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The analysis of money shocks asymmetrical effect on Tehran Stock Exchange price index

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ABSTRACT

The stock exchange is a segment of the country's financial system, which can have a unique role in the country's development and economic growth. On the other hand, monetary policies and other variables can affect this market. Therefore, the effect of money shocks and their asymmetrical impact on the Tehran Stock Exchange price index is examined in this study. The monthly data gathered between March 2011 till May 2020 has been used in this examination. Money shocks were extracted using the (Hodrick-Prescott) method and then examined using the ARDL method. The study showed that negative money shocks impact the Tehran Stock Exchange price index more than positive money shocks. It is proven that positive and negative money shocks have an asymmetrical effect on the Tehran Stock Exchange and the consumer price index has a positive effect on the Tehran Stock Exchange, while housing prices have a negative impact on the Tehran Stock Exchange.

Keywords: *Consumer Price Index, Hodrick-Prescott Filter, House price, Monetary shocks, Tehran Stock Exchange.*

JEL codes: *E44, E52*

INTRODUCTION

Introduction

The financial market exercises a critical role in collecting financial resources and employing them in various investment projects, as it is the place where all capital transactions are made for the purpose of investment or financing in the form of contributions or loans for long-term securities (Banerjee, Devereux, and Lombardo 2016). Generally speaking, financial markets play an important role in achieving the optimal allocation of society's resources, especially if these markets are characterized by efficiency (Banerjee Devereux, and Lombardo 2016). Financial markets can play an effective and applicable role only if it owns competent ingredients that contribute to the evaluation of listed companies through an analysis of available information and data to current and potential investors (Salameh and Alzubi 2018; Sulong, Saleem, and Ahmed 2018).

It is received by observing the macroeconomic structure of any country and various markets in every economy that the capital market is one of the most fundamental markets of any economy. The Securities Exchange is a sub-category of the capital market. The Securities Exchange is a centralized and official market for trading the companies' stocks under specific rules and policies. One of this market's tasks is to assist in the fairness of the securities prices and accelerate the trade process. The Securities Exchange is the headquarters for accumulating savings and the private sector liquidities for financing long-term investment projects. This market is one of the most critical markets in any economy. The indexes of this market are affected by inter-organizational and macroeconomic factors (Karimzadeh and Associates 2013). It is well established that fluctuations in macro-financial variables are likely to affect stock market either in a positive or negative direction (Ulku and Demirci 2012; Bahmani-Oskooee and Saha 2016). The stock price index can be viewed as the economic unit's expectation of the company's future returns, and it also can be considered as an indication of a country's growth and development.

The stock price index is the first and most critical factor that investors encounter for adopting investment decisions in a stock exchange. Factors affecting stock price have been examined by previous researchers. Therefore it is crucial to be aware of the factors that affect stock prices. The factors which affect the stock price are categorized as mentioned below:

Internal factors (fundamental): Those factors affecting the stock prices which are affiliated with the company operations and decisions, such as earnings per share (EPS), dividends per share (DPS), price to earnings ratio (P/E), net profits, capital increase, capital analysis, and other internal factors.

External factors (non-fundamental): Factors that are not within the executive powers of the company and affect the company's activities in some way. These factors are the events and decisions outside the company that affects stock prices. These factors are divided into two categories.

1) Political factors: Factors such as war, peace, economic and political boycott with other countries, change in political elements and etcetera. All of these aspects have a crucial impact on stock prices.

2) Economic factors: Economic factors play a role in stock markets and affect stock prices in recession and boom periods of the economy. In a way, in the boom period of the economy, investment increases in the stock market, increasing the stock price index, and in the recession period, the stock market would accordingly suffer from a recession. Because of these circumstances, investments in fixed-income financial assets are preferred over investments in ordinary shares. Economic factors influential on stock prices are also divided into two categories, which are i) real variables such as savings, tax rate, etc., and ii) Monetary variables such as liquidity ratio, exchange rate, inflation rate, etc. Monetary policy uses tools like Interest rates, liquidity management, exchange rate, credit creation and money supply to nurture the economy (Sanjay Tomar and Kesharwani 2021).

Karimzdeh (2006) explained the long-term relationship between the Tehran stock price index and macroeconomic variables using portfolio theory and Fisher's fundamental theory. The

estimated long-term relationship shows a long-term and significant effect of liquidity, the real exchange rate's significant negative effect, and the bank's real interest rate effect on the stock price index. Su Dinh, Phuc Canh, and Maiti (2019) investigated the effect of money shocks on the Indian stock market in research named "asymmetrical effects of money shocks on the stock price. The result shows that unpredictable money shocks answer quickly and significantly to the production, inflation, and interest rate gaps, and there is an asymmetrical money shock. Freitas Val et al. (2018) examined the effect of unpredicted monetary policy decisions on the total stock return of Brazil and 53 other companies by using Event Study analysis. This analysis shows in some levels of the expected return scale that the financial sector is the most affected by monetary policies. At the same time, the product industry is affected significantly by monetary policies on the excess return scale. Plus, the effect of monetary policy on each firm's assets was heterogeneous. Tchereni and Mpini (2020) investigated investigated the impact of monetary policy decisions on protection markets in rising economies in South Africa and concluded that 5.2% of stock market volatility is due to monetary policy and there was a negative relationship between stock market volatility and M2. Aldass (2017) concluded that interest rate plays a primary function in directing financial market performance, because the central bank seeks to lessen the interest charge on loans to lessen the fee of borrowing and growth the volume of credit score and buy. Fang and Miller (2002) studied the impact of daily currency decrease on the stock market returns for five newly emerging East Asian stock markets. The results revealed that the conditional variances of stock market return and decrease in rates exhibited time-varying characteristics for all markets.

Since liquidity is an influential factor on the Tehran Stock Exchange, positive and negative monetary shocks can affect this price index symmetrically or asymmetrically. Therefore we examine the asymmetrical effect of monetary shocks and the influence of factors such as the consumer price index as a benchmark for inflation in this study. Also, housing prices can be considered a substitute market.

Methodology

Fisher's hypothesis advocates that inflation and stock markets are directly related (Jaffe and Mandelker 1979; Singh and Balasubramanian 2020). It indicates the relation between the stock price index and macroeconomic variables is Fisher's fundamental theory, which states that the real interest rate is the result of subtracting the inflation rate from the nominal interest rate (Karimzadeh and Soltani 2010).

$$R^{r}_{t=} R^{n}_{t} - INF_{t} \qquad (1)$$

Which (R^{r}_{t}) is the real interest rate, (R^{n}_{t}) is the nominal interest rate, and INF is the inflation rate. Fisher states this equation for the stock returns.

$$RS^{r}_{t=} RS^{n}_{t} - INF \quad (2)$$

Furthermore, the real return is equal to the stock price rate of change.

$$RS^{r}_{t=} dLnPS_t \quad (3)$$

According to this equation, Fisher introduces the econometric model below and states that the inflation rate affects stock returns.

$$RS^{r}_{t=} y_0 + y_1 INF_t + u_t \quad (4)$$

In 1981 FAMA stated that Fisher's theory had ignored some macroeconomic variables such as liquidity and interest rates. FAMA uses the money market equilibrium to prove its statements considering the relationship between the money market and the stock market. This is the money market equilibrium.

$$\frac{M}{P} = M(y_t . R_t)$$

In which the M stands for liquidity in the economy (Paper money and coins belonging to individuals, checking and time deposits), P stands for the general price level, Y stands for national income, and R stands for interest rate. Therefore, FAMA states the demand for money as below.

$$Ln(\frac{M_t}{p_t}) = \alpha_1 LnY_t - \alpha_2 R_t \quad \alpha1, \alpha2>0 \quad (5)$$

$$LnP_t = -\alpha_1 LnY_t + \alpha_2 R_t + LnM_t \quad (6)$$

With differentiating this equation:

$$dLnP_t = -\alpha_1 dLnY_t + \alpha_2 dR_t + dLnM_t \quad (7)$$

$$[dLnP_t = INF_t] \quad (8)$$

$$INF_t = -\alpha_1 dLnY_t + dLnM_t + \alpha_2 dR_t \quad (9)$$

$$RS^r_{t=} y_0 - y_0\alpha_1 dLnY_t + y_1\alpha_2 dR_t + y_1 dLnM_t + u_t \quad (10)$$

$$B_{0=} y_t \quad (11)$$

$$B_1 = -y_1\alpha_1 \quad (12)$$

$$B_2 = y_1\alpha_2 \quad (13)$$

$$B_3 = y_3 \quad (14)$$

$$RS^r_{t=} B_0 + B_1 dLnY_t + B_2 dR_t + B_3 dLnM_t + u_t \quad (15)$$

$$RS^r_{t=} RS^r_t - INF_t \quad (16)$$

$$LnRS^n_{t=} \beta_0 + \beta_1 dLnY_t + \beta_2 dR_t + \beta_3 dLnM_t + \beta_4 INF_t + u_t \quad (17)$$

Equation (17) is the basic equation for stating changes in stock prices. According to the variables of every research, which conveys substituting other financial assets with stocks and regarding other factors which affect the stock price, other factors can substitute for available factors.

As the amount of shocks are important, at first, negative and positive money shocks will be separated. In the next part, the asymmetrical effects of money shocks will be examined, and in the last part, asymmetrical tests will be analyzed using econometric methods. Usually, any unpredicted time series variables are assumed to be a shock in experimental studies. In order to extract the shocks, Cover used the residuals of the growth rate of the money supply equation (M2) as money shocks. He considered the negative parts as negative shocks and the positive parts as positive socks. In this method, the results of the residual regressions change with any small

change in the model. Therefore, unpredictable shocks change in signal and size, and hence the results of the estimation change in the production model (Asgharpour 2006). There is also another method for extracting the shocks, which is the Hodrick-Prescott method that is used in this study. After extracting the shocks, equation (18) will be estimated using the Distributed Lag (ARDL) model.

$$Lts = \alpha_0 + \alpha_1 Posshock + \alpha_2 Negshock + \alpha_3 Lhouse + \alpha_3 cpi + e_i \qquad (18)$$

The logarithm variable of the Tehran stock exchange price index (Lts), the logarithm of Theran housing prices (Lhouse), Positive money shocks (Posshock), negative money shocks (Negshock), the logarithm of the consumer price index (Lcpi) and the error term is (ei).

One of the ways to collect the positive and negative impulses is by using the single variable filtering method. One of the most common ways in this regard is using the Hodrick-Prescott filter. One of the benefits of using this method for the separation of a single time series into temporary and permanent pieces is that, unlike other analysis methods like Borich and Nelson, Hodrick-Prescott enforces an equal method to separate the variables from the trend (Abtahi Mehrjordi 2008). In the Hodrick-Prescott method time series (Yt) is obtained from the sum of the two components of growth (gt) and cycle (ct).

$$y_t = c_t + g_t \qquad \text{For} = 1, 2, 3.$$

The quantities of growth (trend) are acquired by minimizing the sum of the squares of time series variable deviation (Yt) and from its trend (Gt). Frankly, the quantities of the trend of the Hodrick-Prescott filter are the quantities that minimize the equation below.

$$\text{Min}\{\sum_{t=1} T\, c_t^2 + \lambda \sum_{t=1} T\, [(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2\}$$

In the equation above, (t) is the number of observations, and y is the parameter that determines the smoothness of the (ct) trend, and their quantities for the seasonal data are 1000, yearly data 100, and monthly data is 14400 (Yazdani and Sherafatmand 2011). Now the shocks can be extracted according to the given explanations. For extracting money shocks, first, we extract the money growth rate trend according to the Hodrick-Prescott filter and label it the HPM. Then, the difference between the amount of the calculated variable trend and the real amount is considered the shock.

Shock=LOG(M) – Hpm

In this case, we can acquire the positive and negative liquidity shocks as below.

Pos shock=max(0,reer shockt)

Neg shock=min(reer shockt,0)

As mentioned in the method, the results depend on the balancing factor, and there is no specific method to obtain it. It is mentionable that although the balancing parameter does not change the signal of the shocks, it is effective in their amount.

Result

The generalized Dickey-Fuller unit root test is used to examine the stationary of the variables, and the results are shown in the Table 1.

Table 1. The stationary test of the variables.

Variable	ADF					
	Single Differentiation			Single Differentiation		
	with width from origin and trend	without width from origin and trend	with width from origin	with width from origin and trend	without width from origin and trend	with width from origin
Lts	0.7	1.0	0.96	0.00*	0.00*	0.00*
Lhouse	0.27	0.92	0.11	0.00*	0.00*	0.00*
Lcpi	0.35	0.99	0.96	0.07	0.16	0.01
Posshock	0.21	0.03	0.05	0.00*	0.00*	0.00*
Negshock	0.20	0.00	0.01	0.00*	0.00*	0.00*

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

As seen in Table 1, the logarithm of the stock price index, consumer price index, and the average housing price is not on the stationary level, and they get on the stationary level with a single differentiation. Shocks are on the stationary level.

After examining the variables' stationary level and the extraction of the money shocks by the Hodrick- Prescott filter and using the Auto Regressive Distributed Lag model, the effect of positive and negative shocks and other variables will be examined.

Table 2. Short-term estimation (Schwarz Bayesian scale).

1- Variable	2- Estimated Coefficients	3- t Statistic	4- Probability
5- Lts(-1)	6- 0.99	7- 8.90	8- 0.000*
9- Lts(-2)	10- 0.006	11- 0.04	12- 0.96
13- Lts(-3)	14- -0.15	15- -1.4	16- 0.15
17- Pos shock	18- 1.41	19- 2.11	20- 0.03*
21- Neg shock	22- -1.95	23- -2.43	24- 0.01*
25- Neg shock(-1)	26- 0.25	27- 0.28	28- 0.77
29- Neg shock(-2)	30- 0.35	31- 0.y8	32- 0.69
33- Neg shock(-3)	34- -2.16	35- -2.72	36- 0.00*
37- Lcpi	38- 0.30	39- 0.29	40- 0.00*
41- Lhouse	42- -0.007	43- -0.01	44- 0.98
45- Lhouse(-1)	46- 0.78	47- 0.86	48- 0.39

49-	Lhou se (-2)	50-	-0.84	51-	-1.74	52-	0 .08**
53-	Effects Specification						
54-	Cross-section fixed (dummy variables)						
R-squared		0/99		Adjusted R-squared		0/99	

According to Table 2, it can be observed that in the short term, housing prices and their second lag negatively affect the Tehran stock exchange price index. The absolute value of the effect of positive money shocks is less than negative money effects, and there is money shock assymetricality in the short term. The short-term effect of the consumer price index positively impacts the Tehran stock exchange price index. The negative money shocks third lag has a negative effect on the stock price index. R2 statistic indicates that the model's explanatory variables explain over 0.99 percent of changes in the Tehran stock exchange price index. The adjusted R2 statistic, which is even to the R2, indicates the high explanatory power of the model, and the entering additional variable problem does not exist in the model.

The results of the classical assumptions test from estimated models are shown in Table 3. Due to the results, according to over 5% probability, the null hypothesis of sufficient classical assumptions, variance heterogeneity, autocorrelation, and normality does not exist.

Table 3. Error term test.

Test	Statistic
Normality	0.49
Autocorrelation	0.03 (0.96)
Variance Heterogeneity	1.33 (0.21)

After estimating the dynamic equation and before examining the long-term balanced equation between the model variables, the long-term cumulative test is conducted between the available variables. The test for the existence of long-term relations includes the Banerjee, Dolado, and Master method and the error correction method. The model is proven by the approval of one of the methods for the existence of a long-term relationship between the variables. In this study, the second method is used to prove the existence of a long-term relationship between the variables. The error correction model connects the short-term fluctuations of the variables to their long-term quantities. The results of the error correction test are shown in Table 4.

Table 4. The error correction model.

Variable	Estimated Coefficients	t Statistic	Probability
DLTS(-1)	0.14	1.53	0.12
DLTS(-2)	0.14	1.65	0.10
DNeg shock	-1.95	- 2.66	0.00*
Dnegshock(-1)	1.81	2.43	0.01*
DNegshock(2)	2.16	2.93	0.00*
DLhouse	-0.007	-0.01	0.98
DLhouse(-1))	0.84	1.81	0.07**
ECM	-0.15	-4.93	0.00*

The test for the existence of long-term relations includes the Banerjee, Dolado, and Master method and the error correction method (ECM). The model is proven by the approval of one of the methods for the existence of a long-term relationship between the variables. In this study, the second method is used to prove the existence of a long-term relationship between the variables. According to the Pesaran and Shin study (1996), if ECM (-1) is between 0 and -1 in the model, there is a long-term relation. If it is equal to -1, it is insignificant, and if it is less than -1, there is no long-term relation (Tashkini and Abbasnejad 2005; Pahlevani et al. 2007). In other words, this coefficient shows how quickly any imbalances occurring in the long-term relation are offset by the amount of change in the Tehran stock exchange price index in this model. Due to the coefficient in Table 4, it can be concluded that according to the error correction term in every cycle, 0.15% of cycle imbalances in the stock price index offsets in the next cycle.

According to the results of the table, the ECM(-1) coefficient is significant and has a negative signal. Therefore because ECM(-1) is between 0 and -1 and is significant, the cumulative and long-term relation between the variables is proven.

As shown in Table 5, the effect of negative money shocks is more than the positive money shocks in absolute value, and the asymmetrical effect of the money shocks is proven. The long-term effect of housing prices has a negative impact, and the long-term effect of the consumer price index positively impacts the Tehran stock exchange price index.

Table 5. Long-term estimation.

Variable	Estimated Coefficients	t Statistic	Probability
Pos shock	9.002	2.70	0.00*
Neg shock	-22.32	-3.77	0.00*
Lcpi	1.96	11.71	0.00*
Lhouse	-0.44	-6.25	0.00*

The asymmetry test: We use the Wald test to examine the asymmetry. Therefore, if the coefficients of the negative and positive changes are even, monetary shocks would possess symmetrical effects on the stock price index variable, and if otherwise, these effects will be asymmetrical. The results of the wald test for examining the long-term and short-term asymmetry are shown in Table 6.

Table 6. Asymmetry.

Wald test statistic	Null hypothesis	Conclusion
(F-Statistic), 4.46 (0.03)	αiPOSSHOCK=αJNEG SHOCK	symmetry hypothesis is rejected

Conclusions and suggestions

In this study, the effect of money shocks, their asymmetry, and the impact of housing prices and consumer price index on the Tehran stock exchange price index are analyzed between the years 2011:3 and 2020:5. For that purpose, first, the positive and negative money shocks have been extracted by using Hodrick-Prescott method and then the effect of the positive and negative money shocks, consumer price index and, housing prices on the Tehran stock exchange price index has been analyzed by using the Auto Regressive Distributed Lag (ARDL) model. Due to the achieved results, it can be stated that positive and negative money shocks have an asymmetrical effect on the Tehran stock exchange price index. Negative money shocks have more effect than positive money shocks in absolute value. There is an asymmetry between positive and negative money shock effects on the Tehran stock exchange price index. Therefore, it is suggested that policymakers consider the asymmetrical effects of money shocks. Policymakers should be more sensitive toward negative liquidity shocks and prevent the stock from decreasing its value.

On the other hand, investment in housing as an asset has attracted many investors to itself. The demand for this asset is affected by various reasons. According to the results achieved by this study, housing prices have an inverse relationship with stock prices. According to the portfolio

theory and the substitution between these assets, the economic rationale of this relationship is justified.

The consumer price index effect positively impacts the Tehran stock exchange price index. Increasing the general price levels by increasing the value of the assets and the production companies' input would be followed by an increase in the stock prices. According to the fact that the consumer price index can be an indication of inflation, and although the inflation rate has a positive and significant effect on the price index, this increase can cause irreparable damage to the country's economy. Therefore it is better to take action to stabilize this rate.

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