerging economies from 2002 to 2017. Considering the effects of GNP, price level, and bank credit, the researchers used the Panel co-integration method to analyze the data, and showed that the relationship between effective monetary policy and shadow banking is negative. Fan & Pan (2020) conducted a study on the *Effect of Shadow Banking on Systematic Risk in a Complex Dynamic Interbank Network System*. Using mathematical modeling and Dynamic Processing Algorithm, researchers showed that shadow banking leads to an increase in systematic risk, increases in the speed of bankruptcy, and decreases the survival ratio. Results also indicate that by reducing the number of shadow banks, the relationship between commercial banks increases and risk decreases. Qiu (2020) conducted a study titled *Shadow Banking and Loss of Commercial Banks' loans on Chinese banks during 2008-2018*. In the model, researchers used non-current loans, ratio of loans to assets, capital adequacy ratio, gross income, net cost, total assets, and economic growth as control variables. The study shows that shadow banking leads to an increase in the loan loss provisions of commercial banks and transfers the risk from shadow banking to commercial banks. Pournajati and Houshmand Neghabi (2021) have studied the effects of shadow banking on banking risk and capital adequacy in banks admitted to the Tehran Stock Exchange. Researchers have used the data of 14 banks admitted to the Tehran Stock Exchange during the years 2013 to 2019 and

two separate regression models to investigate the effect of shadow banking on risk (the first model) and capital adequacy (the second model), in which the size of the bank, the share of deposits, the share of granted facilities and the loss reserve of granted facilities have been included as control variables. Using the Panel Data method, researchers have concluded that shadow banking has a direct and significant effect on banking risk. Makipour, A., et al., (2023). Studied the effects of monetary policy in Iran's economy with the existence of shadow banking, using the Dynamic Stochastic General Equilibrium method. This study shows that shadow banking is growing rapidly in Iran, and due to a lack of activity within the framework of Central Bank regulations, it can reduce the effectiveness of monetary policies. To investigate the role of shadow banking, the effects of monetary policy shock have been investigated in two different scenarios. In both cases of expansionary monetary policy or contraction monetary policy, with the scenario of considering shadow banking in the economy, disruptive effects on growth and inflation variables were observed. Also, with the application of expansionary monetary policy, the production changes after a period become negative, and with the application of contraction monetary policy, taking shadow banking into account, the amount of reduction in production and the general level of prices occurs to a lesser extent and the effects of the contraction policy have been reduced. In the model after tightening monetary policy, regular banks reduce the amount of loans on their balance sheet while shadow banks increase lending. This reduces the real effects of the shock, but at the same time shadow banks increases the reaction of key variables to real shocks and can make the financial sector and the whole economy more unstable and risky which take the economy out of the path of stability and development.

Based on the researcher's reviews of domestic and foreign empirical studies, no study has investigated the effects of shadow banking on banking risk based on ownership in Iran's banking system. In fact, investigating the risk transfer from shadow banking operations in Iranian state banks has not been done in any study. A review of previous studies shows that although

there is a strong theoretical literature on the impact of shadow banking on financial risk, it suffers from the shortage of empirical studies on this effect in the financial system of Iran, especially the state banks which run by the government. Most studies on this issue addressed financial crisis. Also, shadow banking studies mostly examined the issue for a specific country, and none of the studies were devoted to the cross-bank data of a country. The present study deals with the transfer of risk from the shadow banking activities to the official state banks in Iran during the period of 2016 to 2022 in state banks. Also, innovation of this research is, combining the three variables of shadow banking, capital structure and banking risk only in state banks. Moreover, assets quality, liquidity, capital adequacy, and the size of banks are used as the control variables, which cannot be seen in other studies in the form of cross-bank investigation. We expect that shadow banking affect banking risk in the Iranian states banks.

#### **4. Measurement of Iran's Shadow Banking and Model Specification**

In the present study, risk is the dependent variable that is measured using the inverse of relation number (1). Relationship number (1) is known as the Z score where  $K$  is the ratio of available cash to total bank assets,  $\mu$  is the average return on total bank assets, and  $\delta$  is the standard deviation of return on total bank assets (Lee & Hsieh, 2014). This statistical measurement is used to compare data points from different data sets. Z score can be zero, positive or negative. If the score is zero, it indicates that the score is identical to the mean. In other words, it point is average. Positive values represent how far above the mean a point is on the distribution curve. Negative values represent how far below the mean a point is on the distribution curve. A larger Z score means lower the probability of bankruptcy.

$$Zscore = \frac{K + \mu}{\delta} \quad (1)$$

These independent variables are applied in the following models from 3-5 respectively:

- 1) The ratio of off-balance sheet items to the total assets of the bank. Off-balance sheet items are activities that lead to the creation of obligations or claims off the balance sheet or become an asset or liquidity in the balance sheet. These items refers to the transactions that do not appear on the banks' balance sheet and are disclosed only in the explanatory notes of financial statements (used in equation 3).
- 2) The bank's claims from subsidiaries indicates debts of companies that belongs to the bank or debt of companies in which the bank owns more than half of the shares (used in equation 4).
- 3) The bank's investment in securities and loans with short and long-term maturities (used in equation 5).

These indicators used as symbol of shadow banking considering Iran's economy and available data during 2016-2022. In this research, the capital structure has the role of a moderator variable, and following Gill et al. (2011) is defined as the ratio of long-term liabilities to total assets in order to investigate the interactive effect of capital structure and shadow banking activities on risk, so, the multiplication of capital structure and shadow banking indices is included in the model. The control variables of this research include asset quality (the ratio of past due, deferred, and doubtful loans to the total assets of the bank), liquidity (the ratio of cash balance to the total assets of the bank), capital adequacy (the ratio of capital to the total assets of the bank) and bank size (the logarithm of bank assets). Considering these dependent, independents, moderating, and control variables, the proposed model which includes the important variables affecting risk in the banking system. The base equation of the present study is in the form of equation number (2):

$$risk_{it} = \alpha + \beta_1 shadow_{it} + \beta_2 shstructure_{it} + \beta_3 npl loans_{it} + \beta_4 liquidity_{it} + \beta_5 cadequacy_{it} + \beta_6 size_{it} + e_{it} \quad (2)$$

Where *risk* indicates risk, *shadow* (1, 2 and 3 according to the type of shadow banking operations in the Iran's state banks) indicates shadow banking, *shstructure* indicates the interactive effect of shadow banking and capital structure, *nploans* indicates asset quality, *liquidity* indicates liquidity, *cadequacy* indicates capital adequacy, and *size* indicates bank size. It should be noted that the equation number (2) will be estimated in the form of three separate panel data models, in such a way that for shadow banking, the three variables of the ratio of items: off-bank's balance sheet, the bank's claims from subsidiaries, and the bank's investment in securities are separately calculated and entered in models 3-5 respectively. Therefore, the three models of the research will be in the form of equations number (3) to (5):

$$risk_{pub,t} = \alpha + \beta_{11}shadow(1)_{pub,t} + \beta_{12}sh(1)structure_{pub,t} + \beta_{13}nploans_{pub,t} + \beta_{14}liquidity_{pub,t} + \beta_{15}cadequacy_{pub,t} + \beta_{16}size_{it} + e_{1,t} \quad (3)$$

$$risk_{pub,t} = \alpha + \beta_{21}shadow(2)_{pub,t} + \beta_{22}sh(2)structure_{pub,t} + \beta_{23}nploans_{pub,t} + \beta_{24}liquidity_{pub,t} + \beta_{25}cadequacy_{pub,t} + \beta_{26}size_{it} + e_{2,t} \quad (4)$$

$$risk_{pub,t} = \alpha + \beta_{31}shadow(3)_{pub,t} + \beta_{32}sh(3)structure_{pub,t} + \beta_{33}nploans_{pub,t} + \beta_{34}liquidity_{pub,t} + \beta_{35}cadequacy_{pub,t} + \beta_{36}size_{it} + e_{3,t} \quad (5)$$

In this study, the data was obtained from the website of the Higher Institute of Banking Education of Iran. Considering available data, the research period is limited to 2016-2022. The investigated state banks are Agricultural, Housing, Post Bank, Industry and Mining, Sepeh, Export Development and Cooperative Development banks. Because of the existence of a time period and sectors in the data, the estimation is based on Panel Data. Since, the time period is 6 years, therefore, Unit Root and Co-integration tests are not necessary (Baltaji, 2008). Hausman test also showed that fixed effect method is appropriate for models estimation. FGLS method

is also used to account for the effect of heteroscedasticity. There is not also cross-sectional dependency in the models.

## 5. Empirical Analysis and Findings

The estimation results of equation number (3) on state banks are reported in table number (1). The Wald Chi<sup>2</sup> statistic and its corresponding probability indicate that the model is well estimated. Based on the results, shadow banking has a significant increasing effect on the risk of state-owned banks, while capital structure moderates the effect of shadow banking on risk. In other words, an increase in the ratio of off-balance sheet items to assets leads to an increase in risk, but a decrease in the ratio of debt to assets offsets part of this increase. Also, results indicate that the increase in asset quality (decrease in the ratio of past due, deferred, and doubtful loans to total assets), increase in liquidity (increase in the ratio of liquid assets to total assets), and increase in capital adequacy (increase in the ratio of capital to total assets) lead to a decrease in risk in state-owned banks, while an increase in bank size (logarithm of total assets) leads to an increase in the risk.

**Table 1.** Model estimation results, Equation 3

Variable	Coefficient	t-value	P-value
Constant	0.9445	60.11	0.000
The ratio of off-balance sheet items to total asset as an indicator of shadow banking	0.0007	28.98	0.000
Capital structure index * the ratio of off-balance sheet items	-0.0001	-84.07	0.000
Asset quality	-0.0030	-38.04	0.000
Liquidity	-0.0398	-41.11	0.000
Capital adequacy	-0.0231	-20.15	0.000
Size	0.0009	13.87	0.000
Wald Chi <sup>2</sup> (344003)			0.000

Source: Research finding



**Model 4: Bank claims from subsidiaries as an indicator of shadow banking**

The estimation results of equation (4) for state banks are reflected in table (2). According to the Wald Chi<sup>2</sup> statistic and its probability, the model is well estimated. The results show that shadow banking leads to an increase in risk of state banks. On the other hand, the capital structure can mitigate part of the consequence of shadow banking on risk. In fact, increasing the bank's claims from subsidiaries increases the risk, which is partially offset by the capital structure. Regarding other variables, the results indicate that in state-owned banks, increasing asset quality, liquidity, and capital adequacy reduce the risk, while increasing in the size of banks raises the risk.

**Table 2.** Model estimation results, Equation 4

Variable	Coefficient	t-value	P-value
Constant	1.0801	25.82	0.000
Bank claims from subsidiaries as an indicator of shadow banking	0.0170	21.41	0.000
Capital structure index * bank claims from subsidiaries	-0.0008	-27.47	0.000
Asset quality	-0.0028	-18.27	0.000
Liquidity	-0.0529	-19.08	0.000
Capital adequacy	-0.0239	-92.15	0.000
Size	0.0016	5.82	0.000
Wald Chi <sup>2</sup> (59223.4)			0.000

Source: Research finding

**Model 5: Bank investment in securities as an indicator of shadow banking**

The estimation results of model number (5) on state banks are presented in table number (3). The Wald Chi<sup>2</sup> statistic and the corresponding probability confirm the goodness of the model estimation. According to the results, shadow banking leads to an increase in risk in Iran's state banks, and the moderator variable has a negative and significant effect on the dependent variable. In other words, while the risk increases with the increase of the

bank's investment in securities, changing the capital structure and reducing the debt to asset ratio can partially offset the positive effect of shadow banking on risk. In addition, the results similarly show that with the increase in asset quality, liquidity, and capital adequacy, risk in state-owned banks decreases, while bank size has an increasing effect on risk.

**Table 3.** Model estimation results, Equation 5

Variable	Coefficient	t-value	P-value
Constant	0.0554	13.61	0.000
Bank investment in securities as an indicator of shadow banking	0.0241	7.99	0.000
Capital structure index * bank investment in securities	-0.0002	-4.45	0.000
Asset quality	-0.0003	-4.61	0.000
Liquidity	-0.0313	-8.09	0.000
Capital adequacy	-0.0133	-13.11	0.000
Size	0.0003	6.44	0.000
Wald Chi <sup>2</sup> (2612.56)			0.000

Source: Research finding

It is worth mentioning that the results of classical assumptions for all three models were proper, i.e., the mean of our error terms are zero, and their values are normally distributed with constant variance, and uncorrelated.

## 6. Conclusion and Suggestions

Financial institutions face many types of risks. Management of these risks plays a very important role in their efficiency and success. In this research, one of the most important factors determining risk in Iran's banking system has been discussed. Shadow banking activities, as usually described by financial activities outside the regulated banking sector, unsecured funds, lack of access to central bank resources, use of leverage, and off-balance sheet items are among its important features. In this regard, the main goal of

this research was to identify the effect of shadow banking activities on banking risk in Iran, considering with the effect of capital structure, asset quality, ratio liquidity, capital adequacy, and bank size on the risk of state banks in the form of cross-bank data which cannot see in other studies.

The estimation results of all 3 models for state banks in Iran showed that an increase in the ratio of off-balance sheet items to assets leads to an increase in the risk, but a decrease in the ratio of debt to assets offsets part of this increase. Also, increasing in the asset quality, liquidity, and capital adequacy lead to a reduction in the risk in state-owned banks, while an increase in bank size leads to an increase in the risk. This study focused on the transfer of risk from the shadow banking operations of state banks, which is generally consistent with the results of Adrian and Shin (2009), Hsu et al. (2014), Avkiran et al. (2015), Tang & Wang (2016), Turner (2016), Zhou and Tewari (2019), Wu and Shen (2019), Fan and Pan (2020), Qiu (2020) and Pournajati and Houshmand Neghabi (2021).

Bank management are always forced to evaluate, modify and improve banking services, innovate in services, compete with other banks, and increase productivity and efficiency, according to the current and future economic conditions. One of the factors that make the financial statements of banks different from other institutions is the contingent items and conditional obligations that arise from the common transactions of banks, but when they occur, they are not recognized as liabilities in the accounts. These items, which constitute a major part of the bank's business, are known as off-balance sheet items and have a significant effect on the risk to which the bank is exposed. Off-balance sheet activities lead to an increase in banks' risk due to the bank's obligation to pay in the future and uncertainty. Changing the income structure of the banking system in order to maintain profitability has led to increasing desire of banks to carry out off-balance sheet activities over the past years. At first, banks thought that these types of activities lead to profit diversification and they were used as tools to diversify their profits, but in fact, off-balance sheet activities lead to keeping

less capital and more risk for banks. Therefore, banks should pay more attention to the interaction of risk and performance while performing off-balance sheet activities and move towards improving performance and minimizing risk.

The results of this study indicate that income diversification through shadow banking activities, including the ratio of off-balance sheet items to total assets, bank claims from subsidiaries, and bank investments in securities, leads to an increase in risk in state-owned banks in Iran. Therefore, such banks are suggested to pay special attention to the risky operations related to off-balance sheet activities. Considering the growing trend of shadow banking in Iran, which is expected to continue in the coming years, the need to control its activities in line with the stability of the country's financial market becomes more important. In this regard, identifying the types of risks in the activities of shadow banking operations in state banks by a supervisory authority as well as setting rules by the Central Bank can help to minimize such a risk in the monetary economy of the country. Accordingly, there is a need for more regulation on this sector, as the risk of these activities can be transferred to other monetary and financial sectors. Therefore, the supervision of various shadow banking activities by a specialized committee in the Central Bank, emphasizing the presentation of transparent financial information in the banks' financial reports, and the separation of shadow banking activities from other activities, can help mitigate risk from the activities of state owned banks in Iran.

### **Funding**

This study received no financial support from any organization.

### **Authors' contributions**

All authors had contribution in preparing this paper.

## Conflicts of interest

The authors declare no conflict of interest.

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