Iranian Economic Review, Vol.16, No.30, Fall 2011

Portfolio Selection in the Presence of Housing (An Iranian Case Study)

Ali Akbar Gholizadeh*
Masoud Tahuri Matin**

Received: 2011/04/23 Accepted: 2011/10/24

Abstract

The present paper studies the selection of household portfolio in the presence of housing market. A major theory in the study of housing prices and their fluctuations is the theory of household portfolio. The present study attempts to examine the theory to show whether it applies to Iranian economy. For our purpose, we examined all data about the assets under study, including stock shares, foreign currency, gold coins, banking deposits, bonds, and housing over the fiscal period from 1991 to 2006. Applying the mean – variance spanning test model with MATLAB to calculate the return, risk, and correlation coefficients during the period, the optimal composition of assets in household portfolio was determined. The model operates through simulating and giving different weights to each tier of assets. Firstly, categorizing the households into low, medium, and high-risk, it determines the optimal composition of household portfolio based on degrees of risk-taking in the absence of housing. Then it examines whether the existence of housing in the household portfolio and a household's choosing it as an asset would help improve the level of risk and return in the portfolio and change the portfolio composition. The efficient frontier which is the envelope curve of the most efficient portfolios was also extracted. The results show that housing is a significant asset in household portfolio in such a way that the presence of housing would influence the efficient frontier. Moreover, in a spell of rising foreign exchange rates, foreign currencies obtained a substantial portion of household portfolios, but a series of stabilization and unification policies pushed them out of portfolios. During the period, housing was the dominant asset in portfolios.

Key words: portfolio, risk, expected return, efficient frontier, mean – variance model

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* Assistant Professor of Economics, Bu-Ali Sina University, (Corresponding Author).

** Master of Science in Economics.

1- Introduction

Risk and return are considered as two influencing elements in personal asset investments. Every investor seeks higher returns, on the one hand, and lower risks on the other hand. However, one who seeks a greater return is expected to take a greater risk. Most investors are willing to have low-risk returns. Hence, they invest in a portfolio of assets rather than a specific asset. A portfolio of assets is a set of assets in which each specific asset has its own specific return and risk. It produces a certain return and risk considering types and amounts of assets. Investors and consequently, their portfolios are different because of various motivations and behavioral characteristics. The individual differences may stem from levels of risk taking or diversity of tastes. Taking the significance of housing in the life cycle of an individual into account and considering the fact that most studies regarding an appropriate choice of portfolio ignore this significant asset, the present study attempts to examine how the presence of housing in a household portfolio might influence it. Eventually, the authors offer a framework for selection of the optimal household portfolio. In Iran, housing has maintained a key status in household portfolios over the past two decades, because substantial long and mid-term return as well as relatively low risk has altogether helped convince the households that house-investment is the best choice. This paper sets up two hypotheses: 1- Risk and return do influence a household portfolio, 2- The presence of housing in a household portfolio would improve its performance concerning risk and return and pushes the efficiency frontier upward. An attempt has been made to examine the two hypotheses by use of mean – variance model.

2- Theoretical framework

Major developments in investment theories have facilitated major achievements in explanation of investment behaviors both theoretically and empirically. This has resulted in appropriate investment opportunities and strong methods of decision-making about best investments. In investment return ratio based models, two central factors, that is, time value of money and risk have been overlooked. In fact, in these models, the ratio of investment proceeds to the initial value of investment is opted as the parameter of selection. This is regarded as traditional method of selecting

investment projects. With the development of discounting methods, the factor of time value of money was involved in investment selection.

In modern methods, the expected utility hypothesis by Von Neumann – Morgenstern is applied to explain individual choice among different projects. Considering the risk and return of assets and individual risk taking behavior, the selected projects are prioritized according to expected return related utility, forming the basis of selection.

Theories related to asset selection in the life cycle deal with some individual characteristics and their effects on selection and portion of each asset in household portfolio. For example, they study the impact of education, income, age and gender on the composition of portfolio. Capital asset pricing model is designed to determine the expected rate of return for risky assets.

According to the theory of arbitrage, the stochastic process of asset return is a linear function of a set of factors or indicators such as interest rate, inflation and GDP growth.

One of the main assumptions of modern portfolio theory is that every investor tends to increase investment return at a certain level of risk. For this purpose, specific rules must be met. In this theory, security represents assets which have risk and return. Developed by Harry Markovits, this theory determined risk and expected rate of return for a portfolio for the first time. He showed that rate of return deviation is an appropriate criterion for calculating the risk of assets. He also considered the average return of past years for each asset as a criterion for the expected return. Therefore, the expected return of each asset is:

$$E(R_i) = \frac{\sum_{i=1}^{n} R_i}{n} \quad (1)$$

where $E(R_i)$ is expected return of asset A, R_i is asset return for each year and n is the number of years. In this case, the expected return of portfolio $E(R_i)$ is calculated as follows:

$$E(R_p) = \sum_{i=1}^{n} w_i E(R_i) \quad (2)$$

where w_i is percent of assets i in the portfolio, $E(R_i)$ is expected rate of return for asset i. Standard deviation of asset return is considered as risk, to be calculated as follows:

$$\sigma_i = \sqrt{\frac{\sum (R_i - E(R_i))^2}{n-1}} \tag{3}$$

Expected return of portfolio is the weighted mean of expected returns of assets in the portfolio, but for standard deviation, we cannot use weighted mean. In this theory, standard deviation of portfolio is determined as follows:

$$\sigma_{port} = \sqrt{\sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \operatorname{cov}_{ij}} \quad , \quad i \neq j \tag{4}$$

where σ_{port} is standard deviation of portfolio and $\operatorname{cov}_{ij} = \rho_{ij}\sigma_i\sigma_j$. ρ_{ij} is the correlation between i_{th} and j_{th} asset.

Equation (4) shows that the closer the covariance between assets is to -1, the lower is the portfolio risk, the greater the advantages of portfolio diversification and the higher the return of portfolio management. Creating different compositions of assets with all possible various weights in a portfolio, we would reach Figure 1.

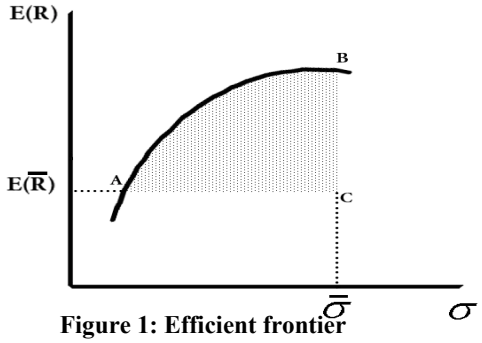

Figure 1: Efficient frontier

The best lap that covers all the probable compositions is called efficient frontier. In fact, an investor's goal could be explained through the following models:

$$\begin{array}{ll} \max E(R_p) & or \quad \min \sigma_p \\ s.t \quad \bar{\sigma}_p & s.t \; E(\bar{R}_p) \end{array} \qquad (5)$$

Considering the target functions and the above mentioned condition, if an investor aims to maximize the expected return at a fixed level of risk, he/she would achieve that by moving from point C to point B on the efficient frontier. Reversely, if one aims to focus on a specific return like *E(R)* and at the same time seeks to minimize the risk, it is achieved by moving from the inefficient point C towards the efficient point A (look at **Figure** 1). Different individuals seek their goals across the efficient frontier in light of their investment goals and maximization of their expected utility through enhancement of expected return and reduction of risk.

3- Review of Literature

In this section, the studies on portfolio selection are reviewed. In Iranian studies, portfolios are examined in the absence of housing whereas in many foreign studies, a special attention has been paid to housing as an asset in household portfolios.

Flavin and Yamashita (1998) used a mean-variance efficiency framework to examine the household's optimal portfolio problem when owner-occupied housing was included in the list of available assets. Based on data from PSID, they found that the inclusion of housing as an asset dramatically improves the efficient frontier available to households, confirming the popular conception that homeownership is a good investment. Cocco (2000) used utility maximization technique for portfolio selection. He showed that investment in housing plays a crucial role in explaining the patterns of cross-sectional variation in the composition of wealth and portfolio composition data. The model also proposed investment in housing had important implications for asset accumulation and portfolio choice among stocks and

Treasury bills. Eichholtz, Koedijk and De Roon (2002) analyzed the effects of residential property holding on optimal investment portfolios. Using a mean-variance framework, they showed that residential real estate offered significant diversification benefits compared to investments in stocks and bonds for US investors. The results of their study suggested that for most geographical areas in the US, investors had the best diversification benefits from residential real estate when about 30% of their investment portfolio was residential real estate. Iacoviello and Ortalo (2003) used mean- variance efficient frontier in England for the period 1977 to 2000. Focusing on the London market, they showed that a major loss from over-investment in housing was that households were forced to hold a very risky portfolio. They also found that the returns to housing in London had been strong but very volatile compared to other financial assets. Households over-invested in housing due to their housing consumption motive gained from the high returns on their home, but were forced to hold a very risky portfolio. Standard financial assets do not provide much of a hedge against the risk of owning a home.

Hasanov and Dacy (2003) provided a mean- variance model for determination of optimal asset proportion in the presence of housing. Both quarterly and annual data over 1952-2000 period were used in their analysis. Their findings indicated that residential housing provided a high average return and low volatility, had low correlation with other assets such as stocks and bonds, and exhibited high positive correlation with inflation. The efficient frontier analysis showed that the residential housing providing diversification should be an important part of the household portfolio. Their results also indicated that housing might be as good an investment as stocks (S&P 500). Pelizzon and Weber (2006) address the issues of portfolio allocation and the efficiency of household portfolios with respect to housing risk. Also they showed that in this asset-liability framework, the efficient financial portfolio allocation was the sum of a standard Markowitz portfolio and a hedge term. This hedge term is a function of correlation between housing and financial assets returns times net housing wealth. They found that the largest proportion of inefficient portfolios existed among the over-housed.

Nitschka (2008) applied an investment assets pricing approach to an examination of fluctuations of housing asset and other assets in Euro area.

The return on real estate wealth seems to be the adequate proxy for the market risk premium in the Euro Area. The evidence provided in the paper conveyed the notion that the model's prediction for time-series behavior of the market risk premium was fulfilled if the return on real estate wealth was taken as approximation of the risk premium on the market portfolio.

The present paper, among other studies conducted on household portfolio in Iran, has brought up a fresh hypothesis to test. Most studies have largely focused on stock shares whereas not enough attention has been paid to housing, although it is a significant asset in selection of portfolio. To bring it to light, two studies which exclusively deal with selection of portfolio in stock market are discussed as follows:

Besharat (1999) studied the effect of common stock diversification on risk reduction. His findings indicated that the highest average risk (%29.97) in Tehran Stock Exchange belonged to single stock compositions and the lowest (%7.33) belonged to stock exchange portfolio including 120 corporations. Meanwhile, the results indicated that non-systematic risk was about %73 of total TEPIX risk which could be mitigated through diversification. Khorhe (2006) studied the relationship between risk and investment period in Tehran Stock Exchange using mean- variance model. The results showed that for minimizing the risk of short-run portfolios, investors should have 39 various types of stocks in their portfolios, while for long-run investors eight types of stocks was sufficient.

4- Model

Here, a mean- variance model is used to study the optimal portion of assets in household portfolio over the period from 1991 to 2006 in Iran. In this regard, six standard investment alternatives are considered: stocks, housing, bonds, foreign currencies, gold, and bank deposits. By household, we mean an investor who invests in the six mentioned assets. Over the period, housing had tolerable return and low volatility. Stocks had the most volatility. Bonds and bank deposits also had the lowest volatility. It is supposed that risk-lover investors keep larger portions of the portfolio in stocks.

4-1- Methodology of research

It seems that risk-taking individuals tend to accommodate a larger percent of stock asset, which is of high risk, in their portfolios. Conversely, risk-averse individuals largely tend to allocate their investment to banking deposits or bonds. Stock shares involve both highest return and highest risk whereas banking or bond interests involve both lowest return and lowest risk. Accordingly, to compare the assets, the coefficient of variations (risk-return ratio.) is applied as an indicator.

Based on the indicator of coefficient of variations (CV), bonds rank first and stock shares rank last in the household portfolio priority table. In the present model, contrary to other models, it is possible to examine the impact of the presence of a new asset in a portfolio. Hence, it would be possible to study the impact of the presence of housing at various levels of risk through extraction of efficient frontier. Dacy and Hasanov (2003) presented the model for the projection of optimal portion of assets in a household portfolio as follows:

$$\text{Minimize } Z = w'Vw$$

$$\text{Subject to} \quad \begin{aligned} i'w &= 1 \\ r'w &= \mu \\ w &\geq 0 \end{aligned} \tag{6}$$

where w is a vector of portfolio shares of n assets; V is the variance-covariance matrix of the assets; i is a unit vector; r is a vector of expected returns, and μ is the desired level of portfolio return. Thus, the objective is to minimize the portfolio variance with the following constraints:

(i) Shares must add up to one;
(ii) Expected portfolio return must equal a desired return (μ), and
(iii) No asset would have a negative portion in the portfolio.

Conducting Lagrange Function and taking differential from *w*, based on the first-order condition, we will obtain the weights of assets in the optimal portfolio:

$$W^{*}(\mu) = \lambda V^{-1} i + \gamma V^{-1} r + V^{-1}\omega \quad (7)$$

where λ, γ, and ω are Lagrange multipliers associated with the above constraints, respectively. Then, the optimal portfolio variance is:

$$\sigma^{2}(\mu) = w^{*\prime} V w^{*} \quad (8)$$

The calculation and extraction of the efficiency frontier curve is performed through second-order equations. As mentioned earlier, the model is resolved by MATLAB. Several functions are embedded in the software including efficient frontier curve drawing, determination of share of assets in optimal portfolio, and optimal portfolio's risk and return. In fact, a collection of portfolio optimization functions and efficient frontier extraction is provided which altogether help achieve the most optimal portfolio for an investor. By use of the m-file page in the program, we first create the matrix [1 * n] out of returns of assets, the matrix [1 * n] out of standard deviations and the matrix [n * n] out of the correlation coefficients functioning between the assets. Then the portfolios, which are involved in calculation of the efficient frontier, are determined. MATLAB extracts the efficient frontier, which is the envelope curve of the most efficient portfolio, by simulating and allocating different weights to each set of assets. In fact, the input variables for creation of efficient frontier include returns of assets, standard deviations of assets, matrix of correlation coefficients and the number of portfolios needed for simulation.

The variables examined in the present model are stock shares, gold coins, banking deposits, bonds, foreign currencies and housing. Table 1 shows the returns, risks and coefficients of variations of the assets during the period under study.

Table 1: risk and return – (percentage)

index	housing	bonds	bank deposit	gold	foreign currencies	stocks
μ	24.78	18	15	19.39	13.7	37.82
σ	20.27	1.72	1.97	22.83	18.25	53.62
CV	0.82	0.1	0.13	1.33	1.33	1.42

Source: Authors' calculations on data from the central bank of Iran.

4-2- Estimation and Analysis of Model Outputs

In this section, efficient frontier related to the mentioned portfolio is, in the absence of housing, depicted in order to determine the optimal portfolio combination for different levels of risk. Then changes originated in the presence of housing in terms of risk, yield, and composition of the portfolio will be discussed.

Table 2: Correlation Matrix of Assets

Asset	Stock	Foreign Currency	Coin	Banking Deposit	Bond	Housing
Stock	1	0.2	0.22	-0.43	0.27	0.35
Foreign Currency	0.2	1	0.73	-0.01	0.7	-0.17
Coin	0.22	0.73	1	0.13	0.16	0.1
Banking Deposit	-0.43	-0.1	0.13	1	-0.66	0.46
Bond	0.27	0.7	0.16	-0.66	1	-0.27
Housing	0.35	-0.17	0.1	0.46	-0.27	1

Source: Authors' calculations on data from the central bank of Iran.

Table 2 shows the correlation coefficients of assets for the overall period under study. According to the figures shown in the table, the return of housing has a negative relationship with foreign currency and bond. The efficient frontier curve can be extracted by application of the sum of yields, risks and correlation coefficients.

4-3- Examination of Efficient Frontier and Determination of Shares of Assets

Most studies about portfolio selection in Iran have paid no attention to housing as a component of portfolio. The reasons may include:

A. Some researchers consider housing as just a shelter rather than a choice in portfolio.

B. Failure to use modern portfolio analyses in the presence of housing due to technical reasons or lack of familiarity with the nature of housing market and its dual role especially in developing countries

C. Some researchers view housing as a slow-liquid asset which fails to take the place of fast-liquid assets. For the same reason, they tend not to consider housing market. In any case, it is very difficult to gain access to data and statistics of housing market.

Now, the effects of housing in portfolio are examined. The efficient frontier curve can be extracted by application of the sum of returns, risks and correlation coefficients. The method is as follows:

First, the expected return, the risk of each asset, and correlation coefficients between assets were inserted into the model. Performing complicated calculations and assigning different weights to each asset, 100,000 portfolios (the points under the efficient frontier curve) were simulated. Then mean- variance efficient frontier (the curve covering all simulated points) is extracted. All points under the efficient frontier curve are deficient assets that have lower return or more risk. There are some optimal points for different risks on the curve. Households, with regard to their risk aversion and expected return, select their desired points on the curve. All points on the curve are efficient and there is only one optimal point available for each risk. In this paper, 50 optimal portfolios on the efficient frontier curve are defined. Each of the 50 points has certain risk and return that is the result of assets composition in the portfolio. Figure (2) and (3), respectively; show the efficient frontier and optimal portfolio composition in the whole period.

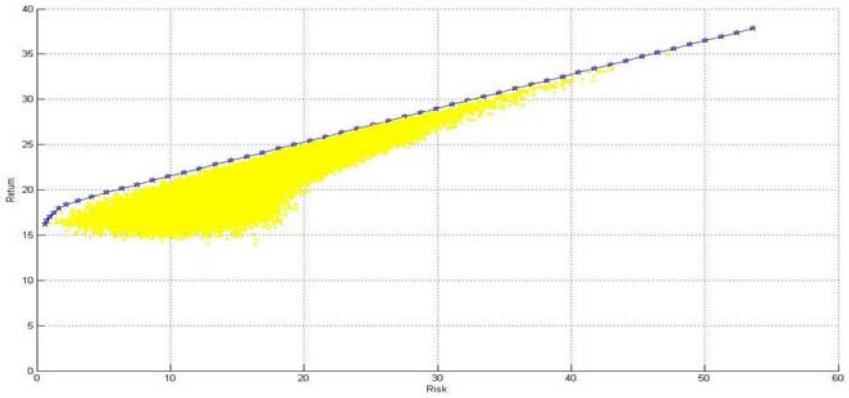

Figure 2: **Portfolio selection without housing**

According to Figure (2), the estimated shares of assets in the optimal portfolio are provided for risk-lover, medium-risk and risk-averse households in Table 3.

Table 3: Estimated shares of assets in the optimal portfolio without housing (percentage)

Risk category	Stocks	Foreign Currencies	Bonds	Gold	Bank Deposits	Total portfolio	
						Return	Risk
Low-risk	10.05	.00	81.50	.00	8.45	19.70	6.10
Medium-risk	46.48	.00	53.52	.00	.00	27.21	35.19
High-risk	83.27	.00	16.73	.00	.00	34.50	44.73

Source: Authors' calculations on data from the central bank of Iran.

Based on Table 3, the composition of different ranges of risk-aversion is specified, and then risk and return of these combinations are calculated. The share of asset in low-risk households is small (only %10). Increased risk causes households to keep more stocks in their portfolio. For high-risk households this portion is %83, thus riskiness causes the stocks' share increases and the bonds' share decreases. Also at high levels of risks, bonds

constitute about 17 percent of the optimal portfolio, because there is not any competitor for them except stock.

In the next step, the efficient frontier and then the optimal composition of portfolio in the presence and in the absence of housing are determined. Figure 2 presents the efficient frontier in the absence of housing which has been created based on simulated points in Table 3. The optimal compositions of portfolios for the households standing in low, medium, and high-risk tiers have been extracted. The households are categorized based on the risk level of their related portfolios.

Risk, return values and correlation coefficients of housing compared to those of other assets suggest that housing has acceptable risk and return and almost low correlation with other assets. Therefore, considering housing as an asset can be of importance and positive effect. The less the correlation of one asset with other assets, the more important its presence in the portfolio; because if the returns of assets are not moving homogenously, fluctuations of the portfolio will decline.

The presence of housing in the household portfolio is effective on efficient frontier, risk, return, and portfolio composition. Figure 3 shows the frontier in the presence of housing.

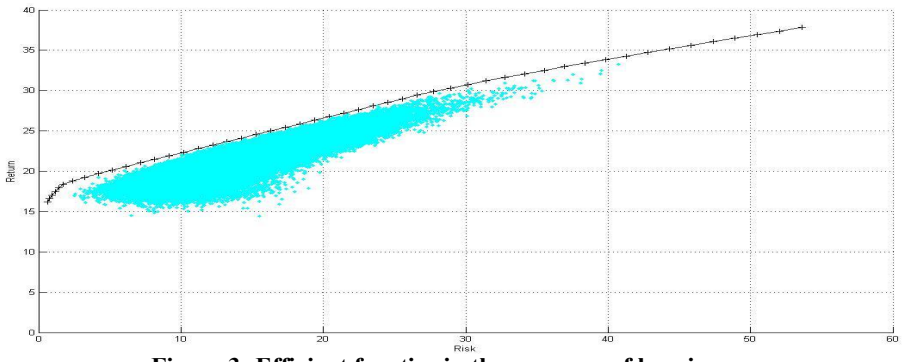

Figure 3: Efficient frontier in the presence of housing

Two different mean -variance efficient frontiers are depicted in Figure4 .

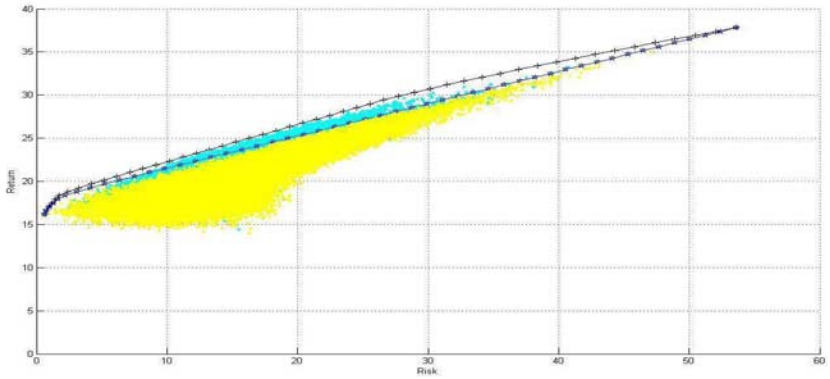

Figure 4:Comparision of efficient frontiers

Once the curves in Figures 2 and 3 are drawn together in one single chart, the effects of the presence of housing on efficiency of the portfolio can be observed. Figure 4 shows the situation.

Addition of housing as an asset improves the efficient frontier. For example, a portfolio with an expected return of %19.7 is associated with standard deviation of %6 if the assets are restricted to only financial assets, whereas standard deviation of %5 can be achieved with the same expected return when housing is included. Figure 4 reinforces the popular notion that home ownership is a good investment. Examination of portfolios on the frontier reveals that housing comprises a considerable proportion of the optimal Portfolio. In this case, households can earn more return with a given risk. Efficient frontier for medium-risk households has had the biggest shift upward. Hence, addition of housing has resulted in the most increased utility for these households. For risk-aversion households (beginning point of low-risk area) and risk-lover households (final points of high-risk area) no change has been made in the efficient frontier.

Presence of housing in the portfolio changes its optimal combination. Table 4 represents estimated optimal shares of assets in portfolio in recent situation.

Table 4: Estimated Shares of Assets in the Optimal Portfolio in the Presence of Housing(%)

Risk category	Stocks	Foreign currency	Bonds	Gold	Bank deposit	Housing	Total portfolio's :	
							Return	Risk
Low-risk	5.09	.00	70.95	.00	9.10	14.86	19.70	5.06
Medium-risk	27.83	.00	17.64	.00	.00	54.53	27.21	21.49
High-risk	74.58	.00	.00	.00	.00	25.42	34.50	42.23

Source: Authors' calculations on data from the central bank of Iran.

Making a comparison between Table 3 and Table 4 suggests that housing, substituting stocks and bonds, obtains a high share in the portfolio in the case of medium-risk taking. Considering the results, both hypotheses of the research are approved.

4-4- Effects of Foreign Exchange Rates Stabilization Policies

Based on the information in Tables 3 and 4, the share of foreign currency in the optimal portfolio is zero during the period under study, because a partial stabilization of nominal exchange rates since 1996 caused it to lose its status as an asset with favorable risk and return during the period. To study the issue, we divided the whole period into two sections: First section (1991 – 1999) during which the exchange rates experienced a substantial rise and second section (2000 – 2006) during which stabilization policies were implemented by central bank. From 1991 to 1996, comprising a substantial portion of household portfolios, foreign currencies' rate of return was noticeable, although it was lower than the return of bank interests. Accordingly, Tables 5 and 6 show the optimal shares of assets in the first and second period, respectively.

Table 5: Shares of Assets in the Optimal Portfolio During a Surge in Foreign Exchange Rates (%)

Risk category	Stocks	Foreign currency	Bonds	Gold	Bank deposit	Housing	Total portfolio's :	
							Return	Risk
Low risk	11.42	13.99	73.39	.00	1.2	0	22.93	8.02
Medium risk	41.13	44.07	14.8	.00	0	0	31.66	28.41
High risk	79.84	20.16	0	.00	0	0	40.15	50.01

Source: Authors' calculations on data from the central bank of Iran.

The figures presented in the Table 5 show that foreign currency takes a substantial portion of portfolio especially in the medium-risk tier. The share of housing in all tiers of portfolios during the period is equal to zero.

Following the implementation of a series of foreign exchange rate stabilization policies during the third five-year Development Plan (1999-2003), household portfolios underwent a dramatic change, leading to a fall in the size of return and risk. It also helped housing obtain a significant portion of portfolio and push out foreign currency out of portfolios (Table 6).

Table 6: Shares of Assets in the Optimal Portfolio During the Exchange Rate Stabilization Period - Percentage- (1999-2006)

Risk category	Stocks	Foreign currency	Bonds	Gold	Bank deposit	Housing	Total portfolio's :	
							Return	Risk
Low risk	2.83	0	70.59	0.22	3.02	23.34	18.15	4.96
Medium risk	15.45	0	13.87	0	0	70.68	22.22	16.72
High risk	69.54	0	0	0	0	30.46	26.17	31.92

Source: Authors' calculations on data from the central bank of Iran.

Stabilization along with other implemented policies led to a fall in the portion of stock shares in the portfolios. In so far as the foreign exchange rate stabilization policies is concerned, the rents due to low price, stabilization policy and unification of foreign exchange rates in industrial sectors led to a decline in the return of stock shares and a surge of the portion of housing in portfolios. Furthermore, the explosion of population, increased expectations about increase in home prices, and speculation in

housing market led to a surge of home prices and subsequently proportion of housing in portfolios.

According to the findings of the study, both hypotheses are approved; meaning that risk and return have influenced the household portfolios, and the presence of housing has pushed up the efficient frontier, leading to improvements in the portfolios. Moreover, an implementation of an official devaluation policy, a foreign exchange rates stabilization policy, and a foreign currency rates unification policy have caused the foreign currency to exit the household portfolios as an asset, giving its place to housing.

4 - Summary and Conclusion

The present research examines the selection of household portfolio through the mean – variance model. The results prove that the expected risk and return are influential factors in the selection of household portfolios. The portfolio has first been studied in the absence and then in the presence of housing. Data pertaining to the composition of the optimal portfolio during the period under study shows that when housing is absent from the portfolio, stock shares and bonds have a dominant share in the portfolio. Stock shares and bonds play a significant role in the portfolios of high-risk and low-risk households, respectively. With housing involved in the portfolio, it is observed that the optimal household portfolio improves and the levels of households' utility grow as the efficient frontier shifts upward.

In an attempt to study the effects of stabilization and unification of foreign exchange rates on the household portfolios, the period under study was divided into two sections. An analysis of the composition of the portfolios indicates that in a spell of surge in foreign exchange rates (first period) housing had no share in the optimal household portfolio. In fact, the presence of this asset was not helpful for improving the return and risk of portfolio. Then the period of stabilization and unification was examined. During that period, housing obtained a very large portion of the optimal portfolio, especially in medium-risk households. The maximum share of housing in the optimal household portfolio during the second period reached %70.68. Considering a medium-risk household as a basis, the assets could be ranked as follows in the optimal portfolio over different periods based on their levels of significance.

Table 9: Asset priority in portfolio over different periods

Period	Absence of housing	Presence of housing
Whole	bonds , stock shares	housing, stock shares, bonds
Surge in foreign exchange rates	foreign currency , stock shares, bonds	
Stabilization of foreign exchange rates	housing , stock shares, bonds	

Table 9 shows that over the three mentioned period, housing received the largest portion of portfolio. Concerning the risk-taking, there is a great difference among the optimal compositions of household portfolio based on the level of risk-taking. A rise in risk-taking mood causes the households to hold more stocks in their portfolios while this is not true with housing. The largest portion of housing belongs to medium-risk households whereas high-risk households hold smaller portions of housing in their portfolios. Moreover, as the degree of risk-taking increases, bonds receive a smaller share in the portfolio. Thus, there is a negative relationship between bonds and the degree of risk-taking. Furthermore, a positive relationship exists between the degree of risk-taking and stocks. Housing and risk-taking have a reverse, U-shape relationship.

4-1- Comparison with foreign studies:

To summarize, the present study is different from similar studies from two aspects:

1- It divides the period of study into two periods of boom and recession of housing.

2- It considers gold as a physical attractive and safe asset from the point of view of Iranian households.

Our findings concerning risk and return, compared to Dacy and Hasanov's, suggest that in the period under study, housing has had appropriate return and low risk, and inclusion of it in asset portfolio plays an important role in improving the efficiency of asset portfolio in such a way that inclusion of housing in the period under study caused efficiency frontier to shift upwardly. Furthermore, we have regarded gold coin as a physical safe asset.

Similar to Dacy and Hasanov's, the share of stocks in asset portfolio rises with the increase of risk-taking, but the share of housing is the most for

middle-risk individuals. The latter fact is true for risk-taking individuals in the Dacy and Hasanov's study.

In the present study, the main share of asset portfolio goes to stocks, housing, and bonds. In contrary, in Dacy and Hasanov's study, housing and stocks have obtained a great share of portfolio, and the share of bonds and foreign exchange is zero for every risk classes.

A similar study by Flavin and Yamashita(2002) indicates that a rise in risk has caused a rise in the shares of housing and stocks in asset portfolio, and bonds are very attractive for middle-risk individuals. Our findings, compared with the two studies mentioned above, suggest that in Iran's markets, as well as the U.S. markets, housing and stocks are the most attractive assets to investors to gain return. The important characteristic of the three studies is to consider housing as a part of asset portfolio, which has been neglected by many studies. Also all three studies indicate that risk, return, and correlation coefficients are effective factors in determining the optimal asset portfolio.

4-2- Comparison with domestic studies

Since there is no similar study in Iran, it is impossible to compare the present study to anyone else. It must be noted that in Iran some research has been performed only to determine the optimal portfolio in stock investments. The results of those studies suggest that as investment portfolio is more diversified, the risk of investment in stocks declines and an appropriate return is earned by the investor. In other words, the best portfolio is the market portfolio which includes all efficient stocks in market.

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