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A Study of variables affecting stock market indices of banks and credit institutions (2003-2013)

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Abstract: The stock market is one of the most influential markets in the economy and the center for collecting savings and the liquidity of private sector for the financing of long term investment projects. The indices of this market are influenced by several factors especially by economic policies and macroeconomic variables. Drawing on data from the economy of Iran relating to the period between 2003 and 2013, this study analyzes shock effects through reaction excitation functions and determines the variables with the highest impact on stock market indices of banks. In the next stage, the study analyzes the long run relationship between the variables using Johansen's co integration analysis. In addition, a vector error correction model (VECM) is used to assess the short-term to long-term adjustment speed. Based on the results of the study, interest rates for banking loans - as an alternative to interest rates - have a negative impact on the total stock market index whereas inflation rates, oil prices and gold coin prices have a positive influence on this index.

Key words: Stock market indices of banks and credit institutions; Tehran Stock Exchange; Johansen's co integration analysis; Vector error correction model

1. Introduction

Financial markets are one of the most influential markets in the economy of any country. Stock market booms and busts affect not only national economies but also the world economy. Therefore, there is a significant relationship between changes in the stock market and economic prosperity or recession. Major policies in any country, especially in relation to macroeconomic variables, affect the stock market. In fact, the explanation of the relationship between stock market indices and macroeconomic variables can lead to better policy-making. Determining the impact of these variables on stock market indices can be useful in many instances of macroeconomic policy-making and enables policy makers to implement monetary, fiscal, and exchange policies that will lead to growth in stock markets and result in economic prosperity.

2. Theoretical Foundations and Literature Review

There are numerous theories on the impact of these variables on stock market indices. One of the most important of these theories is Fisher's theory. According the Fisher equation, the real interest rate is obtained by the difference between the nominal interest rate and the inflation rate, such that:

(1)

$$R_t^r = R_t^n - INF_t$$

Whereby, R_t^r is the real interest rate, R_t^n the nominal interest rate, and INF_t the inflation rate? Thus,

(2)

$$RS_t^r = RS_t^n - INF_t$$

Whereby RS_t^r is the real rate of return on equity and RS_t^n the nominal rate of return? The nominal rate of return is equal to rates of change in the stock price, such that:

(3)

$$RS_t^n = d \ln PS_t$$

Whereby PS_t is the stock price?

According to this equation, Fisher introduces the following econometric equation and asserts that inflation rates are effective on stock returns

(4)

$$RS_t^r = y_0 + y_1 INF_t + U_t$$

Fama (1981) argues that the Fisher equation ignores some macroeconomic variables such as liquidity and interest rates. Considering the relationship between the money market and the stock market, Fama uses the money market equilibrium to prove his claim. The money market equilibrium is as follows:

(5)

$$M_t/P_t = M(Y_t, R_t)$$

Whereby M_t is liquidity in the economy (currency and checking in the hands of individuals, demand deposits and time deposits), P_t the general price level, Y_t the national income, and R_t interest rates? Therefore, Fama introduces the demand for money as follows:

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$$\ln(M_t/P_t) = a \ln Y_t - b \ln R_t$$

(6)

$$\ln P_t = -a_1 \ln Y_t + a_2 R_t + \ln M_t \; a_1$$

$, a_{2>0}$

The differential of the above equation leads to the following equation.

(7)

$$d \ln P_t = -a_1 d \ln Y_t + a_2 dR_t + d \ln M_t$$

Since $d \ln P_t = INF_t$,

(8)

$$INF_t = -a_1 d \ln Y_t + a_2 dR_t + \mathrm{d}\ln M_t$$

Inserting the above equation into equation 4 yields the following equation:

(9)

$$RS_t^r = \beta_0 + \beta_1 d \ln Y_t + \beta_2 dR_t + \beta_3 d \ln M_t + U_t$$

Such that,

$$\beta_0 = Y_0 \;,\quad \beta_1 = -y_1 a_1 \;,\quad \beta_2 = y_1 a_2 \;,\quad \beta_3 = y_1$$

Using the relationship between the nominal rate of return and real rate of return:

(10)

$$RS_t^n = RS_t^r + INF_t$$

Equation 9 can be rewritten as follows:

(11)

$$RS_t^n = \beta_0 + \beta_1 d \ln Y_t + \beta_2 dR_t + \beta_3 d \ln M_t + \beta_4 INF_t + U_t$$

Finally, the equation for the stock price is expressed as follows:

(12)

$$\ln RS_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 R_t + \beta_3 \ln M_t + \beta_4 P_t + U_t$$

As can be seen, the relationship between the variables of inflation rates, interest rates and stock prices are expressed in the Fisher equation and later in Fama's modifications (Ebrahimi and Shokri, 2011). Using vector error correction, Raymond et al. (2009) investigated the long-run relationship between the stock price index and monetary variables in Jamaica. According to the results, there is a long term relationship between the stock price index and monetary variables in Jamaica. Based on the findings of this study, stock price index is positively correlated with inflation rates and liquidity and is negatively correlated with foreign exchange rates and interest rates. Manazir et al. (2012) investigated the long-run relationship between the stock price index and monetary variables in Pakistan. Based on the results obtained from the co integration vector, there is no long-term relationship between the stock price index and monetary variables in Pakistan. Christopher Gan et al. (2006) examined the relationship between New Zealand's stock price indices and a set of seven macroeconomic variables, including: inflation rates, foreign exchange rates, GDP, money supply, long-term interest rates, short-term interest rates, and the retail price of local oil. Johansen's co integration analysis showed that there is a long-term relationship between New Zealand's stock price indices and the economic variables under study. Results of the Granger causality test also showed that New Zealand's stock price indices are not a cause for the variance in economic variables. Rather, the cause is the small size of New Zealand's stock market contrast to stock markets in developed countries. Kia (2003) studied the behavior of stock market participants and analyzed the relationship between macroeconomic variables and stock market price indices of Canada. This study, which was conducted for the period 1975 to 1999, shows that stock market participants react to small changes in the equilibrium stock price in the short term. The results of this study show that foreign stock price indices, foreign exchange rates and interest rates in the long run have a negative correlation with the stock price index whereas the variables of industrial production, consumer price index, and money supply have a positive correlation with the stock price index. Maysami and Koh (2000) evaluated the long-term relationship between Singapore's stock price indices and selected macroeconomic variables (money supply, consumer price index, and industrial production, exports and government bonds) and between Japanese and US stock price indices using a vector error correction model for the years 1988 to 1995. The results show a co-integrative relationship between changes in the price level, money supply, foreign exchange rates, and long-term and short-term interest rates. Singapore's stock market is also characterized by a significant positive co-integrative relationship with Japan's and USA's stock markets. Karimzadeh (2005) evaluated the long-term relationship between stock price indices and macroeconomic variables using a vector auto-regression with distributed lag. The results indicate that there is a co integration vector between stock price indices and macroeconomic variables. In this long term relationship, stock price indices are positively correlated with liquidity but negatively correlated with exchange rates and interest rates. Shahsavar (2009) evaluated the effects of macroeconomic variables on Iran's capital market. To this end, Shahsavar considered quarterly data of different economic variables such as GDP, the amount of money, inflation rates and exchange rates for the years 1991 to 2006. He also used arbitrage pricing theory (APT) and conducted unit root tests, diagnosis and co integration, distributed lag and auto-correlated error models, and error correction to estimate the effects of these variables on stock price indices of Tehran Stock Exchange. The results show that there is a direct correlation between stock price indices and the variables of GDP and the general price level. However, stock price indices have an inverse relationship with exchange rates and the amount of money. Coefficient of the error correction model shows that 15% of imbalances are resolved in each period which indicates a high adjustment speed. Ezatolah Abbasian (2008) examined the effects of macroeconomic variables on

stock price indices of Tehran Stock Exchange. In this study, Abbasian considered the effects of macroeconomic variables such as exchange rates, trade balance, inflation rates, money supply and interest rates on the total stock price index for the years 1998-2005 using quarterly data. The methods used in this study included co integration, error correction models, reaction excitation functions and analysis of variance. The results show that the variables of exchange rates and trade balance have a positive long-term impact on the total stock price index whereas the variables of inflation rates, liquidity and interest rates have a negative long-term impact on the total stock price index.

3. Specifying the Model and Introducing the Variables

The model used in this study is as follows:
(13)

$$BS_t = A + \alpha_1 INF_{t-1} + \alpha_2 EX_{t-1} + \alpha_3 TR_{t-1} + \alpha_5 OIL_{t-1} + \alpha_6 GO_{t-1} + \varepsilon_t$$

Whereby, BS represents the stock price index, EX represents exchange rates, TR represents interest rates, GO represents gold coin prices, and OIL represents oil prices.

The first step in time series methods is to conduct tests of stationarity. Table 1 below presents the results of the Dickey-Fuller test.

3.1. Tests of Stationarity

Table 1: Dickey-fuller test

Variable	With intercept			With intercept and trend		
	Statistic	Critical value	Probability	Statistic	Critical value	Probability
Stock market indices of banks and credit institutions	3.81	2.95	0.0060	4.27	3.54	0.0090
Exchange rates	4.26	2.95	0.0020	4.08	3.54	0.0150
Inflation rates	5.47	2.95	0.0010	5.68	3.54	0.0003
Interest rates for banking loans	6.09	2.95	0.0010	6.18	3.54	0.0001
Gold coin prices	5.58	2.95	0.0010	5.49	3.54	0.0004
Oil prices	6.96	2.95	0.0010	7.42	3.54	0.0001

According to the results, all the variables are at the non-stationary level and become stationary by one level of subtraction. Since the remainders are stationary, there is no concern for spurious regression results.

3.2. Determination of the Co integration Vector

Since the Engle-Granger co integration test presupposes the presence of one vector, it is characterized by a fundamental weakness inasmuch as there may be more than one co integration vector in a model. To overcome the drawbacks of the Engle-Granger test, we use Johansen's co integration analysis. To perform Johansen's co integration analysis, we use a maximum eigenvalue test and an effect-size test. In this research, there are two co integration vectors based on the fourth model and both the maximum eigenvalue statistic and effect-size statistic. The normalized vector is presented in Table 2.

Table 2: Co integration vector

Variable	Interest rates for baking loans	Inflation rates	Oil prices	Gold coin prices
Long-run correlation coefficient	10.11	1.66	3.88	11.11

As can be seen, the total stock market indices of banks have a negative long-term relationship with interest rates and a positive long-term relationship with inflation rates, gold coin prices and oil prices.

3.3. Estimation of the Vector Error Correction Model

Finally, the vector error correction model is used to examine the impact of imbalances in the model. The error correction model is considered as a feedback based on which the dependent variable is adjusted in relation to imbalances in the system to ensure the long-term relationship. The precondition for co integration in error correction models is that the error correction coefficient is statistically significant, with an absolute value between zero and one, and with a negative sign. In this study, according to the vector error correction model in relation to the correlation between the stock price index and macroeconomic variables, the error correction terms (ECT) are equal to 0.50 with an estimated t-statistic of 2.14 which implies that it is significant. As can be

seen, this coefficient has a negative sign and is between zero and one.

4. Conclusion

Estimation results on the variables affecting stock price indices of banks and credit institutions show that interest rates for banking loans - as an alternative to interest rates - have a negative impact on the total stock market index whereas inflation rates, oil prices and gold coin prices have a positive influence on this index. Based on the results of the vector error correction model, the calculated coefficient shows that 0.5 of imbalances caused by shock are resolved in each period and the variables return to their long-run trends.

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