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Econometric model for estimation of equity risk premium in Iran

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Abstract

In this article, the relationship between risk premium spending and important financial and macroeconomic variables in Iran in the years 2013-2014 has been investigated. In this regard, standard OLS regression and the Hodrick-Prescott filter were used. The results of the research showed that there is a positive and significant relationship between the change and evolution of the money supply process and the variable of risk premium. This is while the variables of the gap between private consumption and its trend, exchange rate and stock index of the 50 largest companies in the stock market have a negative and significant effect on the amount of risk premium i.e. ERP in Iran.

Keywords: equity risk premium, fundamentals, econometric model, Iran
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1 Introduction

Today, due to the increasing importance and expansion of capital markets in equipping and collecting small individual funds towards productive activities, identifying the behavior of investors and variables affecting stock returns in These markets have become very important [12]. Without a doubt, investing in the stock market constitutes an important part of the entire economy of a country, and without a doubt, the largest amount of capital is exchanged through stock markets all over the world, and the national economy is strongly It is affected by the performance of the stock market [3]. Also, this market is available to both professional investors and the general public as an investment tool [12]. Since the potential investors of the securities market form a wide spectrum in the society, providing a suitable platform for the wide presence of this spectrum and gaining their trust, consolidating the capital market and deepening this market, is one of the basic It will bring the most economic development tools. In this regard, conducting various researches can play a significant role in attracting investors' trust. The purpose of investing in stocks is to get a good return on investment. Investors consider a set of variables and financial and non-financial factors at the same time when deciding to invest in stocks [1].

Since investing in shares is more risky than other investments, therefore, the expected return on this investment is higher than other investments. Shareholders also do not have priority over the company's assets during bankruptcy,

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and their only privilege is to acquire only the risk. A good estimate of market risk leads to better investment decisions and efficient portfolio management [10].

Due to the fact that one of the topics that is always considered by people who trade in commodity futures contracts is the trade-off between risk and return. Therefore, the mere issue of risk is a controversial category, because it is difficult to determine its existence or non-existence [8]. The existence of a relationship between risk sharing and the efficiency of the stock market has caused the problem of determining the presence or absence of risk sharing in the examination of each market [5].

The risk premium is the price of risk in the stock markets and is not only a key input in estimating the cost of equity and capital in both financial and corporate valuation areas, but also a key measure in evaluating the overall market. Given its importance, it is surprising how difficult the random estimation of the risk premium is in practice and a fundamental problem. Considering the importance of the topic in this article, the relationship between risk premium spending and several financial and macroeconomic variables in Iran has been investigated.

2 Background research

Muto et al. [7] analyzed the performance of different risk exposure value models using daily indices of the Central and Eastern European capital market. They observed that only advanced value-at-risk models such as Frein's value theory or Garch models can measure market risk well. Kjellson [4] in a research estimated the expected runoff using autoregression models and beyond the threshold method. The obtained results indicate that the estimations are influenced by the distribution considered for the returns rather than being influenced by the autoregression models, and the estimation made with the assumption of Student's t distribution is closer to reality. Hammoudeh et al. [6] have investigated the problem of adverse risk management and optimal portfolio based on value-at-risk method for precious metals, oil and stocks. In their research, the Value at Risk (VAR) approach is used to analyze the adverse market risks associated with investing in six specific key assets, including four precious metals, oil and the S&P 500 index, and three diversified portfolios. By using a combination of these assets, three desirable optimal portfolios and their efficient boundaries have been built in the VAR framework, and the risk and return risks for these portfolios have also been analyzed. Singh et al [13] in the article entitled "Frein's market risk and Frein's value theory" used Frein's value theory for its market risk model for the ASX-ALL general index and the American S&P500 index. They showed that EVT can be successfully used for financial market return series to predict VAR, CVAR and ES and expected return level as well as daily VAR calculation using GARCH and EVT model based on dynamic approach. Rădulescu et al [11] have developed an econometric model to predict risk in the United States. In this paper, they estimate the relationship between risk premium expenditure and important US financial and macroeconomic variables over the period 1964-2012 using standard OLS regression and Hadrick-Prescott filter. Their results showed that the spending risk premium in the US will gradually increase in recent years, a development determined by the views of the FED's monetary policy and the narrowing of the private consumption gap. Graham and Harvey [1] have reviewed and analyzed the history of equity risk exposure using surveys of US chief financial officers. They have presented results on the variance of risk among respondents as well as the asymmetry or skewness of risk estimates. Mensi et al [6] have evaluated the system risk and examined the dependence structure of oil and the stock market using the copula analysis method. This study uses a combination of Variational mode decomposition (VMD) and symmetric and static and time-varying functions to investigate the dependence structure between crude oil prices and major regional development markets during different investment horizons. Oh and PATTON [9] have investigated the issue of portfolio risk management. This paper presents a new class of dynamic copula-based models for large-dimensional conditional distributions that facilitate the estimation of a wide range of systematic risk measures. The proposed models work on successful ideas from the subject literature on modeling covariance matrices with large dimensions in time-varying distribution models. The use of copula-based models reduces the computational burden of estimating the common model in different stages. Sajid et al. [12] used the CAPM model to analyze the pure risk premium (ERP) in Pakistan. This study collected monthly stock price data from July 1997 to December 2017 from the PSX data portal and extracted information on macroeconomic factors such as inflation and risk-free interest rate from the State Bank of Pakistan. In addition, this study used private consumption and population data from Pakistan Bureau of Statistics. Van Ewijk et al [14] analyzed the risk premium only. They conducted a meta-analysis of risk taking and in this regard systematically reviewed the literature and summarized the empirical findings in different countries, regions and time periods. Their results showed that the Asian region has a higher than average risk appetite. Also, they showed that GDP per capita growth and nominal interest rate have a positive relationship with risk appetite. On the other hand, they found a significant positive relationship between financial integration and risk taking through the flow of foreign direct investments. Jurdi [3] has studied the prediction of risk premium in Australia. Their paper examines the predictive performance of a range of financial, economic and sentiment variables that predict risk spending in

Australia using data from the past 28 years (1992-2020). The results show that risk-averse investors may rely on the forecasts generated by the regression to extract meaningful profits using different predictors.

The review of previous researches showed that so far in Iran, there has been no study of premium risk and its estimation in the form of econometric models. Therefore, this research is new and innovative in every way. The current research is based on the research of Rădulescu [11] and was conducted in Iran.

3 Research methodology

This research is of applied type in terms of its purpose and descriptive and correlational in terms of data collection using regression methods. In this article, an econometric model is presented to investigate the relationship between ERP and financial and macroeconomic variables, and we use this model to predict ERP. In this article, the annual data of the Central Bank of Iran and the stock market during the years 1390 to 1400 have been used.

3.1 Variables

Spending the risk premium is affected by the money supply in the economy: that is, an increase in the money supply can lead to an increase in stock indices, which leads to bubbles. At the same time, spending risk premium may be affected by changes in personal consumption and its trends. This gap can be described as the state between high optimism and high pessimism of financial market investors [11].

In this article, we examine the relationship between risk premium spending and SP 500 index valuation indices (PER index). A higher value of PER indicates a lower risk aversion for investors, which leads to a decrease in ERP.

The last point is that we also included the effective exchange rate in our analysis, an important indicator both from the point of view of the real economy and the monetary economy. On the one hand, the evolution of the effective exchange rate is an indicator of the external competitiveness of an economy. On the other hand, this rate can indicate changes in the risk aversion of financial markets.

Table 1: Research variables

Row	symbol	Variable name
1	ERP	Iran's annual premium risk spending
2	BMTRENDF	money trend
3	GAPPCF	The gap between private consumption and its trends
4	S&P	Stock index of 50 largest companies in the stock market
5	REERTRENDF	exchange rate

3.2 Research model

In this article, in order to understand the structural dynamics of the relationship between ERP and the research variables (Table 1), we used the structural components of the aforementioned variables (which are determined using the Hadrick-Prescott filter). To explain the relationship between the independent variables in table 1 and the dependent variable ERP, the following model is estimated using OLS regression.

$$\text{ERP} = \alpha_0 + \alpha_1 \text{BMTRENDF} + \alpha_2 \text{GAPPCF} + \alpha_3 \text{PERTRENDF} + \alpha_4 \text{PEERTRENDF} + \epsilon. \tag{3.1}$$

The Hedrick-Prescott macroeconomic filter is a widely used method for distinguishing between the structural trend and the cyclical component of macroeconomic variables. This filter is obtained by minimizing the sum of the square deviation of the variable Y_t from its trend. In fact, the mentioned trend values are the values that minimize the following relation:

$$\text{Min} : \sum_{t=1}^{T} (Y_t + Y_t^*)^2 + \lambda \sum_{t=1}^{T-1} ((Y_{t+1}^* - Y_t^*) - (Y_t^* - Y_{t-1}^*))^2. \tag{3.2}$$

In this formula, Y_t is the macroeconomic variable, Y_t^* indicates its trend, and λ indicates the smoothing parameter. In this paper, we use a value of 100 for this parameter, which was the same in Hadrick and Prescott's (1997) paper [2].

4 Data analysis

As mentioned, in this article, the econometric model for estimating the risk premium in Iran was discussed, and the research model and analysis method were presented in the previous section. In this section, the results of data analysis are presented. The results of OLS regression (according to formula 3.1) are presented in the table below.

The model presented in formula (3.1) has been estimated using the ordinary least squares (OLS) method, and the result is as follows. To solve the problem of serial correlation, we have added the first-order AR term to the model.

Table 2: OLS model estimation

dependent variable: ERP		
$R^2 = \%80$	$F - \text{Statistic} = 24.95$	$D - W = 1.90$
t statistic	coefficient	variable
4.51	15.63	α_0
4.96	0.29	BMTRENDF
2.61	-0.24	GAPPCF
2.16	-0.11	PERTRENDF
2.08	-0.19	PEERTRENDF
4.68	0.69	DUMI
2.32	0.99	AR(1)

$$\text{ERP} = 15.63 + 0.29\text{BMTRENDF} - 0.24\text{GAPPCF} - 0.11\text{PERTRENDF} - 0.19\text{PEERTRENDF} \tag{3}$$

As can be seen in the table above, all independent variables have a significant effect on Iran's annual risk premium (ERP) and the effect of these variables is greater than 2 due to the t-statistic.As can be seen in this table, there is a positive and significant relationship between ERP and the change and evolution of the money supply process, and the corresponding coefficient is equal to 0.29. Therefore, the hypothesis of a positive and significant relationship between ERP and the change and transformation of the money supply process is confirmed, which is consistent with the theoretical foundations. Because the acceleration of money supply has led to the increase of ERP in the past decades in America [11]. In fact, the more the money supply, the more likely there is a bubble in the stock market in Iran.

On the other hand, it can be seen in Table 1 that the private consumption gap variable has a negative and significant effect on ERP, and the coefficient of this variable is equal to -0.24. This result is also consistent with the theoretical foundations, in fact, the change and transformation of private consumption, beyond its potential, causes more dynamics of the indices of the Iranian stock market and as a result, the reduction of ERP. At the same time, ERP seems to be inversely related to PER trend (low probability) and effective effective rate trend (high probability).

The results of the present research are consistent with the theoretical foundations and research results of [11]. Therefore, the obtained results confirm that the fitted regression is valid. The coefficient of determination is also high and this shows that 80% of the changes in the dependent variable are explained by the independent variables. The F statistic shows the significance of the regression as a whole and according to the Durbin-Watson statistic, it can be said that the disturbance components in the above regression do not face the problem of autocorrelation.

According to the failures in the explanatory variables and based on the residuals of the model, we entered the virtual variable named DUMI into the model and observed that it is significant and has a positive effect on the dependent variable.

As mentioned earlier, after estimating this OLS regression, we predicted each independent variable with ARIMA models. The money trend in the broad sense, the private consumption gap, the PER trend and the REER trend are not static. Consequently, we estimated the AR(1) model for the initial level of difference of each of these variables. The positive AR(1) coefficient in the table above shows that ERP changes are influenced by the acceleration of money supply, the decrease in PER trend and the decrease in the value of the US dollar (really effective exchange rate).

Also, various tests have been conducted regarding the violation of the classical assumptions, the results of which are shown in table 2 and indicate the validity of the classical assumptions.

Table 3: Model explanation and diagnosis tests

P-value	Target	Test
0.46	Determining the normality of the distribution of error sentences	Normality
0.13	Examining the autocorrelation of error sentences	LM
0.22	Determining the heterogeneity of the variance of error sentences	Arch LM

Source: Researcher's calculations

- **Normality:** The Histogram and Normality test was used. Therefore, according to the Jrque-Bera statistic, the assumption of normality of the distribution of disordered sentences is confirmed.

- **Autocorrelation:** To check the presence or absence of autocorrelation, Durbin-Watson (D-W) test and Breusch-Gudfrey Serial Correlation LM test (LM) were used. The results show that there is no autocorrelation problem.

- **Collinearity and non-collinearity of variance:** One of the most obvious effects of collinearity is the high value and non-significance of the coefficients of the variables. In order to ensure the absence of collinearity and also in order to fix it in case of incomplete collinearity, by using correlation matrix and the regression result of each of the explanatory variables on other explanatory variables and according to the main model and value And the significance of the coefficients of the problem of collinearity between the variables was not observed. Also, to check the presence or absence of heterogeneity in the variance, Auto- Regressive Conditional Heteroskedasticity was used. According to the results of the test, the statistics and their related probabilities, homogeneity of variance is accepted.

Regarding the tests related to the pathology of the model, it should be said that the P-Value for this test confirms the normality of the disturbance components in this regression. The tests related to autocorrelation and heterogeneity of variance also indicate the absence of these problems in this model.

5 Conclusion

The purpose of this article is to estimate the econometric model for estimating the risk premium in Iran during the years 1390 to 1400. The results of the research showed that the variable of money supply change has a positive and significant relationship with ERP changes. Also, the variables of the gap between private consumption and its trend, exchange rate and stock index of 50 largest companies in the stock market have a negative and significant effect on the value of ERP.

The results of this research are consistent with the theoretical foundations and ERP changes in the American market, and these results have also been observed in the research of 10- Rădulescu [11] The results of the research show that risk premium expenditure is influenced by the money supply in Iran, and the increase in money supply leads to an increase in stock indices and thus leads to a bubble in Iran.

The users of the results of this type of research are institutional investors, real investors, regulatory organizations such as the stock market, and executive organizations such as the Central Bank. Real and legal investors are suggested to use the results and model of this research to improve investment performance. According to the results of the research, it was shown that the increase in money supply causes a bubble in the stock market in Iran, it is suggested to the central bank and related organizations to revise the money supply policies in order to reduce the possibility of creating a bubble. Reduce and control the injection of money into the economy. Academic activists are also suggested to test the models developed in this research using other methods such as neural networks.

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