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RESEARCH PAPER

Does the Equity Premium Puzzle exist in Iran?

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Abstract

Investors decide on the type and amount of their investment by considering the two components of risk and return. In general, investing in risky and risk-free assets should be made according to their yield. The equity premium is obtained from the difference between the rate of return on risky and risk-free assets. In the theoretical literature, the failure of financial theory to explain the equity premium is known as the premium puzzle. In this context, the present study aims to empirically examine the equity premium puzzle in Iran for the quarterly period 1993–2021. Using the C-CAPM model, we obtained the value of the negative risk aversion coefficient, and it was outside the accepted range, which indicates the existence of the puzzle of equity premium in Iran. Indeed, it is not possible to justify a negative risk aversion coefficient in an economy where agents are concerned about their consumption flow. Considering this issue and in order to resolve this puzzle, we incorporated exogenous consumption habits in the C-CAPM model. This measure resulted in a relatively positive risk aversion coefficient within an acceptable range. Thus, we could resolve the equity premium puzzle by applying habits to the C-CAPM model.

Keywords: C-CAPM, Equity Premium Puzzle, Financial Markets, Habit of Consumption, Risk Aversion Coefficient.

JEL Classification: E2, G12, O16.

1. Introduction

One of the central issues in financial economics is the question of choosing intertemporal households and firms in relation to the allocation of their resources. Their choice is influenced by the two components of risk and return, and any tradeoff between risk and return will offer different investment combinations. If decision-makers are risk-averse, in choosing their asset portfolio, they will need a higher rate of return for the risky asset than the risk-free asset. In recent years, stocks have become the most preferred asset by investors. Besides offering large profits, stock investment also has a risk factor that can occur at any time (Hersugondo et al., 2023). In case the risky asset is stocks, because shareholders' consumption is more volatile than that of risk-free asset holders, their consumption will be more related to excess returns in the stock market (Mena and Tirley, 2014). In the stock market, this additional return is described as equity premium or risk premium. Risk premium is obtained from the difference between the fixed rate of return of a risk-free asset and the rate of return of a risky asset.

In this article, following Keshavarz and Esfahani (2014), Safari and Erfani (2015), Donadelli and Prosperi (2011), and Mehra (2007), the average one-year and short-term bank deposit rates are considered as substitutes for risk-free asset rates, and stocks are considered as risky assets.

Figure (1) shows the quarterly trend of the rate of return on stocks and risk-free assets in the period 1993–2021.

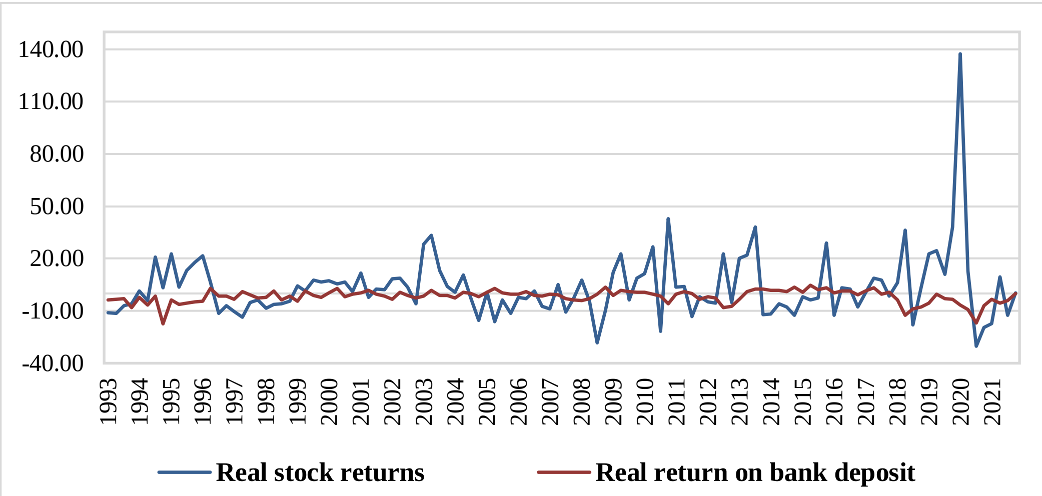

Figure 1. The Quarterly Trend of the Rate of Return on Stocks and Risk-Free Assets between 1993 and 2021

Source: Central Bank of Iran.

According to Figure (1), the real average rate of the risk-free asset is -1.78, and the real average of the stock return is 3.43. From the difference of these two rates, the real average of equity premium for Iran during the period under review will be 5.21%. It seems that with this amount of difference, more people should have been motivated to direct their capital toward the capital market and reduce the amount of their deposits with banks. But this is not what has transpired.

Polkonichenko (2004) showed that curbing participation in risk-free assets cannot guarantee a significant increase in risk-taking (cited in Mena and Tirley, 2014).

Tobin (1958) and Pratt (1964) were the first economists who investigated the relationship between market risk premium and investors' risk aversion. William Sharpe (1964) later introduced the capital asset pricing model (CAPM). These models all try to explain the stock market premium in such a way that the expected stock premium (excess of stock returns over risk-free asset returns) is proportional to the market's excess returns (the coefficient of this variable is called market beta).

The consumption-based capital asset pricing model (C-CAPM) is also a traditional model in which changes in stock returns are related to changes in consumption expenditures. These models were proposed two decades after the introduction of the basic model of capital asset pricing. Lucas (1978) and Breeden (1979) were the first to propose a consumption-based asset pricing model. In the C-CAPM model, the risk-averse person is faced with an important economic fluctuation, namely, consumption fluctuation. In this model, assets that have a positive correlation with consumption growth (i.e., have a negative correlation with the final utility of consumption) are less attractive. Therefore, it is not desirable to maintain such assets in times when the final utility of consumption is high. In such circumstances, risk-averse investors are willing to keep such assets only if the risk-reward of holding is higher than the rate of return on a risk-free asset (Radnia, 2016; Mehra, 2003).

In C-CAPM models, consumption expenditure is included as a risk factor; therefore, the expected stock premium changes with the covariance of stock returns and consumption. The coefficient of this variable is called relative risk aversion or consumption beta. In general, it is considered an investment model whose utility function is based on consumption, and the investor can exchange between risky assets (stocks) and risk-free assets to pay for goods and services.

What most studies and Mehra and Prescott (1985, 2003) have shown is that Strong risk aversion outside the range of 2 to 10 is unreasonable, because the household must be strictly risk-averse to match the observed high return with consumption behavior. This issue is known as the equity premium puzzle. Therefore, if a person is averse to consumption fluctuations, risky assets will pay high returns because the consumer is strongly risk-averse. The equity premium puzzle does not mean that equity returns are higher than risk-free asset returns.

Rather, it means stock returns are too high to be explained by fluctuations in real consumption growth. In other words, financial theory is not able to explain it.

Many studies have investigated the equity premium puzzle and have tried to solve it, but so far, no study has investigated the comparison of the equity premium puzzle in Iran with the two approaches of Mehra and Prescott, Campbell and Cochran, in two cases, without consumption habits and with consumption habits. With this view in this article, we are looking for an answer to the question, "Does the Equity Premium Puzzle exist in Iran? If yes, how can we solve it?"

The structure of the current research is as follows: In the second part, the concept of the Equity Premium Puzzle has been introduced using two methods, C-CAPM of Mehra and Prescott, and Campbell, and in the rest of this part, the empirical literature has been described. In the third part, Variables and descriptive statistics have been investigated, and the Equity Premium Puzzle in Iran has been investigated with Mehra and Prescott and Campbell and Cochran methods. The fourth part, by introducing consumption habits, mentions it as an approach to solve the Equity Premium Puzzle; this parameter was entered in the models of Mehra and Prescott, as well as Campbell and Cochran, and once again Equity Premium Puzzle has been re-examined with this approach. The fifth part is the conclusion of this study.

2. Equity Premium Puzzle

2.1 Equity Premium Puzzle and Mehra and Prescott's Standard Preference Function

Using the standard neoclassical consumption model based on intertemporal consumption optimization, Mehra and Prescott (1985) were the first to prove the existence of the equity premium puzzle. Modifying the model introduced by Lucas (1978), they presented the function of household preferences on the path of random consumption as follows:

$$E_0[\sum_{t=0}^{\infty} \beta^t U(C_t)] \quad . \quad 0 < \beta < 1 \tag{1}$$

where c_t is the growth rate of per capita consumption and β is the mental time discount rate that shows the household's tolerance for consumption. If β is small, it means that people are very intolerant to consumption and have strong preferences for present consumption as opposed to future consumption. E_0 is the operator of conditional expectations on the set of information available at zero time (present time). The utility function of constant relative risk aversion (CRRA) is presented as follows:

$$U(C.\alpha) = \frac{C^{1-\alpha}-1}{1-\alpha} \quad , \ 0 < \alpha < \infty \tag{2}$$

The parameter α calculates the reverse of the elasticity of substitution of consumption or the relative risk aversion coefficient (Mehra and Prescott, 1985).

Suppose that y_t is the dividend of the productive unit, and a share is exchanged at the price of p_t per unit of consumption. If the consumer decides to postpone their consumption to the next period, it will cause a loss in their current utility. Therefore, it compensates for the loss by discounting the expected utility from consumption in the next period, which is obtained from the purchase of an additional unit of stock in the current period. The amount of loss in the utility function is equal to $P_t\acute{U}(c_t)$. By selling the additional unit of the share in the next period, the amount of $p_{t+1}+y_{t+1}$ additional unit can be consumed. Therefore, the expected value of the utility function in the next period is equal to $\beta Et[(p_{t+1}+y_{t+1})\acute{U}(c_{t+1})]$; these values should be equal to each other. The result of this equality is the basis of the asset pricing relationship (Mehra, 2003):

$$P_t\acute{U}(C_t) = \beta Et\left[(p_{t+1} + y_{t+1})\acute{U}(C_{t+1})\right] \tag{3}$$

The above equation for risky assets and risk-free assets is presented as follows:

$$1=\beta E_t[\frac{\acute{U}c_{t+1}}{\acute{U}c_t} R_{e.t+1}] \tag{4}$$

$$1=\beta E_t[\frac{\acute{U}c_{t+1}}{\acute{U}c_t} R_{f.t+1}] \tag{5}$$

where $R_{e,t+1}$ is the stock return rate and is equal to $\frac{(p_{t+1}+y_{t+1})}{p_t}$, $R_{f,t+1}$ is the net risk-free asset rate equal to $\frac{1}{q_t}$, and q_t is the price of the risk-free asset. Drawing on some algebraic relationships, one can show that the expected net return of stock assets is equal to:

$$E_t[R_{e.t+1}] = R_{f.t+1} + COV_t\{\frac{-(\acute{U}c_{t+1})}{E_t(\acute{U}c_{t+1})} R_{e.t+1}\} \tag{6}$$

Equity premium is equal to $E_t(R_{e,t+1})-R_{f,t+1}$. According to the above equation, the expected stock returns are equal to the risk-free asset return plus the reward for risk tolerance. Here, risk depends on the covariance of asset returns and the marginal utility of consumption.

Mehra and Prescott (1985) estimated a US equity premium of 6%; however, the question is whether the covariance of asset returns and the marginal utility of consumption is high enough to explain the resulting equity premium?

To answer this question, Mehra and Prescott (1985) considered the following standard assumptions to calculate the equity premium:

- Consumption growth rate $x_{t+1}=\frac{Ct+1}{Ct}$ and the growth rate of dividends $z_{t+1}=\frac{yt+1}{yt}$ are identically and independently distributed (i.i.d);
- (xt, zt) are jointly lognormally distributed, so (x_t, $R_{e,t}$) will have a joint lognormal distribution. We assume a utility function with constant risk aversion (CRRA), substitute $\acute{U}(c_t) = c_t^{-\alpha}$ in the main pricing relationship, and then apply the following conditions:

$$\mu_X = E(lnx)\ ,\ \sigma_x^2 = var(lnx)\ ,\ \sigma_{x.z} = cov(lnx. lnz)\ ,\ R_f = \frac{1}{\beta e^{-\alpha\mu_x+1/2\alpha^2(\sigma_x^2)}}$$

Consequently, we will have the following equations:

$$\begin{gathered} \text{Ln}R_f = -ln\beta + \alpha\mu_x - \frac{1}{2}\alpha^2\sigma_x^2 \\ \text{lnE}(R_e) - \text{lnR}_f = \alpha\sigma_{x,z} \quad , \quad \text{lnE}(R_e) - \text{lnR}_f = \alpha\ \sigma_{x,Re} \\ \sigma_{x\ ,\ Re} = \text{cov}(\text{lnx}\ ,\ \text{lnR}_e) \end{gathered} \tag{7}$$

In this model, the equity premium is obtained by multiplying risk aversion and the covariance between the consumption growth rate and the asset return or dividend. In the case of equilibrium x=z, asset returns will be completely correlated with the consumption growth rate.

$$\text{lnE}(R_e) - \ln(R_f) = \alpha\sigma_x^2 \tag{8}$$

$$\sigma_x^2 = Ln\left\{1 + \frac{var(x)}{[E(x)]^2}\right\} \tag{9}$$

$$\begin{gathered} \text{Ln}\ E(x) = \mu_x + \frac{1}{2}\sigma_x^2\ ,\ \mu_x = Ln\ E(x) - \frac{1}{2}\sigma_x^2 \\ \alpha = \frac{\text{lnE(Re)} - \ln(\text{Rf})}{\sigma_x^2} \end{gathered} \tag{10}$$

According to Equation (8), the equity premium is obtained by multiplying the risk aversion coefficient (α) and the variance of the consumption growth rate (σ_x^2).

Using the equations introduced above, Mehra and Prescott (1985) and Mehra (2003) set the value of the risk aversion coefficient to 10, the discount rate to 0.99, the risk-free asset rate to 12.7%, and the stock return to 14.1%. From the difference of these two rates, an equity premium equal to 1.4% was obtained, which was lower than the observed value of 6%. This is due to the existence of a puzzle that risk considerations alone cannot solve. In fact, Mehra and Prescott (1985) showed that if we replace the returns of risky and risk-free assets in the C-CAPM model according to historical data, the calculated risk aversion coefficient for people is higher than its normal value. The findings of most studies also support that in order to match the observed high return with consumption behavior, the household must be very risk-averse, yet extremely high risk aversion outside the range of 2–10 is unreasonable. In short, this situation is known as the equity premium puzzle (Aras, 2020). In this puzzle, a high equity premium leads to an unreasonable and high level of risk aversion among investors, which will affect the smoothing of consumption and precautionary savings of households.

2.2 Campbell's Equity Premium Puzzle Model

In the present paper, in addition to Mehra and Prescott (1985), we use Campbell's approach to the equity premium puzzle (1996; 2003). The representative agent's utility function that seeks to maximize utility is as follows:

$$Max\ E_t \sum_{j=0}^{\infty} \delta^j U(C_{t+j}) \tag{11}$$

where δ is the discount factor, C_{t+j} is the future consumption flow, and $U(C_{t+j})$ is the future consumption utility. The budget limit is as follows:

$$s.t:\ W_{t+1} = (W_t - C_t)(1 + R_{p.t}) \tag{12}$$

where W_t is wealth and $R_{p.t}$ is the return on financial assets (stocks). The representative agent maximizes utility according to their budget constraint. The first-order condition resulting from this action is Euler's equation of consumption, which explains the path of consumption and investment of the representative agent as follows:

$$\acute{U}(C_t) = \delta E_t\left[(1 + R_{i.t+1})\acute{U}(C_{t+1})\right] \tag{13}$$

$R_{i.t+1}$ represents the net returns of asset i. The representative agent considers the reduction of the current consumption equal to the increase in expected utility resulting from the discounted consumption of the next period. If the utility function is in the form of Equation (14), Euler's equation will be as Equation (15):

$$Max\ E_t \sum_{j=0}^{\infty} \delta^j \frac{C_{t+j}^{1-\alpha}}{1-\alpha} \tag{14}$$

$$1 = E_t[\delta(\frac{C_{t+1}}{C_t})^{-\alpha}(1 + R_{i.t+1})] \tag{15}$$

According to Campbell (1996), it is assumed that the joint distribution of stock returns and consumption growth rate is log-normal with time-varying volatility. Therefore, we get the following logarithm from Equation (15):

$$0 = E_t r_{i.t+1} + log\delta - \alpha E_t[\Delta c_{t+1}] + 0/5(h_{rt} + \alpha^2 h_{ct} + 2\alpha h_{r.c}) \tag{16}$$

$$E_t\left[r_{i.t+1} - r_{f.t+1}\right] + \frac{h_{rt}}{2} = \alpha h_{r.c} \tag{17}$$

The term on the right side of Equation (17) is the variance. According to this Equation, the equity premium is equal to the difference between the return on risk-free assets and the return on stocks. Also, the equity premium is equal to multiplying the relative risk aversion coefficient by the covariance of stock returns and the consumption growth rate. According to the existing theories, the relative risk aversion coefficient should be in the range of 2 to 10. According to the empirical observations of the equity premium, if the value of this coefficient is very high or outside the defined range, this coefficient will be unjustified and will indicate the existence of a puzzle.

2.3 Literature Review

Mohammadzadeh et al. (2016) proved the existence of a puzzle in the framework of C-CAPM for the period 1989–2013 in Iran, and reported a negative risk aversion coefficient. While pointing out the shortcomings of the C-CAPM model in that it only considers a linear relationship between consumption beta and asset returns, they adjusted the C-CAPM model by introducing savings into this model. Consequently, the risk aversion coefficient became positive and lay within the permissible range.

Erfani et al. (2016) investigated the puzzle of the stock exchange in Iran in the framework of two-variable GARCH and virtual fuzzy nested variable. They obtained the value of the relative risk aversion coefficient as -2.89. Stressing that the risk aversion coefficient is considered constant in the C-CAPM model, they used the fuzzy method to solve the equity premium puzzle and presented a model called CCAPM-F. While pointing out that relative risk aversion increases in a recession and decreases in a boom, they considered four periods by applying boom and bust periods to the capital market and the entire economy. Accordingly, consumption fluctuations in the economy and return fluctuations in the capital market (stocks) were examined under boom and recession conditions, and only two periods could adequately justify the puzzle of stocks with economic realities.

Constantinides (1990) was the first to use the idea of habit formation to justify the puzzle of the equity premium and presented his research using the terms of the continuous neoclassical growth model.

Brandt and Wang (2002) developed the asset pricing model based on consumption in the framework of habits, taking into account the change in risk aversion to inflation news, and the results of this study in the framework of the GMM estimator showed that risk aversion changes in response to inflation and equity premium increase.

Chen et al. (2018) in a research with a real business cycles model, investigated the fluctuations of asset prices and macro variables under high risk aversion. According to the results of this research, investment and production, high volatility, and consumption and risk-free rate of return have little volatility under high risk aversion in the real business cycle model.

3. Variables and descriptive statistics

3.1 Variables

In this article, we use the data and information available in the Central Bank of the Islamic Republic of Iran and the Tehran Stock Exchange. The data are quarterly and from the first quarter of 1993 to the fourth quarter of 2021. The first variable is the total price index of the Tehran securities market.

$$r_e = \frac{p_t - p_{t-1} + d_t}{p_{t-1}} \tag{18}$$

In Equation (18), p_t is the annual price index of common stocks, r_e is the growth rate of stock returns, and d_t is the distributed dividend of the stock. Since there are no reliable data on the dividends for the mentioned time period, the d_t amount was omitted (Erfani and Safari, 2016). It should be emphasized that the amount spent on shares would be higher than the equity premium of 5.21 if we considered dividends.

The second variable is the time series of household final consumption. The data of this variable were obtained from the Central Bank of Iran website every quarter.

The third variable is providing a suitable tool for the rate of return on risk-free assets *rf*. In the financial literature, in economies where there are no long-term treasury bonds, the current rate in the money market is used as the rate of risk-free assets (Keshavarz and Esfahani, 2013; Safari and Erfani, 2016; Donadelli and Prosperi, 2012; and Mehra, 2008). The present study uses the average one-year and short-term bank deposit rate as a proxy for the risk-free asset rate.

3.2 Descriptive Statistics of Variables

Descriptive statistics of the abovementioned variables are as follows:

Table 1. Descriptive Statistics of Variables

Variable name	Symbol	Average	Standard Deviation	Skewness	Kurtosis	Jarque-bera Probability
Real Stock Returns	re	3.43	18.75	3.34	23.84	(0.00)*
Real Growth Rate of Household Final Consumption	rc	0.84	3.78	0.25	6.15	(0.00)*
The Average Real Yield of a One-Year and Short-term Bank Deposit	rf	-1.77	3.72	-1.51	6.81	(0.00)*
Equity Premium	ep	5.21	19.46	3.41	23.88	(0.12)

Note: The sign (*) means the significance of the test.
Source: Research finding.

3.3 Equity Premium Puzzle in Iran

In this article, in order to investigate the equity premium puzzle in Iran, we drew on the C-CAPM model introduced by Mehra and Prescott (1985) and the study by Campbell and Cochran (1999). The results are as follows:

Table 2. Estimating the Equity Premium Puzzle in Iran

Method	The Coefficient Value
Mehra and Prescott (C-CAPM)	-0.25
Campbell and Cochrane	7.13

Source: Research finding.

According to the C-CAPM model proposed by Mehra and Prescott (1985), the estimation results in Iran show that the coefficient of relative risk aversion (α) is -0.25. Considering Mehra's study (2003), since the relative risk aversion coefficient is out of the permissible range, one is faced with an equity premium puzzle; Because A negative relative risk aversion coefficient is unreasonable in an economic model where people pay attention to their consumption flow. In fact, this finding in Iran shows that investors are risk-takers and tend to accept risk in the stock market. This is contrary to the findings of the C-CAPM model, which stipulates that people are risk-averse and desire to smooth consumption. This result is similar to Mohammadzadeh et al. (2016) and Erfani et al. (2016). Also, the estimation results show that the covariance between the consumption growth rate and the stock return rate is negative; This means that with the increase in stock returns, consumption decreases, so consumption fluctuations cannot explain the observed equity premium in the Tehran Stock market based on the quarterly average of 5.21% in the analyzed time period.

The results of the equity premium puzzle, according to the approach taken by Campbell and Cochrane, also show that the value of the coefficient η is greater than or equal to 7.13. When η is equal to 7.13, it is not a puzzle, but if this coefficient is more than 10, we are faced with an equity premium puzzle.

4. Habit Formation Models

When preferences entail habit formation, the present consumption will heighten the marginal utility of consumption in the next period. In such a way that, if an agent consumes more in a certain period, they will be even more passionate to consume in the following period. Meanwhile, in terms of durability, the current consumption provides utility for the following periods, such that as the household consumes more in the current period, it will need less to spend in the next period, so as to gradually smooth the marginal utility of consumption. In this situation, consumption goods could be substituted across contiguous periods (Uribe, 2002).

Menna and Tirelli (2014) stated that under normal conditions, consumption growth drives households to reduce their savings. But in the case of consumption habits and by taking into account the strong correlation between dividends and household consumption, fluctuations in consumption due to fluctuations in dividends increase precautionary savings and reduce the demand for bonds. As a result, the risk-free asset rate declines because the existence of consumption habits causes the marginal utility of consumption to increase, precautionary savings to grow, and the risk-free asset rate to decrease (Menna and Tirelli, 2014).

Models with the formation of habits are introduced in two ways: Models with endogenous habits and models with exogenous habits. In models with endogenous habits, the contribution of the human factor from these habits is a function of the entire history of its past consumption (Erfani et al., 2016). On the other hand, the models proposed by Pollack (1970) and Abel (1990) suggest that habits are determined exogenously. Some methods of modeling consumption habits are as follows:

$$u(0) = u\left(C_t . \bar{\mathrm{h}}\bar{\mathrm{C}}_{t-1}\right) \tag{19}$$

In the above relation, $\overline{C_{t-1}}$ is an exogenous factor and shows the average consumption level of the society in the previous period, $\bar{\mathrm{h}}$ measures the sensitivity to it. In equilibrium, we have C_t=$\overline{C}_{t-1}$, but it does not mean that the formation of exogenous or endogenous habits leads to equivalent pricing relations.

Following this study, we discuss exogenous consumption habits as an approach to solving the puzzle of the equity premium in Iran:

4.1 C-CAPM and the Framework of Consumption Habits

Accordingly, Constantine (1990) and Sun (1989), the utility function is not only a function of current consumption but also depends on past consumption due to incorporating the mechanism of habit formation; It is as follows:

$$U(c) = E_0[\sum_{t=0}^{\infty} \beta^t U(C_t - hC_{t-1})] \quad , \quad X_t = hc_{t-1} \tag{20}$$

where C_{t-1} is the consumption of the past period, X_t is exogenous consumption habits, and h shows the degree of dependence on consumption habits (0<h<1). In other words, it determines how much the consumer is willing to adjust their consumption level compared to the per capita consumption of the previous period. Due to the existence of habits, we have $C_t > C_{t-1}$. That is, at time t, household consumption must be h% larger than the average per capita consumption of the economy in period t-1. By entering the consumption habits in the C-CAPM model of Mehra and Prescott, we rewrite relations 3 to 6 as follows:

$$P_t \acute{U}_c(\mathrm{C_t} - \mathrm{X}_t) = \beta \mathrm{Et}[(\mathrm{p_{t+1}} + \mathrm{y_{t+1}})\acute{U}_c(\mathrm{C_{t+1}} - \mathrm{X}_{t+1})] \tag{21}$$

The above relationship is the relationship of asset pricing based on consumption habits, in which y_t is the dividend. Since the agent postpones consumption to the next period, this causes a loss in the current utility is equal to $P_t \acute{U}_c$ (C_t−X_t). By selling additional units of shares in the following period, the amount of p_{t+1}+y_{t+1} additional units can be consumed. Therefore, the expected value of the utility function in the next period is equal to $\beta E_t[\acute{U}_c(C_{t+1}-X_{t+1})(p_{t+1}+y_{t+1})]$.

Equation (21) can be reformulated for risky stocks and risk-free assets as Equations (22) and (23), respectively:

$$1=\beta E_t\left[\frac{\acute{U}_c(\mathrm{C_{t+1}}-\mathrm{H_{t+1}})}{\acute{U}_c(\mathrm{C_t}-\mathrm{H_t})} R_{e.t+1}\right] \quad . \quad R_{e.t+1} = \frac{\mathrm{p_{t+1}} + \mathrm{y_{t+1}}}{\mathrm{p_t}} \tag{22}$$

$$1=\beta E_t[\frac{\acute{U}_{C_t}(\mathrm{C_{t+1}}-\mathrm{H_{t+1}})}{\acute{U}_c(\mathrm{C_t}-\mathrm{H_t})} R_{f.t+1}] \tag{23}$$

where $R_{e.t+1}$ and $R_{f.t+1}$ are the real return rates of stock assets and risk-free assets. Again, Equations (22) and (23) can be presented as follows:

$$1=\beta E_t[\mathrm{M_{t+1}} \,.\, R_{e.t+1}] \quad . \quad R_{e.t+1} = \frac{\mathrm{p_{t+1}} + \mathrm{y_{t+1}}}{\mathrm{p_t}} \tag{24}$$

$$1=\beta E_t[\mathrm{M_{t+1}} \,.\, R_{f.t+1}] \tag{25}$$

$\mathrm{M_{t+1}}$ is the random discount factor**:**

$$M_{t.t+1} = \frac{\acute{U}_c(C_{t+1}-H_{t+1})}{\acute{U}_c(C_t-H_t)} = \boldsymbol{\delta}(\frac{C_{t+1}}{C_t})^{-\boldsymbol{\alpha}}(\frac{S_{t+1}}{S_t})^{-\alpha} = \boldsymbol{\delta}\,(\frac{C_{t+1}}{C_t})^{-\boldsymbol{\alpha}}(\frac{RRA_t}{RRA_{t+1}})^{-\alpha} \quad (26)$$

This definition (the stochastic discount factor) guarantees that the economy will be arbitrage-free and prices will be kept the same. Using algebraic relationships, the return on net assets is as follows:

$$E_t[r_{e.t+1}] = r_{f.t+1} - COV_t\{\frac{(m_{t+1}.r_{e.t+1})}{E_t(m_{t.t+1})}\} \quad (27)$$

where $E_t[r_{e.t+1}] - r_{f.t+1}$ is the equity premium.

4.2 The Mechanism of Campbell and Cochran's Model (1999)

Campbell and Cochran (1999), by introducing exogenous consumption habits in the utility function of constant relative risk aversion, assume that:

$$U(C_t - X_t) = \frac{(C_t - S_t)^{1-\gamma}}{1-\gamma} \text{ و } \eta = -\frac{C_t u_{cc}(C_t X_t)}{u_c(C_t X_t)} \quad (28)$$

So that C_t is factor consumption and $S_t = \left(\frac{C_t - X_t}{C_t}\right)$ is extra consumption habits. The agent's view is exogenous to S_t. They also assume that:

1. Consumption growth has a log-normal distribution:

$$\Delta C_{t+1} = logC_{t+1} - logC_t \equiv g + \tilde{v}_t \quad , \quad \tilde{v}_t \sim i.i.d.N(0, \sigma_V^2) \quad (29)$$

2. The logarithm of additional consumption (S_t) follows the log-normal distribution to be consistent with condition (1).

$$S_{t+1} = (1-\varphi)\bar{S} + \varphi S_t + \vartheta(S_t)(\Delta C_{t+1} - g) \quad (30)$$

φ and $\bar{S}$ and g are parameters, and $\vartheta(St)$ is the sensitivity function. The pricing core of time t and t+1 is as follows:

$$\begin{aligned} MRS_{t,t+1} &= \beta\frac{u_c(C_{t+1}, S_{t+1})}{u_c(C_t, S_t)} = \beta\left(\frac{C_{t+1}}{C_t}\frac{S_{t+1}}{S_t}\right)^{-\gamma} \\ &= \beta e^{-\gamma[(1-\varphi)(\bar{S}-S_t)+(1+\vartheta(S_t)\Delta C_{t+1} - \vartheta(S_t)g} \\ &= \beta e^{-\gamma[(1-\varphi)(\bar{S}-S_t)+(1+\vartheta(S_t)\tilde{v}_{t+1}} \end{aligned} \quad (31)$$

Under these characteristics, it is clear that the standard deviation of MRS and its correlation with the growth rate of consumption (both of which are important factors for the equity premium) will be determined by the shape of the sensitivity function. In the following, Campbell presents an assumption for the construction of the sensitivity function $\vartheta(S_t)$:

$$\vartheta(S_t) = \begin{cases} \frac{1}{s}\sqrt{1-2(\bar{S}-S_t)} - 1 \ , & S_t \leq \max S_{max} \\ 0 \ , & S_t \leq \max S_{max} \end{cases} \quad (32)$$

$$\bar{S} = \sigma\sqrt{\frac{\beta}{1} - \varphi} \quad , \ S_{max} = \bar{S} + \left(\frac{1}{2}\right)(1 - \bar{S}^{\,2}) \quad (33)$$

These relationships allow not only the formation of habits to reflect some key features of the data; they also produce a process of acceptable habits. Campbell and Cochran (1999) further introduced the following relationship to investigate the equity premium puzzle:

$$\frac{E(r_i)}{\sigma(r_i)} \leq \sqrt{e^{\eta^2\sigma^2} - 1} \approx \eta\sigma \qquad (34)$$

In Equation (34), $\frac{E(r_i)}{\sigma(r_i)}$ is Sharpe ratio, $E(r_i)$ is average excess rate of return, $\sigma(r_i)$ is the standard deviation of the rate of excess return, and σ is Standard deviation of consumption growth rate; where $\eta < 2$, $\eta > 10$; there is mehra and Prescott's (1985) equity premium puzzle.

According to the study by Smets and Wouters (2007), the value of the habit parameter is 0.70. Considering this assumption, the results according to the models by Mehra and Prescott (1985) and Campbell and Cochran (1999) are as follows:

Table 3. Estimating the Equity Premium Puzzle in Iran with Consumption Habits

Method	The Coefficient Value
Mehra and Prescott (C-CAPM)	7.98
Campbell and Cochrane	2.00

Source: Research finding.

Following the study by Mehra and Prescott (1985) and Campbell and Cochrane (1999), the estimation results in Iran show that the value of the relative risk aversion coefficient (α) and (η) was positive 7.98 and 2.00, while considering consumption habits. Since this coefficient is in the permissible range of 2 to 10, it can be concluded that the consumption habits can solve the equity premium puzzle in Iran. Also, the estimation results show that the covariance between the consumption growth rate and stock return rate becomes positive while considering consumption habits. This means that with the increase in stock returns, consumption also increases. In order for risk-averse agents to be willing to hold stocks, they must receive a higher return due to accepting the risk of holding stocks. This is the equity premium. The existence of consumption habits causes economic factors to be risk-averse, refraining from a large reduction in consumption. The opposite of this also happens, so that consumption habits do not mean growth in consumption once and for all. Since the habit of increasing consumption will create the greater marginal utility consumption in the future than in the present, and agents will be stimulated to postpone current consumption for the future period; For this reason, agents will rationally seek to smooth consumption by creating a habit; therefore, according to observations, the existence of consumption habits in Iran causes that makes investors reasonably risk-averse; Since they do not like sudden changes in consumption, compensate these changes with changes in savings or deposits in the bank, which can affect the risk-free interest rate and the equity premium (5.21 percent) observed in the stock market should be explained; This is according to the findings of the C-CAPM model of Mehra and Prescott (1985), which states that people are risk averse and tend to smooth consumption.

Therefore, the risk aversion of agents and parameters of consumption habits in Iran can prevent the stagnation of other financial and investment markets in the country and affect the return of risk-free assets. Therefore, in addition to the parameter of risk aversion coefficient, policymakers should also pay attention to the parameter of consumption habits in the country. The figure below shows the growth rate of quarterly consumption under two states: with and without considering consumption habits.

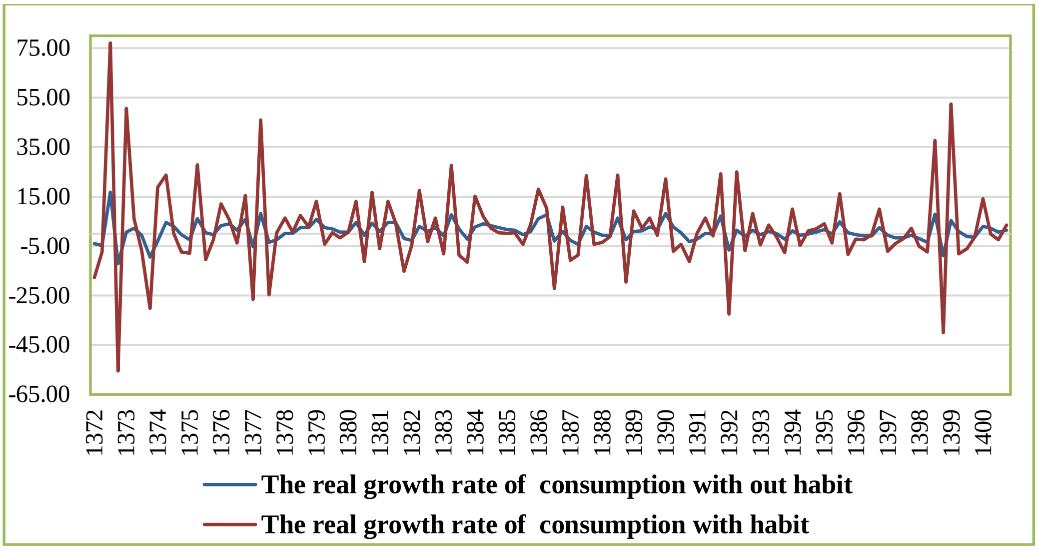

Figure 2. The Quarterly Trend of the Growth Rate of Consumption with and without Considering Consumption Habits in the Period 1993–2021

Source: Central Bank of Iran.

In Figure (2), consumption volatility in the state without habits is higher than when consumption habits are considered. Since the economy of Iran has been accompanied by economic fluctuations, the consumption of factors has also been affected by these fluctuations. During the recession in the economy and the stock market, agents' consumption is low, and they prefer to invest in risk-free bank deposits; in this case, they will need higher risk coverage to accept risk and invest in the stock market. On the contrary, in times of the boom in the economy and the stock market, they are willing to accept risk and invest in the stock market, and the equity premium will not be high compared to recession conditions.

5. Conclusion

The equity premium puzzle is one of the most famous puzzles that was first proposed by Mehra and Prescott (1985), who introduced the C-CAPM model in order to formulate the equity premium puzzle. In the C-CAPM model, consumption expenditure is considered a risk factor. So that the expected equity premium is correlated with the covariance of stock returns and consumption (the coefficient of this variable is called relative risk aversion or consumption beta). The value of the risk aversion coefficient in the C-CAPM model for Iran between 1993 and 2021 (quarterly) was -0.25. Since this coefficient is negative and outside the range proposed by Mehra and Prescott and other economic researchers (i.e., 2–10), the existence of the puzzle of equity premium in Iran is confirmed. This coefficient is unreasonable in an economic model where people are extremely cautious about their consumption flow, because the negative coefficient suggests that people are willing to accept risk in the stock market. In such conditions, the results showed that risk considerations are not able to explain the equity premium with a quarterly average of 5.21% that was observed in the Tehran market in the mentioned period.

Considering these points, we tried to resolve the equity premium puzzle in Iran by applying exogenous consumption habits (proposed by Constantinides (1990)) in the C-CAPM model. After the consumption habits were incorporated in the C-CAPM model of Mehra and Prescott, the value of the relative risk aversion coefficient was +7.98 (this coefficient is within the acceptable range and indicates that people are risk-averse). Thus, risk considerations were able to explain the equity premium in the Tehran market with a quarterly average of 5.21%. This model is based on the agents' strong aversion to high-frequency consumption fluctuations. In fact, the habit formation model illustrates the equity premium by showing extreme sensitivity to high-frequency fluctuations, and it is because of this sensitivity that one sees consumption fluctuations in the last 28 years in Iran.

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