

# Identifying Factors Affecting the Pricing of Housing Facility Bonds

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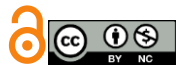
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## ABSTRACT

**Objective:** The objective of this study is to identify the financial and non-financial factors influencing the pricing of housing facility bonds at the Housing Bank of Iran.

**Methodology:** The study utilizes a qualitative research approach, employing the Delphi technique in two rounds. Seven experts and specialists from the Housing Bank were selected based on their expertise in bond pricing. Data were collected through note-taking and semi-structured interviews. The analysis was conducted by coding and categorizing the extracted concepts into four primary indices. Kendall's coefficient of concordance was used to measure consensus among experts.

**Findings:** The analysis identified 35 key components grouped into four indices—fluctuations, restrictions, market, and technical factors. The main drivers of bond pricing fluctuations include increased demand for construction loans without deposits, consumer demand for home purchases using loan bonds, and a rise in real estate investors seeking housing facility bonds. Factors such as interest rate fluctuations, housing market expectations, and seasonal effects were also found to significantly impact bond prices.

**Conclusion:** The study concludes that fluctuations, restrictions, market conditions, and technical factors are critical in determining housing facility bond prices for corporate clients at the Housing Bank. It is recommended that the bank adopt a combined method of artificial neural networks, genetic algorithms, and logistic regression to forecast bond pricing based on these indices. Additionally, developing financial instruments based on housing facility bonds can improve pricing accuracy in the capital market.

**Keywords:** *Housing facility bonds, bond pricing, financial indices, market conditions, Delphi technique, Housing Bank.*

## 1 Introduction

In the past two decades, Iran's economy has witnessed some of the most volatile fluctuations in housing prices. Severe recessions and booms in the housing sector have caused detrimental effects on this sector and other areas of the economy. The rapid increase in housing prices and the occurrence of cyclical housing price shocks in various countries, especially in Iran, represent a widespread and complex phenomenon that extends beyond a limited or sector-specific issue. The economic effects and social consequences of sharp increases in housing prices or severe fluctuations in assets have extensive dimensions (Faghani Makrani, 2015). For this reason, one of the most important factors in the provision and production of housing is securing financial resources in this sector. This issue has always been a major concern for policymakers, officials, and applicants. Housing finance is a core component of the housing system. The absence of an efficient housing finance system prevents low- and middle-income households from participating in housing markets, as purchasing a home for most economic agents is only possible by spreading the heavy costs over time through financial tools. Therefore, the availability of long-term housing finance over time is crucial, and alongside bank financing methods, almost all financial innovations have occurred in high-income countries. The unregulated increase in housing prices in Iran and the lack of diverse housing finance tools due to incompatibility with Islamic law have led to a significant demand for housing finance and loans from the Housing Bank (Faghani Makrani, 2015).

An analysis of the global economic system reveals that there is always a close relationship between investment and the level of economic development in countries. This means that countries with efficient models for capital allocation to various economic sectors generally enjoy greater economic progress and consequently higher social welfare. The mobilization and allocation of investment resources to economic activities occur through the financial market, with bond pricing being a part of this market. The primary activity of banks is to collect financial resources and allocate them to various economic sectors. However, it must be noted that, on one hand, these financial resources meet the bank's needs for granting facilities, and on the other hand, banks must optimally allocate their limited financial resources to the production of goods and services, which implies that the firm operates efficiently. According to economic theories, efficiency results from the optimization of production and

resource allocation (Behnam Rad & Gholizadeh, 2022; Rajabzadeh Moghani et al., 2017).

In emerging economies like Iran, the importance of creating an efficient, transparent, and streamlined financial system to encourage entrepreneurship and achieve developmental goals is amplified. One of the key subsystems of financing that leads to the realization of these goals is the pricing of facility bonds in the securities market. Nonetheless, institutions that require financing are screened objectively and scientifically based on rules, resulting in optimal resource use and equitable capital distribution. In the financial and capital markets, banks and credit institutions play a central role, and the task of controlling and managing the pricing of facility bonds is an inseparable duty of these organizations. Banks need a method and tool to estimate the pricing of facility bonds and reduce the default rate of the loans offered as much as possible. Employing an efficient system in this area will provide significant benefits for the stakeholders of banks and credit institutions. Despite the importance of this matter, an organized process for determining the pricing, rating, and ranking of facility bonds based on effective indices is not observed in the Iranian banking system, and it mainly relies on the judgment of experts and credit committees (Amin et al., 2023; McCannless, 2023; Pourshahabi et al., 2022). Thus, having an efficient risk model not only facilitates decision-making regarding the pricing of facility bonds but also enables the banking system and, consequently, the country to adopt an efficient model for capital allocation to various economic sectors.

In past studies, statistical methods such as discriminant analysis, fuzzy regression, classification and regression trees, and logistic and probit regression were used for the pricing of facility bonds. However, recently, with the development of artificial intelligence-based models and heuristic methods on one hand, and the advancement of software and hardware capabilities on the other, many studies have been conducted on the application of these methods in credit scoring and bond rating models (Hori & Mahdavi, 2015).

The housing sector accounts for about 20 to 25 percent of economic growth and includes approximately 1,200 activities both directly and indirectly. In our country, this sector has always been turbulent due to the large-scale migration to major cities, the population growth rate in the early years after the revolution, and other factors. Published statistics indicate that in recent years, despite relatively adequate construction activities in the country, the number

of residential units supplied each year has been less than the number of households in need of housing. In fact, the amount of housing built has not been insignificant, but it has failed to meet the effective demand in the market, leading to problems in this sector (Zohairi Hashemi et al., 2021).

Housing, as an economic commodity, has characteristics that distinguish it from other goods. On one hand, housing can be a consumer good, which, after food and clothing, is one of the most essential human needs, and on the other hand, as a durable, immovable asset, it is considered a capital good. Investment in housing constitutes a large portion of household assets and holds special appeal not only for households but also for economic enterprises (Behnam Rad & Gholizadeh, 2022; Gholizadeh et al., 2016; Oreski & Oreski, 2014). Given that housing finance is a fundamental component of the housing market, this variable is important from both economic and social dimensions. From a social perspective, the issue of housing for low-income households and how to finance it, given their inability to afford and purchase housing units, remains a major challenge for governments in the housing sector (Behnam Rad & Gholizadeh, 2022).

One of the important factors in housing provision is the issue of housing finance, and for responsible organizations, the matter of providing housing loan resources. This has always been one of the concerns and problems faced by housing authorities and applicants. Among the housing finance tools, the mortgage-backed bonds are a new and easy tool for financing housing for low-income groups, where individuals can access housing loans by paying a small amount for purchasing mortgage-backed bonds, thereby providing housing loan resources for the responsible banks.

The Housing Bank, as the only specialized bank in the housing sector, created the Special Investment Deposit Account to achieve its goal of providing public housing, particularly for low-income groups, increasing customer choice, and diversifying banking services. The Special Investment Deposit Account in the Housing Bank was established in three categories: individuals, special individuals, and legal entities. Depositors in this account can not only receive interest on a regular short-term deposit account from the Housing Bank but also benefit from housing facility bonds. Holders of these bonds, in addition to using the housing loans, have the option to sell these bonds to others. The first series of mortgage-backed bonds was issued and delivered to account holders. These bonds are the vouchers for receiving housing purchase or construction loans, granted to account holders.

Transactions of mortgage-backed bonds were initially conducted in informal markets, but later all transactions of these bonds were carried out through the OTC market (Farabourse). The general process of trading mortgage-backed bonds in Farabourse is similar to the transactions of other types of securities. That is, the price of these bonds in the Farabourse trading system is determined by auction based on the existing supply and demand in the system. Thus, the daily price is determined by the volume of transactions and the supply and demand prices.

Many economic experts have suggested that mortgage-backed bonds are a suitable alternative to housing loans. In recent years, such securities have been defined as a financial tool by the Housing Bank for housing finance. Mortgage-backed bonds represent the same housing loans that are traded as securities in the market. Recently, these mortgage-backed bonds have gained significant attention from housing applicants, as the Special Investment Deposit Account has eliminated the long waiting periods for loan maturity and irrevocable powers of attorney.

In Iran's financial markets, on one hand, there is a clear lack of pricing indices for facility bonds and rating institutions, and on the other hand, there is no organized process for determining the pricing and ranking of these bonds based on model indices. Therefore, having an efficient model for pricing facility bonds not only facilitates decision-making regarding bond pricing but also allows the banking system and, consequently, the country to adopt an efficient model for capital allocation to various economic sectors. Despite the importance of bond pricing in banking and financial institution activities, it appears that there has been no organized effort to develop pricing models for facility bonds in the country. Meanwhile, in developed banking systems such as Germany, pricing models for facility bonds have been presented. Some of these features include repayment period, credit amount, installment-to-income ratio, number of existing credits in the bank, credit history, the ratio of balance to bonds, and so on. Accordingly, the main goal of the present research is to identify the factors influencing the pricing of housing facility bonds. This research will be conducted to meet the research needs of the Housing Bank, and its results will be used to increase the efficiency of the bond pricing system in the securities market. Given the aforementioned explanations, this study seeks to answer the following question: What are the key indices for pricing housing facility bonds?

## 2 Methods and Materials

The present study utilizes a qualitative method and the Delphi technique, wherein the aim is to facilitate the indirect circulation of knowledge and information among experts. In each round, the anonymous and aggregated opinions of respondents are shared in the following round, allowing them to adjust their initial opinions if they agree with the information provided, ultimately aiming for greater consensus on the factors affecting the model.

In the first step, to identify the key indices for pricing housing facility bonds, various sources such as publications, internal, and external research in this field will be reviewed. To establish an initial consensus on the proposed categorization, this information will be shared with the expert group. Seven banking experts will be selected based on factors such as professional experience in pricing housing facility bonds and their history of conducting scientific research in this area. The sampling method used in this study is purposive sampling. In-depth interviews with the experts from the Housing Bank of Iran were conducted to collect the necessary data for the research. The interview process continued until the findings from the interviews reached saturation, meaning that no new information was being obtained. Following the analysis of the interviews, initial codes were extracted from the content.

Data collection in this research occurs in two stages. In the first stage, for developing the theoretical framework of the research, both library and field (interview) methods were employed. In the second stage, data were gathered from the Central Bank of Iran's website and publications, as well as from the Iran Statistics Center.

## 3 Findings and Results

To identify the factors influencing the pricing of housing facility bonds in the qualitative section of the study, semi-

structured interviews were conducted. Initially, seven managers, experts, and specialists from the banking sector were selected, and semi-structured interviews were held with them. At the start of each interview, the interviewees were informed that the research aimed to identify the factors affecting the pricing of housing facility bonds. The duration of the interviews varied between 20 to 35 minutes. At the end of each interview, the interviewees were asked if they had any additional opinions regarding the discussion.

The questionnaire was distributed to the seven members of the panel both in person and via email, with follow-up commencing a few days after distribution. On average, each panel member was contacted three times by phone and once via email. One panel member did not complete the questionnaire, resulting in a total of six responses (85%). All respondents in this round had also participated in the previous round.

In the second round of the questionnaire, a list of factors that participants had identified as pricing indices for housing facility bonds in the first round was presented. Table 1 includes results related to the first part of the second-round Delphi questionnaire, detailing the number of responses for each item, mean responses, standard deviations, Kendall's coefficient of concordance, and notes on whether the factor was accepted or rejected. In this section, the experts proposed numerous factors, and after combining some of them, 35 factors remained. Kendall's coefficient of concordance in the second round indicates strong consensus among panel members regarding the indices. It is worth mentioning that the mere significance of Kendall's coefficient is insufficient to stop the Delphi process. A consistent or negligible increase in this coefficient over two consecutive rounds indicates no further increase in consensus, and thus, the Delphi process should be terminated.

**Table 1**

*Statistical Description of Respondents' Opinions on Housing Facility Bond Pricing Indices — Delphi Technique*

Factor Description	Number of Responses	Mean	Standard Deviation	Kendall's Coefficient	Comments
Interest rate fluctuations	6	3.21	1.373	.735**	Accepted
Fluctuation in facility ceiling	6	4.38	0.054	.551	Accepted
Fluctuation in facility terms such as repayment duration	6	4.44	0.852	.576*	Accepted
Land price fluctuations	6	4.16	1.104	.600*	Accepted
Fluctuation in returns for superior deposit holders	6	4.08	1.057	.784*	Accepted
Inflation rate fluctuations	6	3.80	1.258	.567*	Accepted
Exchange rate fluctuations	6	3.21	1.373	.650**	Accepted
Restrictions on the ceiling of bond purchases	6	4.18	1.094	.536*	Accepted

Decrease in bond issuance by the bank	6	4.14	1.021	.568	Accepted
Imposing restrictions on housing loan bond transactions by the bank in coordination with OTC (Farabourse)	6	3.95	1.304	.603*	Accepted
Transaction restrictions regarding a minimum waiting period (four months) from purchase to sale of bonds	6	3.91	1.119	.616*	Accepted
Considering expiration periods for bond use	6	3.57	1.253	.612*	Accepted
Tax rate	6	4.19	1.075	.622*	Accepted
Lack of private investment funds	6	4.14	1.013	.561*	Accepted
Bank's policies and programs	6	4.10	1.030	.545*	Accepted
Increase in superior deposit balances	6	3.98	1.288	.634*	Accepted
Tehran Stock Exchange price index	6	4.69	0.514	.531*	Accepted
Price of housing facility bonds in previous periods	6	4.30	0.875	.548*	Accepted
Credits granted to homebuyers	6	4.48	0.756	.551	Accepted
Bond allocation coefficient for housing facility certificates	6	3.83	0.841	.579	Accepted
Extent of housing price coverage through loans	6	3.72	0.770	.576*	Accepted
Housing price expectations	6	4.05	0.838	.726**	Accepted
Market share	6	4.28	0.682	.537*	Accepted
Market trends	6	4.41	0.688	.621*	Accepted
Supply and demand conditions for bonds	6	4.59	0.608	.558*	Accepted
Increasing presence of real estate investors in the market intending to purchase homes and loans using housing facility bonds	6	4.59	0.575	.655**	Accepted
Unregulated speculative markets in housing facilities	6	4.52	0.644	.785	Accepted
Diversity of demand for bond purchases	6	4.29	0.747	.709*	Accepted
Increase in consumer demand for home purchases using loan bonds	6	4.53	0.634	.822	Accepted
Increase in demand for home renovation loans due to new policies for providing loans to owners and residents of Mehr Housing units	6	4.60	0.626	.634*	Accepted
Increase in demand for construction loans without deposits, part of which is allocated to developers through bond purchases	6	3.78	0.912	.620*	Accepted
Government debt to housing contractors	6	3.94	0.817	.800	Accepted
Forecast of lifting the recession on housing transactions with moderate prices	6	3.84	0.954	.544*	Accepted
Seasonal effects	6	4.05	0.838	.726**	Accepted
Decline in the purchasing power of housing loans in the residential property market	6	4.28	0.682	.537*	Accepted

The analysis of Kendall's coefficient of concordance in the second round reveals that strong consensus exists among panel members regarding the indices. It is also noteworthy that the mere significance of Kendall's coefficient is not sufficient to stop the Delphi process. If the coefficient remains unchanged or shows only minimal growth over two consecutive rounds, it indicates that no further consensus has been reached, and the process should be concluded. Since Kendall's coefficient showed no significant change between the first and second rounds, the Delphi process is terminated.

After reviewing the interviewees' opinions and conducting a qualitative analysis, the extracted codes were organized into a unified table based on their corresponding categories. This allowed for the generation of meaningful interpretations, with each extracted theme named according to its concept. The use of short, meaningful phrases in the qualitative data resulted in the derived categories.

Following the extraction of common codes and concepts from the raw data, the categorization of concepts was performed, and the results are reflected in [Table 2](#).

**Table 2**

*Extracted Categories from Conceptual Analysis*

Category	Title
Fluctuations	Interest rate fluctuations
	Fluctuation in facility ceiling
	Fluctuation in facility terms such as repayment duration
	Land price fluctuations
	Fluctuation in returns for superior deposit holders
	Inflation rate fluctuations
	Exchange rate fluctuations
Restrictions	Restrictions on the ceiling of bond purchases

	Decrease in bond issuance by the bank
	Imposing restrictions on housing loan bond transactions by the bank in coordination with OTC (Farabourse)
	Transaction restrictions regarding minimum waiting period (four months) from purchase to sale of bonds
	Considering expiration periods for bond use
	Tax rate
	Lack of private investment funds
Technical	Bank's policies and programs
	Increase in superior deposit balances
	Tehran Stock Exchange price index
	Price of housing facility bonds in previous periods
	Credits granted to homebuyers
	Bond allocation coefficient for housing facility certificates
	Extent of housing price coverage through loans
	Housing price expectations
Market	Market share
	Market trends
	Supply and demand conditions for bonds
	Increasing presence of real estate investors in the market intending to purchase homes and loans using housing facility bonds
	Unregulated speculative markets in housing facilities
	Diversity of demand for bond purchases
	Increase in consumer demand for home purchases using loan bonds
	Increase in demand for home renovation loans due to new policies for providing loans to owners and residents of Mehr Housing units
	Increase in demand for construction loans without deposits, part of which is allocated to developers through bond purchases
	Government debt to housing contractors
	Forecast of lifting the recession on housing transactions with moderate prices
	Seasonal effects
	Decline in the purchasing power of housing loans in the residential property market

In the qualitative phase, semi-structured interviews were analyzed using coding techniques. The data analysis process was carried out through common coding, conceptualization,

and categorization, which ultimately led to identifying the indices for housing facility bond pricing.

**Table 3**

*One-Sample t-Test Results for Factors Influencing Housing Facility Bond Pricing*

Variable	Mean	t-Value	Degree of Freedom	Significance	Mean Difference	Lower Bound (CI:95%)	Upper Bound (CI:95%)
Fluctuations	3.7856	11.720	360	0.000	0.78564	0.6532	0.9181
Restrictions	4.3362	29.712	360	0.000	1.33616	1.2473	1.4250
Technical	4.0542	27.703	360	0.000	1.05415	0.9790	1.1293
Market	4.7421	31.504	360	0.000	1.04982	0.9917	1.1354

The results in Table 3 show that the mean viewpoints regarding fluctuations, restrictions, technical factors, and market factors are 3.78, 4.33, 4.05, and 4.74, respectively, all of which are above the midpoint of the Likert scale. The significance level is 0.000, which is smaller than the 0.05 error level, indicating that the observed means are significant. Additionally, the t-values for the variables are 11.72, 29.71, 27.70, and 31.50, respectively, all of which are greater in absolute terms than the critical value of 1.96. Furthermore, both the upper and lower bounds of the confidence interval are greater than zero (positive), confirming the test claim. Based on these statistical findings, with 95% confidence, it can be stated that fluctuations, restrictions, technical factors, and market factors are

considered influential in the pricing of housing facility bonds by the respondents.

#### 4 Discussion and Conclusion

The present study was conducted with the aim of identifying the factors influencing the pricing of housing facility bonds. This research seeks to examine both financial and non-financial indicators affecting the pricing of facility bonds at the Housing Bank. For this purpose, seven experts and specialists from the Housing Bank were selected. Various techniques, including note-taking and interviews, were used for data collection. After the data analysis, conclusions must be drawn from the research findings.

Based on these findings, suggestions for future research are also provided to assist those interested in this topic. Utilizing the results of this research requires consideration of the study's limitations. Additionally, it should be noted that although the descriptive and inferential statistics used in this research are built on scientific principles, the application of these results necessitates further research, some of which are suggested in the recommendations section for future investigations.

In response to the research question, the Delphi method was applied in two rounds. The evaluation of Kendall's coefficient of concordance in the second round indicates a strong consensus among the panel members regarding the indices. After reviewing the opinions of the interviewees and conducting qualitative analysis, the concepts were categorized. Based on the results, it was determined that 35 components, categorized into four indices—fluctuations, restrictions, market, and technical—were identified as key pricing indices for facility bonds for corporate clients at the Housing Bank.

The findings reveal that the following four factors significantly influence both the volume of bond transactions and the average price of each housing facility bond: (1) the increase in demand for housing renovation loans due to the new decision to provide these loans to the owners and residents of Mehr Housing units, (2) the increase in demand for construction loans without deposits, part of which is allocated to developers through bond purchases, (3) the rise in consumer demand for home purchases using loan bonds, and (4) the heightened presence of real estate investors in the market who intend to purchase homes and obtain loans using facility bonds. Currently, these four groups of housing loan applicants are preparing to receive housing loans by purchasing bonds, as the first step to receiving such loans is the purchase of bonds, which serve as a qualification for obtaining non-deposit housing loans. The increased demand for bond purchases has led to a rise in transaction volume and upward pressure on their price.

The sale of housing facility bonds in the secondary market has provided an opportunity for investors' expectations of returns to be reflected in the price of this financial tool. The interaction of supply and demand for this tool is one of the most critical factors in determining its price. Fluctuations in interest rates and housing price expectations significantly impact the price of housing facility bonds. In an economy where rates have historically been administratively set, the introduction of this tool has been a valuable opportunity. Another factor influencing the

growth in demand and consequently the price of these bonds is the anticipated recovery in the housing market, particularly for properties with moderate prices. As the broader economy (especially the investment sector) faces a relative downturn, interest in housing finance has increased. Another influential factor in the price fluctuations of this financial tool is seasonal effects. The summer season typically sees a boom in housing transactions, and currently, it is the time for last year's deposits to mature. Consequently, real estate market participants are preparing their financial portfolios for entering this market. The future market for housing facility bonds also presents an opportunity for the banking system to design various bonds and offer different types of real estate loans through the capital market, with pricing determined by supply and demand mechanisms. Furthermore, the development of financial instruments based on housing facility bonds (which can be highly diverse) will significantly reduce the likelihood of mispricing in the capital market. The creation of deposit-based investment funds and the issuance of bonds by these funds is an initial idea in this field, and with further study and thought, many financial instruments can be designed based on this concept. Undoubtedly, all financial tools that leave the determination of pricing mechanisms to the market will be more efficient than price manipulation by financial institutions.

The findings of this research align with prior studies (Behnam Rad & Gholizadeh, 2022; Bekhet & Eletter, 2014; Faghani Makrani, 2015; Gholizadeh et al., 2016; Hori & Mahdavi, 2015; Rajabzadeh Moghani et al., 2017; Rakizadeh & Moghaddaszadeh, 2016; Zohairi Hashemi et al., 2021).

Based on the research results, which indicate that financial indices can explain the pricing changes of facility bonds for corporate clients at the Housing Bank, it is recommended that Housing Bank officials use a combined method of artificial neural networks, genetic algorithms, and logistic regression to forecast the pricing of facility bonds for both individual and corporate clients based on financial indices.

Based on the research results, which indicate that market indices can explain the pricing changes of facility bonds for corporate clients at the Housing Bank, it is recommended that Housing Bank officials use a combined method of artificial neural networks, genetic algorithms, and logistic regression to forecast the pricing of facility bonds for corporate clients based on market indices.

Based on the research results, which indicate that technical indices can explain the pricing changes of facility bonds for corporate clients at the Housing Bank, it is recommended that Housing Bank officials use a combined method of artificial neural networks, genetic algorithms, and logistic regression to forecast the pricing of facility bonds for corporate clients based on management indices.

### Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

### Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

### Transparency Statement

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Data are available for research purposes upon reasonable request to the corresponding author.

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### Declaration of Interest

The authors report no conflict of interest.

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### Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.