

Examining the Effect of Selective Macroeconomic Variables on The Stock Exchange's Depth and Breadth (Case Study: Tehran Stock Exchange)

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Abstract

One of the features of developed countries is the existence of effective financial markets, which not only play an important role in the economy, but also facilitate economic growth and a country's development. Stock exchangedevelopment is affected by many macroeconomic variables. In this survey, we mainly attempt to examine the effect of macroeconomic variables on the development of the Tehran Stock Exchange. To do so, national income, investment rate, financial intermediary development and macroeconomic instability are considered as macroeconomic variables, and depth and breadth are considered as indices of the stock exchange development. Necessary data were collected seasonally during 1998-2007. For statistical analysis, we first examined stationarity of the variables by augmenting the Dickey-Fuller Unit Root Test. Then, the Johansen co-integration Test was used to estimate co-integration vectors. Finally, we used the Vector Error Correction Model to test the research model. Findings suggest that national income and investment rates have a positive, significant effect on the depth and breadth of the stock exchange. Also, financial intermediary development and macroeconomic instability have a negative, significant effect on the depth and breadth of the stock exchange.

Keywords: Capital market, Stock exchange development, Stock exchange depth, Stock exchange breadth, Macroeconomic variables

JEL: E20, G11, F31

1. Introduction

More and more investigations on stock exchange seem necessary with due attention to the important and vital role of

stock exchange in capital construction and facilitation of the economic development (Khodaei, 2001). Depth and breadth are two major measures of stock exchange development. Depth of the market refers to size and liquidity of the stock exchange, and breadth means variety of the market in terms of participation of large and small corporations, various kinds of corporations from different sectors of industry and international companies (Fathi and Asgarnezhad Nouri, 2010; Miller, 2002). Based on the literature, determining the factors affecting stock exchange development is important for managing the whole economic system. These factors could be placed in one of three groups of internal factors of the organization, external economic factors and external non-economic factors (Khalili and Ramezan Pour, 2002; Boubakri and Olfat, 2007; Cajueiro, Periklis et al., 2009; Demirguc – Kunt and Ross, 1995; Fischer, 1996).

Abdul Rahman, et al., (2009) have studied mutual relationships between selected macroeconomic variables and stock prices in the stock exchange in Malaysia. They showed that monetary policy variables (i.e. money supply, currency rate, resources and interest rate) and internal supply factor (introduced with industrial production) have considerable long-term effects on the Malaysian stock exchange. Solman and Tei (2008) have studied the manner of the effect of macroeconomic indices on the performance of the stock exchange in Ghana. Results reveal that the lending rate of banking savings has a negative effect on stock exchange performance. Also, negative effect of the inflation rate on stock exchange development is obtained with a time period delay, and also investors are benefited from reduction of the currency rate as a result of internal currency rate drop. Miller (2002) has studied the relation between stock exchange development and privatization of corporations owned by the government in Brazil, Argentina and Chile. In this research, stock exchange development has been specified with the three features of depth, breadth and sophistication. Miller (2002) has considered a three-step process in order to test the effect of privatization on stock exchange development. In the first step, Perron Test for Structural Gap Point has been executed by means of measurement criterion of stock exchange development, which is depth of the market. In the second step, the relationships between structural gap and privatization activity is studied, and in the third step, the possible effect of the other factors except privatization on structural gap are studied. Finally, it is concluded that structural gap in the market's capital is in relation to increasing privatization activities. Garcia and Liu (1999) have studied the effect of macroeconomic variables on stock exchange development and especially on the market's capital. Data related to fifteen countries have been collected in the time period from 1980 to 1995. Market capital is the dependent variable of research. Real income, saving rate, investment rate, financial intermediary development, liquidity of stock exchange and macroeconomic stability are descriptive variables. Garcia and Liu (1999) believe that national income, saving rate, investment rate and liquidity of stock exchange have a positive effect on market's capital. Also, they concluded that stock exchange and banking sector are complement, and they are not substitute.

Our purpose is to study whether or not macroeconomic variables affect the development of the Tehran Stock Exchange. In this research, the features of depth and breadth are used to measure stock exchange development. Moreover, national income, investment rate, financial intermediary development and macroeconomic instability are selected as independent variables based on data limitation and the literature.

In section 2, Stock Exchange Development, we present definitions and different indices of stock exchange development. Section 3, Factors Affecting Stock Exchange Development, includes the effective factors on development of stock exchange. In section 4, Research Methodology, we introduce the research variables and hypotheses and discuss the used statistical methods. Section 5, Findings, tries to focus on the results. Finally, in section 6 and 7, conclusions, limitations, and suggestions of the research are described.

2. Stock Exchange Development

According to studies, financial development is a multimodal concept. Since financial structure of a country is made up of various markets and financial products, some limited criteria could not include all necessary aspects of financial developments. It is possible to define financial development from six different aspects including banking sector development, non-banking financial sector development, monetary sector and monetary policy-making development, banking rules and supervision, openness of financial sector, and institutional environment (Creane et al., 2004; Gelbard and Sergio, 1999; Jbili et al., 1997; Khan and Abdelhak, 2000).

We can describe stock exchange development through three major features of depth, breadth and sophistication. Depth refers to size and liquidity of stock exchange and breadth means variety of market in terms of participation of large and small companies, various kinds of companies from different sectors of industry and foreigners. Breadth reduces risk of the total market and encourages extensive ownership, which leads to an increase in capital and enables small corporations to have more access to financial resources. Sophistication refers to management and administration of the market. When there are more firms in the market, the average amount of complicated transactional technologies would be reduced, and corporations and investors show more sensitivity towards investing in the market. Corruption that is special in some small markets could be reduced by more supervision or,

conversely, could be increased because of insufficient execution of privatization programs and as a result of freehold of few shareholders (Fathi and Asgarnezhad Nouri, 2010; Demirguc – Kunt and Ross, 1995; Miller, 2002).

3. Factors Affecting Stock Exchange Development

Generally, the factors affecting stock exchange development could be classified into three groups, namely internal factors of corporations, external non-economic factors and external macroeconomic factors (Pearce and Richard, 2002).

Earnings per share, capital structure of the corporation, demand for the corporation's product, dividend policies, reward and decomposition of stock, capital increase, ownership structure, etc. are some intra-organizational factors affecting stock exchange development (Pearce and Richard, 2002). External non-economic factors affecting the stock exchange development are classified as political, legal, social, cultural, and technological factors (Osulian, 2006; Black, 2001; Boubakri and Olfä, 2007; Torre et al., 2006). These internal and external studies conclude that national income, saving rate, investment rate, financial intermediary development, liquidity of stock exchange, liberalization of stock exchange, privatization, macroeconomic instability, tax rate, interest rate, inflation rate and currency rate are among the most important, effective macroeconomic variables on stock exchange development (Osulian, 2006; Black, 2001; Boubakri and Olfä, 2007; Naceur et al., 2007; Torre et al., 2006). In this research, four variables including national income, investment rate, financial intermediary development, and macroeconomic instability have been selected according to Garcia and Liu (1999). It is predicted that higher income has a positive effect on stock exchange development. Higher income means better education, better commercial environment and wealthier citizens (Naceur et al., 2007). Incomes of individuals are divided into two parts of consumption and saving. Whenever economic conditions of a country allow a high rate of saving i.e., people save part of their income in addition to paying daily expenses, we can say investment in that country will be strengthened. On one hand, it is possible to guess that investment is one of the important factors determining stock exchange capital since investment rate depends on saving rate (Naceur et al., 2007). On the other hand, stock exchange could not be developed without the existence of an efficient system of financial intermediaries including underwriters, dealers, etc. Because banks and stock markets act as intermediaries in directing individuals' savings towards investment projects, they could complement or substitute each other (Black, 2001). Boyd and Smith (2001) and Demirguc-Kunt and Levin (1995) believe that banks and stock exchange institutions act as each other's complement, not substitute. In contrast, Garcia (1986) understood that the central bank could cause a reverse correlation between banking system growth and stock exchange development (Garcia, 1986). The last macroeconomic variable of research is macroeconomic instability: the more the economic instability (for example, the permanent change of inflation rate) the less the motivation of corporations and investors to invest in the stock exchange, and consequently, the fewer opportunities for stock exchange development (Khalili and Ramezan Pour, 2002; Fischer, 1996; Naceur et al., 2007; World Bank, 1996; World Bank Staff, 1993).

4. Research Methodology

As we show in the following equations, according to Garcia and Liu (1999) and Miller (2002), national income, investment rate, financial intermediary development and macroeconomic instability are selected as independent variables, and since depth and breadth of stock exchange are selected as dependent variables, we will obtain the following two new multiple regression equations:

$$MD = \alpha_0 + \beta_1 RI_t + \beta_2 IR_t + \beta_3 FID_t + \beta_4 MI_t + e$$

$$MB = \alpha_0 + \beta_1 RI_t + \beta_2 IR_t + \beta_3 FID_t + \beta_4 MI_t + e$$

In these equations, MD is market depth, MB is market breadth, RI is real income, IR is investment rate, FID is financial intermediary development and MI is macroeconomic instability. It is noteworthy to say that saving rate in Garcia and Liu (1999) and sophistication of market among dimensions of stock exchange development in Miller's research (2002) have been omitted because of limitations. Measures of research variables are shown in Table 1. It should be mentioned that because of different criteria used to measure each of the four variables of market depth, market breadth, financial intermediary development and macroeconomic instability, the TOPSIS method has been used to combine these polymorphous measurement criteria and to obtain a unit number for the above variables in seasonal time period (Azar and Rajabzade, 2009).

The required data have been obtained from information archives of the Tehran Stock Exchange, web sites of Central Bank of the Islamic Republic of Iran, Iran Statistics Center and Tadbir Pardaz financial software. The Vector Error Correction Model has been used to test hypotheses of the research. In the Vector Error Correction Model, a combination of long-term data with short-term adjustment mechanism is used. In other words, short-term fluctuations of a variable are related to its long-term value. In this model, the residual terms of convergence equation

can be used as a variable, and its coefficient is considered as a ratio of short-term balance. The correlation value is between minus one and zero, and it shows the relation between short-term fluctuations and long-term value of a variable (Nofresti, 2000). Totally, the first condition for econometrics relying on macro variables is that all used variables should be stationary. Otherwise, it is necessary to convert non-stationary variables into stationary variables before the estimation of the model. The first step towards determining the reliability of a variable is observing its time series graph. However, we cannot explicitly judge the recognition of reliability using charts in some cases. Therefore, the reliability of variables is examined statistically. In econometrics, time series with a unit root is called a random walk process and is an example of a non-stationary time series (Nofresti, 2000). The Dickey-Fuller Generalized Test will be applied to study the stationary of variables. On the other hand, it is necessary to be sure about the existence of long-term relation among variables to determine optimal interruption length and to execute the Johansen co-integration Test before using the Vector Error Correction Model. So, optimal interruption length was determined in the next step, and the Johansen Co-integration Test has been executed. Finally, the Vector Error Correction Model has been applied to estimate research models in the third step because of the existence of co-integration vector and long-term relations among variables (Nofresti, 2000).

5. Findings

In Table 2, we show the results of the Dickey-Fuller Unit Root Test, which conclude that two variables of MI and FDI are stationary and four variables of MD, MB, GDP and IR are non-stationary by comparing, augmented the Dickey-Fuller test statistic with the test critical values on significance level of 5%. Therefore, the first difference is used to make the above four variables stationary. In Table 3, augmented the Dickey-Fuller Unit Root Test is shown in the first difference of variables. The results are shown in Table 3.

Briefly, results show that four variables of MD, MB, GDP and IR are stationary at first difference, and two variables of MI and FDI are stationary. In Table 4, amounts of the Schwarz Bayesian Criterion and the Akaike Information Criterion are shown in order to determine the order of VAR for depth index of the stock exchange and macroeconomic variables.

In Table 4, the lowest amount of the Schwarz Bayesian Criterion and the Akaike Information Criterion area bout zero, but it is impossible to select zero for optimal order of VAR. Therefore, the number one will be selected as the optimal order of VAR since the lowest amount of the Schwarz Bayesian Criterion and the Akaike Information Criterion are related to number one without considering zero. In Table 5, amounts of the Schwarz Bayesian Criterion and the Akaike Information Criterion are shown in order to determine optimal order of VAR, for the breadth index of the stock exchange and macroeconomic variables.

Conditions of Table 5 are the same as for those of Table 4. Thus, number one is selected as the optimal order of VAR also. It is necessary to perform theco-integration test after determining optimal order of VAR in order to comment about the existence or non-existence of long-term relationship among the variables. Therefore, the co-integration test used by Johansen for the first time in 1998 is applied. The Number of co-integrating vectors is determined by means of trace and maximal eigenvalue of the stochastic matrix (Nofresti, 2000). Results of this test are shown for the depth index of the stock exchange and macroeconomic variables in Table 6.

According to the trace test and the maximal eigenvalue test, the existence of three equilibrium co-integration vectors is confirmed among the variables. This means that there are long-term equilibrium relationships among variables of model, and variables are convergent, and the relationship among variables is reliable. Co-integration vectors in normalized form are as follows:

$$MD=0.0001GDP+37.91IR-3.33FID-3.07MI$$

$$MD=0.0037GDP-35.14IR-279.34FID+320.61MI$$

$$MD=-0.0002GDP-51.37IR-9.52FID-36.88MI$$

In Table 7, the result of the co-integration test is shown for the breadth index of the stock exchange and macroeconomic variables.

According to the trace test and the maximal eigenvalue test, the existence of three equilibrium co-integration vectors is confirmed for the variables. This means that there are long-term equilibrium relationships among variables of the model, and variables are convergent, and the relationship among the variables is reliable. Co-integration vectors in normalized form are as follows:

$$MB= 0.0001GDP+4.33IR-1.21FID-1.04MI$$

$$MB=0.00018GDP-13.38IR-17.45FID+15.48MI$$

$$MB=0.0001GDP+5.47IR-1.48FID+3.05MI$$

6. Discussion

Through a general conclusion, and with due attention to the existence of three co-integration vectors among macroeconomic variables and depth index of the stock exchange, we can say that national income, investment rate, financial intermediary development and macroeconomic instability affect stock exchange depth. Moreover, a glance at co-integration vectors shows that the first vector in comparison to the second and the third vector reveal relationships among research variables in a better form. Thus, the first co-integration vector must be studied in order to determine the relation among macroeconomic variables and the depth index. Co-efficients of research variables in the above vector show a positive relationship between independent variables of gross domestic production and investment rate with dependent variable of the stock exchange depth. Also, there is a negative relationship between independent variables of financial intermediary development and macroeconomic instability with dependent variables of stock exchange depth.

Moreover, due to attention to the three co-integration vectors between macroeconomic variables and breadth index of the stock exchange, we can say generally that national income, investment rate, financial intermediary development and macroeconomic instability affect stock exchange breadth. Moreover, a glance at co-integration vectors shows that the first vector in comparison to the second and the third vectors reveal relationships among research variables in a better form. Therefore, the first vector must be used in order to study relationships between macroeconomic variables and breadth index of the stock exchange. Co-efficients of the above variables in this vector demonstrate that there is a positive relationship between independent variables of gross domestic product and investment rate with dependent variables of stock exchange breadth. Also, there is a negative relationship between independent variables of financial intermediary development and macroeconomic instability with dependent variables of stock exchange breadth.

7. Conclusions

In this study, we mainly attempt to examine the effect of macroeconomic variables on the development of the Tehran Stock Exchange. So, national income, investment rate, financial intermediary development and macroeconomic instability were considered as macroeconomic variables. The most important feature of this research is that depth and breadth are considered as indices of the stock exchange development, while in most previous researches, stock index is used as the only variable to determine stock exchange development.

Results show that national income and investment rate have a positive effect on depth and breadth of stock exchange. In other words, we expect the depth and breadth of stock exchange (e.g. market capital, transactions value, turnover ration, the number of accepted companies, the average size of accepted companies composition and concentration rate of top ten market companies) to increase with the increase in national income. These results are consistent with Abdul Rahman, et al. (2009), Yartey (2008), Naceur et al. (2007), Hump and Macmillam (2006), Ibrahim (2003) and Garcia and Liu (1999). By justifying these results, we expect that a higher percentage of people's savings is invested in financial assets resulting in development of financial markets. About the investment rate, it can be said that by increasing the capital, the volume of capital flows will be enhanced through the stock exchange. On the other hand, and based on research results, financial intermediary development and macroeconomic instability have negative effects on depth and breadth of the stock exchange, i.e. with the increase in the development level of financial intermediaries and instability of macroeconomic, we expect depth and breadth of the stock exchange to increase. These results are consistent with Coleman and Tetty (2008), Chen, et al. (2005), Lili and Zulu (1998), and Garcia (1986). To conclude, we can say that the banking sector is an important competitor for the stock exchange in attracting investment funds. In fact, the stock exchange in Iran is in its primary developmental phase unlike institutions such as governmental and private banks. In relation to the macroeconomic instability variable, it could be said that stable conditions on the macroeconomic level will provide greater motivation for corporations and investors to participate in the stock exchange.

Considering a special time period and limitations in access to seasonal data are the main limitations of this research. The results of this study indicate that government should pave the way for stock exchange development by adopting appropriate policies in order to accelerate national income growth, create double motivation in people for investment and provide stable conditions in macro level. Future researchers are recommended to follow this research by separating each industry with a longer time period and an international scope. Researching about the effect of other macroeconomic variables and non-economic factors such as cultural, political, social and technological factors on stock exchange development, performing meta-analysis tests in order to provide various results obtained from previous researches, and having access to comprehensive results about the research subject are other recommendations for future researches.

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Table 1. Variables of Research and Their Measures

Type	Variable	Abbreviation Sign	Measurement Criteria
Dependent	Market Depth	MD	Market Capitalization
			Traded Value
			Turnover Ratio
	Market Breadth	MB	Number of Listed Firms
			Average Size of Listed Companies
			Sectoral Concentration
Independent	National Income	INC	Gross Domestic Production to Base Price of 1998
	Investment Rate	IR	Ratio of Gross Fixed Capital Formation to Gross Domestic Production
	Financial Intermediary Development	FID	Ratio of Liquidity to Gross Domestic Production
			Ratio of Monetary Base (M2) to Gross Domestic Production
			Monetary Increasing Coefficient
	Macroeconomic Instability	MI	Changes of Inflation Rate
			Changes of Parity Ratio of U.S. Dollar to Iranian Rials
			Changes of Ratio of Budget Deficit (Surplus) to Gross Domestic Production

Table 2. Conclusions of Augmented Dickey-Fuller Unit Root Teston MD, MB, GDP, IR, FID, MI

Variables	Augmented Dickey-Fuller Test Statistic	Test Critical Values on Significance Level of:		
		1%	5%	10%
MD	-2.31	-3.61	-2.93	-2.6
MB	-2.27	-4.21	-3.52	-3.19
GDP	-2.35	-4.23	-3.54	-3.2
IR	-1.49	-3.62	-2.94	-2.61
FID	7.15	-2.63	-1.95	-1.61
MI	-8.87	-4.21	-3.52	-3.19

Table 3. Conclusions of Augmented Dickey-Fuller Unit Root Teston D(MD), D(MB), D(GDP), D(IR), D(FID), D(MI)

Variables	Augmented Dickey-Fuller Test Statistic	Test Critical Values on Significance Level of:		
		1%	5%	10%
D(MD)	-7.83	-3.61	-2.94	-2.6
D(MB)	-5.64	-4.21	-3.53	-3.19
D(GDP)	-42.49	-4.23	-3.54	-3.2
D(IR)	-24.46	-3.62	-2.94	-2.61

Table 4. Test Statistics and Choice Criteria for Selecting the Order of the VAR Model (MD, GDP, IR, FID, MI)

Order of Var	Criterion	Schwarz Bayesian Criterion (SBC)	Akaike Information Criterion (AIC)
0		-170.5852	-163.1027
1		-110.1745	-83.9856
2		-95.5097	-50.6145
3		-80.3735	-16.7720
4		-57.5460	24.7619

Table 5. Test Statistics and Choice Criteria for Selecting the Order of the VAR Model (MB, GDP, IR, FID, MI)

Order of Var	Criterion	Schwarz Bayesian Criterion (SBC)	Akaike Information Criterion (AIC)
0		-197.7788	-190.2963
1		-152.3222	-126.1333
2		-137.27	-92.3748
3		-148.0519	-84.4504
4		-139.0696	-56.7617

Table 6. Results of Johansen Co-integration Test for Depth Index of the Stock Exchange and Macroeconomic Variables

Trace test			Maximal Eigenvalue test			
95% Critical Value	Statistic	Contrary Hypothesis	95% Critical Value	Statistic	Alternative Hypothesis	Null Hypothesis
82.23	179.03	r>=1	37.07	83.47	r=1	r=0
58.93	95.56	r>=2	31.00	48.16	r=2	r<=1
39.33	47.39	r>=3	24.35	38.25	r=3	r<=2
23.83	9.14	r>=4	18.33	8.17	r=4	r<=3
11.54	0.96	r=5	11.54	0.96	r=5	r<=4

Table 7. Results of Johansen Co-integration Test for Breadth Index of the Stock Exchange and Macroeconomic Variables

Trace test			Maximal Eigenvalue Test			
95% Critical Value	Statistic	95% Critical Value	95% Critical Value	Statistic	95% Critical Value	95% Critical Value
70.49	173.03	r>=1	37.07	97.88	r=1	r=0
47.88	91.7	r>=2	31	47.55	r=2	r<=1
31.54	41.46	r>=3	24.35	34.91	r=3	r<=2
17.86	12.81*	r>=4	18.33	7.5*	r=4	r<=3
8.07	1.79	r=5	11.54	1.14	r=5	r<=4