Available online at www.worldscientificnews.com

World Scientific News

6 (2014) 1-9 EISSN 2392-2192

The nexus between Prices and Macroeconomic Variables in Iran

Mohsen Mehrara

Faculty of Economics, University of Tehran,
Kargar-e-shomali, Po Box 14166-6445, Tehran, Iran

E-mail address: mmehrara@ut.ac.ir

ABSTRACT

This paper examines the causal relationship between stock prices and macroeconomic aggregates in Iran, by applying the techniques of the long–run Granger non–causality test proposed by Toda and Yamamoto (1995). We test the causal relationships between the TEPIX Index and the three macroeconomic variables: money supply, value of trade balance, and industrial production using quarterly data for the period 1993:1 to 2010:4. The results show unidirectional long run causality from macroeconomic variables to stock market. Accordingly, the stock prices are not a leading indicator for economic variables, which is inconsistent with the previous findings that the stock market rationally signals changes in real activities. Contrarily, the macro variables seem to lead stock prices. So, Tehran Stock Exchange (TSE) is not informationally efficient.

***Keywords*:** Macroeconomic variables; Stock Price Index; Granger Causality and Efficient Market Hypothesis

***JEL classification*:** G1; E4

1. INTRODUCTION

The informational efficiency of major stock markets has been extensively examined through the study of causal relations between stock price indices and macroeconomic aggregates. The findings of these studies are important since informational inefficiency in stock market implies on the one hand, that market participants are able to develop profitable trading rules and thereby can consistently earn more than average market returns, and on the other hand, that the stock market is not likely to play an effective role in channeling financial resources to the most productive sectors of the economy.

As for the effect of macroeconomic variables such as money supply and trade balance on stock prices, the efficient market hypothesis (EMH) suggests that competition among the

profit-maximizing investors in an efficient market will ensure that all the relevant information currently known about changes in macroeconomic variables are fully reflected in current stock prices, so that investors will not be able to earn abnormal profit through prediction of the future stock market movements. Therefore, it can be concluded that, in an informationally efficient market, past (current) levels of economic activity are not useful in predicting current (future) stock prices. Stated in Granger jargon, informational efficiency exists if a uni-directional lagged causal relationship from a macroeconomic variable to stock prices could not be detected (e.g., Abdalla and Murinde, 1997; Ajayi, *et al.*, 1998; Ibrahim, 1999; Habibullah and Baharumshah, 2000).

While finding causality from lagged values of stock prices to an economic aggregate does not violate informational efficiency, this finding is equivalent to the existence of causality from current values of stock prices to future levels of the economic variable. This would suggest that stock prices lead the economic variable and that the stock market makes rational forecasts of the real sector. If stock prices accurately reflect the underlying fundamentals, then the stock prices should be employed as leading indicators of future economic activity.

If, however, lagged changes in some economic variables cause variations in stock prices and past fluctuations in stock prices cause variations in the economic variable, then bi-directional causality is implied between the two series. This behavior indicates stock market inefficiency. In contrast, if changes in the economic variable neither influence nor are influenced by stock price fluctuations, then the two series are independent of each other and the market is informationally efficient. Therefore, the causal relations and dynamic interactions among macroeconomic variables and stock prices are important in the formulation of the nation's macroeconomic policy.

The purpose of the present study is to investigate the empirical relationship between stock prices and macroeconomic aggregates: industrial productions, trade balance, money supply in the Tehran Stock Exchange (TSE) using quarterly data that span from 1993-1 to 2010-4. Specifically, in this study we test for market informational efficiency in TSE, by testing the existence of a long-run causal relationship between macroeconomic aggregates and stock prices using Granger non-causality test proposed by Toda and Yamamoto (1995). Among the three forms of market efficiency, namely the weakly efficient, semi-strong and strongly efficient, we consider the semi-strong form relevant to the Iran context. The hypothesis states that all publicly available information is reflected in stock prices.

The rest of the paper is organized as follows. A survey of the existing literature including empirical evidences on the nature of the causal relationship between macroeconomic aggregates and stock prices is conducted in Section 2. Section 3 discusses the methodology to be employed and presents the variables and data descriptions. Section 4 reports the empirical results followed by conclusion in Section 5.

2. REVIEW OF LITERATURE

The relation between stock market returns and fundamental economic activities in the United States is well known (Fama, 1970, 1990, 1991). Numerous studies (Chen, 1991; Chen et al., 1986; Fama, 1991; Huang & Kracaw, 1984; Pearce & Roley, 1988; Wei &Wong, 1992) modeled the relation between asset prices and real economic activities in terms of production rates, productivity, growth rate of gross national product, unemployment, yield spread, interest rates, inflation, dividend yields, and so forth.

Fama (1990), Schwert (1990) and Lee (1992) reported that the US stock market acted as signal to changes in real economic activity. However, Binswanger's (2000) study revealed that stock variation did not lead real activity in US any longer since the occurrence of the stock market boom in early 1980s. Thornton's (1993) work emphasized the importance of stock prices on real output in United Kingdom (UK). Aylward and Glen (2000) conducted an international empirical study on stock prices as leading indicators of economic activity for twenty three markets, including the G7 countries, Australia and 15 emerging countries. The evidence that stock price changes lead gross domestic product (GDP), consumption and investment in most of the countries was found. Bittlingmayer (1998) showed that the current and past increases in stock volatility were associated with output decline in Germany, consistent with the US experience.

Some works on the money and stock market relations were conducted by Serletis (1993) for the case of US and Thornton (1993) for the case of UK. Thornton's study revealed that the stock prices tend to lead money supply while Serletis's finding supported the EMH in the US stock market. Mookerje and Yu (1997)'s study on forecasting share prices for the Singapore case obtained a result that money supply and exchange rate have an impact upon forecasting share prices. In Mookerjee (1987), Pearce and Roley (1983), and Davidson and Froyen (1982)'s studies, M1 and M2 were found to be as significant explanatory variables on explaining share returns. In this respect, M1 was selected as the first candidate explanatory variable in this study.

It has been recognized that external sector indicators like exchange rate, foreign exchange reserves and value of trade balance can also have an impact on stock prices. For the United States, Bahmani-Oskooee and Sohrabian (1992) point out that there is a two-way relationship between the U.S. stock market and the exchange rates. However, Abdalla and Murinde (1997) found out that the results for India, Korea and Pakistan suggest that exchange rates Granger cause stock prices, which is consistent with earlier study by Aggarwal (1981). But, for the Philippines, Abdalla and Murinde found out that the stock prices lead the exchange rates. Morley and Pentecost (2000), in their study on G7 countries, argue that the reason for the lack of strong relationship between exchange rates and stock prices may be due to the exchange controls that were in effect in the 1980s. Muradoglu, Metin and Argac (2001) examined the long-run relationship between stock returns and three monetary variables (overnight interest rate, money supply and foreign exchange rate) in Turkey. They pointed out that the whole sample period (1988-1995) showed no cointegrating relationship between stock prices and any of the monetary variables. This is also true only for the first sub-sample (1988-1989) but all the variables were cointegrated with stock prices for the second (1990-1992) and third sub-samples (1993-1995).

Lee (1992) investigated the causal relations and dynamic interactions among the asset returns, inflation and real interest rate for US in the postwar period. Stock returns did not Granger-cause inflation. Real interest rate explained a substantial fraction of the forecast error variance in inflation while inflation did not have significant explanatory power for growth in industrial production in the presence of stock returns and interest rate. Poon and Taylor (1991)'s study for the UK market, Martinez and Rubio (1989)'s study for the Spanish market, and Gjerde and Saettem's study (1999) for the Norwegian market have not implied a significant relation between stock returns and macroeconomic variables. Ibrahim (1999) investigated the dynamic interactions between stock prices and macroeconomic variables for Malaysia. The results from the bivariate and multivariate analysis revealed that the stock market was informationally inefficient with respect to consumer prices, official reserves and credit aggregates.

Habibullah et al. (2000) examined the lead-lag relationship between stock prices and five macroeconomic variables, namely, interest rate, price level, national income, money supply and real effective exchange rate. They also employed the Toda-Yamamoto long-run Granger causality test for determining the association between integrated series without having to worry about the order of integration or cointegrating rank in the vector autoregression system. The results suggested that the stock prices led national income, price level and exchange rate, which also meant that stock market acted as a leading indicator for many macroeconomic variables. At the same time, money supply and interest rate were found to lead stock prices.

The economic role of the stock markets in relatively less developed Asian countries is less clear. Particularly, the studies on relationships among stock prices and macroeconomic variables in Iran are relatively scarce compared to the developed economies. Specifically, how does this less-developed market (TSE) respond to changes in its fundamental economic variables, compared with the well-developed, well-organized, and more-efficient markets? It is hoped that this paper can contribute to bridge the gap.

3. DATA AND METHODOLOGY

In this study, the relationships between share returns and selected macroeconomic variables have been examined for the Iran case. Quarterly data covers the period of 1993:1 to 2010:4. To measure the general stock price level, we use the end-of-quarter of values Tehran Exchange Price Index (TEPIX), which are obtained from TSE. Selected macroeconomic variables, consistent with the approach of many other studies surveyed in section 2, are Money Supply (M1), non-oil Trade Balance[1] (TB), and Industrial Production Index (IP) in large manufacturing establishments, selected from various issues of the quarterly bulletins published by the Central Bank of Iran. All variables are in the logarithm.

Table 1. Unit-root tests.

Variable	Augmented Dickey-Fuller (ADF)		Phillips-Perron(PP)	
	Levels	First differences	Levels	First differences
TEPIX	-2.31	-3.72	-2.11	-3.64
M1	-3.04	-7.03	-2.96	-7.00
TB	-2.33	-4.83	-2.06	-4.45
IP	-1.38	-4.30	-1.45	-4.31

Notes: The lag lengths for the ADF and PP tests are chosen by using Akaike's information criterion and Newey and West (1987) method respectively.

Before conducting any econometric analysis, the time series properties of the data must be investigated. So, we first conduct augmented Dickey and Fuller (ADF) and Phillips-Perron (PP) tests to establish the order of integration for the real economic activity (IP), stock price (TEPIX), trade balance (TB) and money stock (M1) series. Table 1 shows the results of the

1. This variable captures oil shock during sample period too.

tests for presence of a unit root in levels and first differences. The results of both tests do not provide evidence against the unit root in the levels. Meanwhile, the test for a unit root in the first difference series indicates strong rejection of the null hypothesis in all the cases. As a result, these data series can be characterized as I(1) for period of analysis.

As pointed out by Toda and Yamamoto (1995) and Zapata and Rambaldi (1997), the power of unit roots and cointegration tests are very low against the alternative hypothesis of (trend) stationarity. Moreover, these tests are cumbersome and sensitive to the values of the nuisance parameters in finite samples and therefore their results may be unreliable. Hence, the method we apply in our empirical investigation to test for Granger causality is Toda and Yamamoto (1995) methodology. This procedure provides the possibility of testing for causality between integrated variables based on asymptotic theory. In order to clarify the test method of Toda and Yamamoto (1995) augmented Granger Causality; let us consider the simple example of a bivariate model with *k* lag, based on the following equations:

$$Y = \alpha_y + \sum_{i=1}^{k+d} \theta_{yi} X_{t-i} + \sum_{i=1}^{k+d} \phi_{yi} Y_{t-i} + \varepsilon_{yt} \quad (1)$$

$$X = \alpha_x + \sum_{i=1}^{k+d} \theta_{xi} X_{t-i} + \sum_{i=1}^{k+d} \phi_{xi} Y_{t-i} + \varepsilon_{xi} \quad (2)$$

where *d* is the maximal order of integration order of the variables in the system, *k* is correct optimal lag order and $\boldsymbol{\varepsilon_{it}}\boldsymbol{s}$ are error terms that are assumed to be white noise with zero mean, constant variance and no autocorrelation. Indeed, all one needs to do is to determine the maximal order of integration *d*, which we expect to occur in the model and construct a (augmented) VAR in their levels with a total of (*k* + *d*) lags. In equation (1) *X* "does not Granger-causes" *Y* if it is $\boldsymbol{\theta_{yi} = 0} \quad \boldsymbol{for} \quad \boldsymbol{i \leq k}$. Similarly, in equation (2), *Y* "does not Granger-causes" *X* if it is $\phi_{xi} = 0 \quad for \quad i \leq k$. Notice that the additional lags (d) are unrestricted.

Their function is to ensure that the asymptotical critical values can be applied when test for causality between integrated variables are conducted, according to Toda and Yamamoto (1995). The zero restrictions are tested by computing the modified Wald (MWALD) test statistic.

This method is applicable whether the VAR's are stationary (around a deterministic trend), integrated of an arbitrary order, or cointegrated of an arbitrary order.

4. EMPIRICAL RESULTS

The unit root tests presented in the earlier section, suggest that the variables are all characterized as integrated of order 1. Having determined that $d_{\max} = 1$, we then proceed in estimating the lag structure of a system of VAR in levels and our results indicate that the optimal lag length based on Schwarz Information Criterion(SIC) is 3, that is, *k* = 3. We then estimate a system of *VAR* in levels with a total of $(d_{\max} + k = 4)$ lags.

$$\begin{bmatrix} TEPIX \\ M1 \\ TB \\ IP \end{bmatrix} = A_0 + \sum_{i=1}^{4} A_i \begin{bmatrix} TEPIX_{t-i} \\ M1_{t-i} \\ TB_{t-i} \\ IP_{t-i} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad (3)$$

The system of equations is jointly estimated as a "Seemingly Unrelated Regression Equations" (SURE) model by Maximum Likelihood and computes the MWALD test statistic. The MWALD statistic will be asymptotically distributed as a Chi Square, with degrees of freedom equal to the number of "zero restrictions", irrespective of whether the variables are I (0), I (1) or I (2), non-cointegrated or cointegrated of an arbitrary order. The results of the MWALD test statistic as well as its *p*-values are presented in Table 2.

Table 2. Results of long run Causality due to Toda-Yamamoto (1995).

Null Hypothesis	**MWALD Statistics**	***p*-values**
Stock price versus money supply		
TEPIX does not *Granger cause* M1	4.21	0.24
M1 does not *Granger cause TEPIX*	12.35	0.00
Stock price versus Trade Balance		
TEPIX does not *Granger cause TB*	2.21	0.53
TB does not *Granger cause TEPIX*	8.31	0.04
Stock price versus Industrial Production		
TEPIX does not *Granger cause IP*	1.73	0.63
IP does not *Granger cause TEPIX*	8.05	0.04

The test results in Table 2 suggest that past M1, TB, and IP significantly cause current change in TEPIX at less than the 5% level. In other words, the results suggest that these three macro variables lead TEPIX. More over, we fail to reject the null hypothesis of Granger non-causality from stock price to macro variables including money supply, value of trade balance and industrial production at 5% level of significance. So, it seems that there is a unidirectional long-run causality from macro variables to stock prices for Iran. This implies that the stock market cannot be used as a leading indicator for future growth in money supply, value of trade balance and industrial production in Iran.

5. CONCLUSIONS

The efficient market hypothesis (EMH) was formalized by Fama (1970). The hypothesis suggests that changes in the macroeconomic variables cannot be used as a trading

rule by investors to earn consistently abnormal profits in the stock market. In an efficient market, current as well as past information on the growth of these variables are fully reflected in asset prices so that investors are unable to formulate some profitable trading rules using the available information.

The main objective of the present paper is to determine the lead and lag relationships between the Iran stock market and three key macroeconomic variables: Money Supply (M1), Trade Balance (TB) and Industrial Production (IP). In this study, the TEPIX index was used as a proxy for the Iran stock market. We endeavor to investigate the question: Can the Iran stock market act as a barometer for the Iran economy? This is of course an empirical question. The earlier studies that analyzed the nature of the causal relationship between macroeconomic aggregates and stock prices have employed the traditional Granger–Causality test. Since it is now recognized that the conventional procedure may be inadequate, conclusions based on such an approach may yield misleading inferences. So, we have employed the recently developed long–run Granger non–causality test proposed by Toda and Yamamoto (1995) in our study.

In general, the findings imply that macroeconomic variables are significant in predicting changes in stock prices. Thus, it can be claimed that stock price variability is fundamentally linked to economic variables, although the change in stock price lags behind those economic activities. In other words, while macro variables Granger-caused stock prices, no reverse causality was observed. So, the stock price index is not a leading indicator for economic variables, which is inconsistent with the findings that the stock market rationally signals changes in real activities (Fama, 1991; Geske & Roll, 1983). Moreover, it may be concluded that Iran stock market does not have informational efficiency at least with respect to three macroeconomic variables: money Supply, trade balance and industrial production.

References

[1] Abdalla, I. S. A. and Murinde V. (1997). "Exchange Rate and Stock Price Interactions in Emerging Financial Markets: Evidence on India, Korea, Pakistan, and Philippines, " *Applied Financial Economics*, 7, 25-35.

[2] Aggarwal, R. (1981). "Exchange Rates and Stock Prices: A Study of the US Capital Markets under Floating Exchange Rates," *Akron Business and Economic Review*, 12, 7-12.

[3] Ajayi R.A., Friedman J. and Mehdian S.M. (1998). "On the Relationship between Stock Returns and Exchange Rates: Tests of Granger Causality," *Global Finance Journal*, 9, 241-51.

[4] Aylward, A., and Glen, J. (2000). "Some International Evidence on Stock Prices as Leading Indicators of Economic Activity," *Applied Financial Economics*, 10, 1-14.

[5] Bahmani-Oskooee M. and Sohrabian A. (1992). "Stock Prices and the Effective Exchange Rate of the Dollar,"*Applied Economics*, 24, 459 – 464.

[6] Binswanger, M. (2000). "Stock Returns and Real Activity: Is There Still a Connection?," Applied Financial Economics, 10, 379-387.

[7] Bittlingmayer, G. (1998). "Output, Stock Volatility, and Political Uncertainty in a Natural Experiment: Germany, 1880-1940," *Journal of Finance*, 53, 2243-2257.

[8] Chen, N.F., Roll, R. and Ross, S.A. (1986). "Economic Forces and the Stock Market," *Journal of Business,* 59, 383-403.

[9] Choudhry, T. (1997). "Stochastic Trend in Stock Prices: Evidence from Latin American markets," *Journal of Macroeconomics*, 19, 285-304.

[10] Dickey, D.A., and Fuller, W.A. (1979). "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association,* 74, 427-437.

[11] Fama, E.F. (1981). "Stock Returns, Real Activity, Inflation and Money" *American Economic Review*, 71, 545-65.

[12] Fama, E.F. (1990). "Stock Returns, Expected Returns, and Real Activity," *Journal of Finance,* 45, 1089-1108.

[13] Habibullah, M.S. and Baharumshah, A.Z. (2000)." Testing for Informational Efficient Market hypothesis: The Case for Malaysian Stock Market" In M.S. Habibullah and A.Z. Baharumshah (eds.). *Issues on Monetary and Financial Economics: Studies on Malaysian Economy*

[14] Habibullah, M.S., Baharumshah, A.Z., Azali, M. and Azman-Saini, W.N.W. (2000), "Stock Market and Economic Activity: An Application of Toda-Yamamoto Long-Run Causality Test", in: *ASEAN in an Interdependent World,* ed. Habibullah, M.S. Ashgate Publishing Company: Aldershot, 81-94.

[15] Ibrahim, M.H. (1999). "Macroeconomic Variables and Stock Prices in Malaysia: An Empirical Analysis," *Asian Economic Journal*, 13, 219-231.

[16] Johansen, S. (1991). "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Econometrica,* 59,1551-1580.

[17] Lee, B.S. (1992). "Causal Relations Among Stock Returns, Interest Rates, Real Activity and Inflation," *Journal of Finance*, 47, 1591-1603.

[18] Meyer, L.H. (2001). "Does Money Matter?", *Federal Reserve Bank of St. Louis Review,* 83(4), 1-15.

[19] Mok, H.M.K. (1993). "Causality of Interest Rate, Exchange Rate and Stock Prices at Stock Market Open and Close in Hong Kong," *Asia Pacific Journal of Management*, 10,123-143.

[20] Morley B. and Pentecost E.J. (2000). "Common Trends and Cycles in G7 Countries Exchange Rates and Stock Prices," *Applied Economic Letters*, 7, 7-10.

[21] Muradoglu, G., Metin, K., and Argac, R. (2001). "Is There a Long-Run Relationship Between Stock Returns and Monetary Variables: Evidence from an Emerging Market," *Applied Financial Economics*, 11, 641-649.

[22] Olesen, J.O. (2000). "Stocks Hedge against Inflation in the Long Run: Evidence from a Cointegration Analysis for Denmark", *Working Paper 6-2000*, Department of Economics, Copenhagen Business School.

[23] Panda, Chakradhara and Kamaiah, B. (2001). "Monetary policy, Expected Inflation, Real Activity and Stock Returns in India: An Empirical Analysis," *Asian – African Journal of Economics and Econometrics*, 1, 191-200.

[24] Schwert, G.W. (1990). "Stock Returns and Real Activity: A Century of Evidence," *Journal of Finance*, 45, 1237-1254.

[25] Serletis, A. (1993). "Money and Stock Prices in the Unites States," *Applied Financial Economics*, 3, 51-54.

[26] Thornton, J. (1993). "Money, Output and Stock Prices in the UK: Evidence on Some (Non)Relationships," *Applied Financial Economics*, 3, 335-338.

[27] Toda, H.Y. and T. Yamamoto. (1995). "Statistical Inference in Vector Autoregressions with Possibly Integrated Processes," *Journal of Econometrics*, 66, 225-250.

(Received 14 October 2014; accepted 07 November 2014)