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Asymmetric effects of industrial production, money supply and exchange rate changes on stock returns in Turkey

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ABSTRACT
The aim of this article is twofold: First, it examines the asymmetric effects of industrial production, money supply and RER on stock returns in Turkey by using the non-linear autoregressive distributed lag (NARDL) model over the periods of 1994:01–2017:05 and 2002:01–2017:05. Second, it tries to determine whether there is a change of these macroeconomic variables' effects on stock returns after the 2001 financial crisis since after 2002 period represents a structural break from the past in terms of economic, political and macroeconomic policy approaches. The study finds that the effects of the changes in industrial production, money supply and RER on stock returns are asymmetric, and the asymmetries are larger after the 2002 subsample compared to the full sample period. The empirical results further suggest that tight monetary policies appear to retard the stock returns more than easy monetary policies that stimulate them.

KEYWORDS
Monetary policy; economic activity; non-linear ARDL; stock returns

JEL CLASSIFICATION
E52; C32; G10; E44;

I. Introduction

This article is an empirical examination of non-linear dynamic interactions between selected macroeconomic variables of industrial production, money supply and real broad effective exchange rate and the stock returns in Turkey. Examining such relationship is important since the changes in stock market returns affect aggregate effective demand, which in turn has an impact on the economic and monetary policy decisions that target both the interest rate and the RER as Gavin (1989) argues. Theoretical works such as the efficient market hypothesis by Fama (1970) and the arbitrage pricing theory by Ross (1976) have been used to study the impact of changes in macroeconomic variables on stock market returns. As listed in related sections below, many previous studies by using various econometric methods studied the link between macroeconomic fundamentals and stock market response by assuming a symmetrical relationship between the dependent and independent variables. It could be the case that this assumption is wrong and the relationship can be asymmetrical.

It is important to look into asymmetries in the stock price adjustment process, as suggested by Koutmos (1998, 1999) showing that stock prices respond to bad news faster than the good news. Studies from Lobo (2000), suggesting asymmetric reaction of stock returns to interest rate cuts and hikes, Bahmani-Oskooee and Saha (2015, 2016) and Ajaz et al. (2017) all present asymmetrical effects of the changes in macroeconomic variables. Bernanke and Kuttner (2005), Chen (2007), Ismail and Isa (2009), Chulia, Martens, and Dijk (2010), Zare and Azali (2015) and Ajaz et al. (2017) showed the asymmetrical link between monetary policy and stock prices indicating that tight and easy monetary policies appear to have a different impact on the stock prices. The results of these international studies show that a tight monetary policy has a more strong effect than the effect of easy monetary policies on stock prices.

The current domestic and international literature review shows that there exist various studies showing the symmetrical relationship between macroeconomic variables and the stock returns, but the studies showing asymmetrical relationship is limited

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in international literature specifically presenting asymmetrical relationship between interest rate and stock returns (Lobo 2000) or between monetary policy and stock returns (Bernanke and Kuttner 2005; Chen 2007; Ismail and Isa 2009; Chulia, Martens, and Dijk 2010; Zare and Azali 2015; Ajaz et al. 2017). So far, there is no Turkish and international empirical study exist showing the asymmetrical relationship between stock returns and the macroeconomic variables of industrial production, monetary policy and the RER.

The main contribution of the article is twofold: First, this study is one of the first attempts to examine the non-linearity and asymmetry in industrial production index (IPI), money supply (M3) and RER on stock market returns in Turkey by using non-linear ARDL (NARDL) model. Second, the study tries to determine whether there is a change in these macroeconomic variables' effects on stock returns after the 2001 financial crisis. This separation of the periods is important since after 2001 period represents a structural break from the past in terms of political stance and applied macroeconomic policies.

The empirical study results show that the effects of the changes in IPI, M3 and RER on stock returns are asymmetric and the effects and this asymmetry are larger after the 2002 period compared to the full period of 1994–2017. Also, the results are consistent with the theory and in line with the empirical results.

This article is organized as follows: the literature survey includes both the surveys of international and Turkish stock market theoretical and empirical studies. Then, the econometric methodology and data are discussed. Empirical findings and policy implications finalize the article.

II. Theoretical background and the literature review

Economic theory suggests that stock prices reflect the investors' expectations about the future firm profits. In this sense, profits reflect the level of aggregate economic activity. Influential works of Fama (1970) and Ross (1976) have been used as a theoretical base to study the impact of changes in macroeconomic variables on stock market returns. Theoretically, the economic activity and stock prices are positively related. An increase in economic activity is expected to lead to an increase in higher corporate earnings, hence an increase in stock returns. The stock returns–real economic activity causal relationship can be discussed as follows: First, the output may affect stock prices through its impact on profitability since the increase in output may boost cash flow and hence enhance stock prices. Alternatively, there is a link from the effects of major stock market fluctuations on consumption and investment and, thus, may lead to an increased output.

The IPI has been used as a proxy for measuring economic activity. By using IPI as a measure of economic activity, Chen, Roll, and Ross (1986) for the USA and Mukherjee and Naka (1995) for Japan found a positive relationship between stock returns and real economic activity. This relationship is also supported by the other empirical studies of Fama (1990), Schwert (1990), Mahdavi and Sohrabian (1991), Abdullah and Hayworth (1993), Gallinger (1994), Apergis (1998), Levine and Zervos (1998), Kwon and Shin (1999), Nasseh and Strauss (2000), Ratanapakorn and Sharma (2007), Shahbaz, Ahmed, and Ali (2008), Humpe and Macmillan (2009), Vazakidis and Adamopoulos (2009), Kumar and Padhi (2012) and Pradhan et al. (2013), among others. Further, Mahdavi and Sohrabian (1991), Dhakal, Kandil, and Sharma (1993) and Gallinger (1994) note that asymmetric causation runs from stock returns to real economic activity. On the other hand, Naceur, Ghazouani, and Omran (2007) and Sahu and Dhiman (2011) investigated the causal relationship and the direction of causality between stock market development and economic growth, in India, and found no causal relationship.

The literature about the relationship between monetary policy and stock prices presents vast evidence that monetary policy has a significant impact on asset prices. These empirical studies include Cassola and Morana (2004), Ewing, Payne, and Forbes (1998, 2003), Thorbecke (1997), Kwon and Shin (1999), Bernanke and Kuttner (2005), Ratanapakorn and Sharma (2007), Farka (2009), Chulia, Martens, and Dijk (2010) and Kumar and Padhi (2012).

According to the Monetarist and Keynesian views, monetary policy changes can influence the stock prices. There could be a positive and negative relationship between money supply changes and stock returns. From the monetarist point of view, an expansionary monetary policy change causes an increase in stock prices since it increases the optimum money balances and hence increases the demand for equities. Keynesian theory indicates that the fall in interest rates, resulting from an expansionary monetary policy change, makes bonds less attractive than equities, causing the price of equities to rise. Also, the increase in money supply leads to a decrease in interest rates, hence to an increase in investment and GDP and eventually to an increase in stock prices. Kwon and Shin (1999), Ratanapakorn and Sharma (2007) and Kumar and Padhi (2012) show that the stock prices are positively related to the money supply. However, Fama (1981) argues that an increase in money supply could lead to inflation which in turn might decrease stock prices. Empirical literature supports both effects. However, there is a general agreement in the literature that a decrease in the money supply is associated with a decline in stock returns.

Another variable which is included in this study is the real effective exchange rate (RER). Theoretically, change in exchange rate affects the global performances of the firms which will affect their share prices. As Tiryaki, Erdoğan, and Ceylan (2017) argue, there are many explanations for a stock price–RER relationship. First, changes in exchange rates may affect the value of firms' portfolios and firms' stock prices. Second, there exists a negative relationship between stock prices and the home currency for export-oriented countries. If exports are important for a country, the exchange rate appreciation lowers its competitiveness and negatively affects domestic stock prices. However, theoretically, a real currency depreciation may affect the share prices in both directions. For the firm level, the exporting firms gain international competitiveness as a result of a real depreciation and export more, and they are expected to make more profit and their share prices increase as a result. On the other hand, the firms that import inputs face an increase in their input costs and experience a decline in their profits and hence their share prices are expected to decrease. Third, there could be an indirect link due to the relationship between exchange rates and economic activity and between economic activity and stock prices. Finally, exchange rates may influence stock prices through interest rate effects. Aggarwal (1981), Choi (1995), Kwon and Shin (1999), Ratanapakorn and Sharma (2007) and Tripathy (2011) show that the stock prices are positively related to a real depreciation of exchange rate.

Various studies look at the link between macroeconomic variables and Turkish stock returns. Erdem, Arslan, and Erdem (2005) analysed the price volatility spillovers in Istanbul Stock indexes for the exchange rate, interest rate, inflation, industrial production and M1 money supply and found unidirectional strong volatility spillover from inflation and interest rate to all stock price indexes. Also, they found spillovers from M1 money supply to financial index and from exchange rate to both IMKB100 and industrial indexes. The study finds no volatility spillover from industrial production to any index. Acikalin, Aktas, and Unal (2008) find unidirectional positive relationship from GDP and exchange rate to the Turkish stock returns. Kandır (2008) finds that exchange rate affects all of the portfolio returns, but IPI and money supply do not appear to have any significant effect on stock returns. Aydemir and Demirhan (2009) found a bidirectional causal relationship between exchange rate and all stock market indices. Also, they found negative causal relationship from exchange rate to all stock market indices. Özlen and Ergun (2012) found that the exchange rate and interest rate are the most significant factors in the stock price fluctuations of the firms. Tiryaki, Erdoğan, and Ceylan (2017) find that IPI (positive) and RER (negative) have significant effects on Turkish stock returns.

All above-mentioned literature about the stock returns mostly assumed that there is a linear relationship between dependent variable and explanatory variables. However, it is important to look into asymmetries in the stock price adjustment process, as suggested by Koutmos (1998, 1999), Lobo (2000), Bahmani-Oskooee and Saha (2015, 2016), Bernanke and Kuttner (2005), Chen (2007), Ismail and Isa (2009), Chulia, Martens, and Dijk (2010), Zare and Azali (2015) and Ajaz et al. (2017).

III. The data and methodology

The study uses monthly data for Turkey covering two sample periods: The full-sample period of 1994:01–2017:05 and the subsample period of 2002:01–2017:05. Besides the full sample period, the subsample period of 2002–2017 is chosen in order to see whether there is a structural break after the 2001 economic and financial crisis in Turkey. After the 2001 crisis, the economic and political policies have changed, and compared to pre-2002 conditions, the Turkish macroeconomic variables are less volatile. All the variables used in the study that are expressed in natural logarithm are the Borsa Istanbul share price index (BIST100), IPI, money supply (M3) and real broad effective exchange rate (RER) of Turkey. The monthly data are obtained from the databases of the Central Bank of the Republic of Turkey (CBRT), the Federal Reserve Economic Data (FRED) of the Federal Reserve Bank of St. Louis and the OECD.

The BIST100 index is the Borsa Istanbul's largest share price index composed of national market companies except investment trusts. The BIST100 includes the largest financial and industrials indices in Turkey. Thus, the use of this share price index represents the Turkish stock returns, in general, to be used in such study.

In the study, benefiting from economic literature in general and the literature about the Turkish economic developments, it is assumed that the main determinants of the Turkish stock returns are the IPI, M3 and RER. In order to represent economic activity in Turkey, monthly data of IPI are used to see their effect on stock returns. M3 money supply is chosen to see the monetary policy stance of the CBRT. Berument, Togay, and Şahin (2011), Berument, Denaux, and Yalçın (2012) and Kılınç and Tunç (2014) use the M3 monetary aggregate to represent the stance of monetary policy in Turkey, and Canova and Favero (2005) include the announcement of a quantitative reference value for M3 growth for European Central Bank. According to Berument, Togay, and Şahin (2011,) the broader monetary aggregates are the measures of liquidity and are affected by the state of the economy as well as by the country's monetary policy. Besides these, Guney and Cepni (2016) conclude that the money supply in Turkey is endogenous; that is, the central bank and the banks fully meet the total demand for money in the Turkish economy. According to them, if the money supply is exogenous, 'central banks will have full control over money supply via policy actions including the adjustments of interest rates and reserve ratios, both of which alter commercial banks' lending decisions' (Guney and Cepni 2016). However, in the case of the endogenous money supply, the demand for bank loans in money creation is essential. 'More specifically, banks create money by meeting the demand of economic agents' (Guney and Cepni 2016). From their conclusions, it can be inferred that the narrow monetary aggregates cannot be used to represent the money supply, and the M3 can be accepted as the broad monetary aggregate to represent the stance of monetary policy of the central bank.

The RER is used to represent both the international trade link of the country and the global economic and political change effects on the country.

This study uses the NARDL model to analyse the existence of asymmetric effects of IPI, M3 and RER on BIST100 stock returns in Turkey. The NARDL model is used for testing potential asymmetric effects in the short run and the long run. There are some advantages of the NARDL model. First, it relaxes the usual assumption in the cointegration analysis that all variables must be integrated of the same order except I(2) variables. Second, 'the NARDL framework enables testing for hidden cointegration so that it avoids omitting any relationship which are not visible in a conventional linear setting. Thus, the NARDL model allows to distinguish the existence of linear cointegration, nonlinear/asymmetric cointegration and lack of cointegration' (Shahzad et al. 2017).

The NARDL model is an asymmetric extension of the linear ARDL model proposed by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (2001). The unrestricted error-correction model in the linear ARDL model takes the following form:

$$\Delta y_t = \delta_0 + \sigma y_{t-1} + \vartheta x_{t-1} + \sum_{i=1}^{p-1} \mu_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \beta_i x_{t-i} + \varepsilon_t \quad (1)$$

where y_t is the dependent variable. x_t is a k x 1 vector of regressors. The parameters of σ and ϑ represent the long-run and the parameters of μ_i and β_i represent the short-run coefficients, respectively. The ε_t is the error term.

The NARDL model decomposes the vector of regressors (x_t) into its positive and negative partial sums. The decomposition of the x_t can be written as follows:

$$x_t = x_0 + x_t^+ + x_t^- \tag{2}$$

In Equation (2), x_0 denotes the initial value. $x_t^+ = \sum_{i=1}^{t} \Delta x_i^+ = \sum_{i=1}^{t} \max(\Delta x_i, 0)$ and $x_t^- = \sum_{i=1}^{t} \Delta x_i^- = \sum_{i=1}^{t} \min(\Delta x_i, 0)$ are positive and negative partial sums.

Non-linear asymmetric long-run cointegrating regression in the NARDL model is written as:

$$y_t = \lambda^+ x_t^+ + \lambda^- x_t^- + e_t \tag{3}$$

In Equation (3), e_t denotes the deviations from the long-run equilibrium. $\lambda^+$and λ^- represent the long-run coefficients associated with the positive and negative changes in x_t, respectively. Then, the asymmetric error correction model can be written as by combining Equations (1) and (3) as follows:

$$\Delta y_t = \delta_0 + \sigma y_{t-1} + \vartheta^+ x_{t-1}^+ + \vartheta^- x_{t-1}^- + \sum_{i=1}^{p-1} \mu_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \left(\beta_i^+ \Delta x_{t-i}^+ + \beta_i^- \Delta x_{t-i}^- \right) + \varepsilon_t \tag{4}$$

In Equation (4), both dependent and explanatory variables are defined as $\vartheta^+ = -\sigma\lambda^+$ and $\vartheta^- = -\sigma\lambda^-$, and $\beta_i^+$and $\beta_i^-$are the short-run adjustments to positive and negative changes in the explanatory variables x_t.

Following Shin, Yu, and Greenwood-Nimmo (2014), in order to test the short- and long-run asymmetric effects of IPI, M3 and RER on stock returns, the NARDL model has to take the following steps. First, Equation (4) should be estimated by standard OLS. Second, the bounds test approach can be applied by using the *F*-statistics (F_{PSS}) developed by Pesaran, Shin, and Smith (2001) to test the existence of an asymmetric long-run relationship among the levels of the series y_t, x_t^+ and x_t^-. Thus, F_{PSS} refers to the joint null hypothesis of no cointegration against the alternative of cointegration. It can be expressed as:

$$H_0 : \sigma = \vartheta^+ = \vartheta^- = 0 \tag{5}$$

$$H_1 : \sigma \neq \vartheta^+ \neq \vartheta^- \neq 0 \tag{6}$$

Third, the null hypothesis is $\vartheta = \vartheta^+ = \vartheta^-$ for the long-run symmetry and $\sum_{i=0}^{q-1} \beta^+ = \sum_{i=0}^{q-1} \beta^-$ for the short-run symmetry is tested by employing the Wald test. Fourth, Equation (4) is utilized to derive asymmetric cumulative dynamic multipliers effect on y_t, of the change in x_t^+ and x_t^- . This process is written as:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial x_t^+}, \text{ and } m_h^- = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial x_t^-} \tag{7}$$

where $(h = 0, 1, 2 \ldots..)$. For Equation (7), if $h \to \infty$, then $m_h^+ \to \lambda^+$and $m_h^- \to \lambda^-$, the long-run coefficients of $\lambda^+$and $\lambda^-$are computed as $\lambda^+ = -\frac{\vartheta^+}{\sigma}$ and $\lambda^- = -\frac{\vartheta^-}{\sigma}$.

The NARDL model is estimated in the study that covers the short and long run of the positive and negative partial sums. Thus, the NARDL model takes the following equation form:

$$\begin{aligned}\Delta BIST100_t = {} & \delta_0 + \sigma BIST100_{t-1} + \vartheta_1^+ IPI_{t-1}^+ \\ & + \vartheta_1^- IPI_{t-1}^- + + \vartheta_2^+ M3_{t-1}^+ \\ & + \vartheta_2^- M3_{t-1}^- + \vartheta_3^+ RER_{t-1}^+ + \vartheta_3^- RER_{t-1}^- \\ & + \sum_{i=1}^{p-1} \mu_i \Delta BIST100_{t-i} + \sum_{i=0}^{q} \beta_{1,i}^+ \Delta IPI_{t-i}^+ \\ & + \sum_{i=0}^{q} \beta_{1,i}^- \Delta IPI_{t-i}^- + \sum_{i=0}^{q} \beta_{2,i}^+ \Delta M3_{t-i}^+ \\ & + \sum_{i=0}^{q} \beta_{2,i}^- \Delta M3_{t-i}^- + \sum_{i=0}^{q} \beta_{3,i}^+ \Delta RER_{t-i}^+ \\ & + \sum_{i=0}^{q} \beta_{3,i}^- \Delta RER_{t-i}^- + \varepsilon_t\end{aligned} \tag{8}$$

IV. The empirical results

The results of the unit root tests

The break-point unit root tests are used to determine the order of integration at level and first difference under the assumption of the presence of intercept for both periods. Different from the standard ADF and Phillips–Perron unit root tests, the structural break-point unit root tests allow us to find stationarity in time series in case of the existence of structural breaks, since ignoring the existence of such breaks can lead us to false acceptance of unit roots as Perron (1989) argues. Also, in order to observe structural breaks, the use of break-point unit root test is important since the 2001 and 2008 financial crisis in Turkey could have created such breaks in Turkish data. The Zivot and Andrews (1992) test is also applied, but the results are the same with the reported outcomes. Table 1 reports the break-point unit root test results. For the full sample period, the RER is level stationary, while all the other variables are stationary at the first differences. For the subsample period, all variables are stationary at the first differences. The unit root test results provide a strong justification for the use of the NARDL model because all dependent variables are I(1) and all the variables are not found to be I(2).

Table 1. Break-point unit root test results.

	ADF Test Statistics		Break-date		
Variables	Level (Intercept)	First difference (Intercept)	Level	First difference	Decision
FULL SAMPLE (1994–2017)					
LBIST100	−3.313835	−14.05392	**1998M10**	**2000M1**	I(1)
	(−4.432140)	**(−4.432140)**			
LIPI	−2.691044	−24.74055	**2001M12**	**2001M12**	I(1)
	(−4.432140)	**(−4.432140)**			
LM3	−2.797010	−19.37642	**2001M10**	**2001M10**	I(1)
	(−4.432140)	**(−4.432140)**			
LRER	−4.747573	−11.92557	**2002M8**	**2008M1**	I(0)
	(−4.432140)	**(−4.432140)**			
SUB-SAMPLE (2002–2017)					
LBIST100	−3.023041	−11.22018	**2009M3**	**2006M2**	I(1)
	(−4.432140)	**(−4.432140)**			
LIPI	−3.210827	−16.92685	**2009M3**	**2007M2**	I(1)
	(−4.432140)	**(−4.432140)**			
LM3	0.020711	−9.668962	**2006M6**	**2006M6**	I(1)
	(−4.432140)	**(−4.432140)**			
LRER	−3.719957	−9.594212	**2004M6**	**2008M1**	I(1)
	(−4.432140)	**(−4.432140)**			

The numbers in parentheses indicate the critical values at 5% significance level. The optimal lag structure is chosen based on the Schwarz information criterion (SIC).

Table 2. Bounds test for cointegration.

Dependent variable	*F*-statistics (F_{PSS})	Bounds critical value**		Outcome
Full sample (1994–2017)		I(0)	I(1)	
LBIST100 = *f*(IPI, M3, RER)	9.016561*	3.23	4.35	Cointegration
Subsample (2002–2017)				
LBIST100 = *f*(IPI, M3, RER)	7.173297*	3.23	4.35	Cointegration

*' indicates the null hypothesis of no cointegration at 5%.
'**'The bounds critical values are taken from Pesaran, Shin, and Smith (2001) with unrestricted intercept and no trend.

The bounds test for cointegration

Table 2 reports the results of the bounds test. Since the F_{PSS} statistics exceeds the bounds critical value at 5% significance level for full and subsamples, the null hypothesis of no cointegration is rejected. Test results imply that there is long-run cointegration relationship between stock returns and the variables of IPI, M3 and RER.

Table 3 shows the Wald test results to see the null hypothesis of long-run symmetry against the alternative of asymmetry between the BIST100 stock returns and selected macroeconomic variables in the NARDL model. Based on the results, for the full and subsample, the null hypothesis of long-run symmetry can be rejected at the 5%. So, the results indicate that the IPI, M3 and RER have asymmetrical effects on BIST100 stock returns for the full and subsample periods.

The NARDL estimation results for BIST100 stock returns

In order to estimate the long-run asymmetrical relations between the BIST100 stock returns and

Table 3. The Wald test results.

Variables	Long-run asymmetry
FULL SAMPLE (1994–2017)	
	BIST100
LIPI	4.609252
	(0.0328)
LM3	5.979542
	(0.0152)
LRER	12.23884
	(0.0006)
SUB-SAMPLE (2002–2017)	
	BIST100
LIPI	11.88607
	(0.0007)
LM3	6.862026
	(0.0096)
LRER	10.90439
	(0.0012)

The numbers in parentheses are p-values and denote the rejection of the null hypothesis of long-run symmetry at the 5% significance level.

Table 4. The NARDL estimation results for the BIST100 full sample period.

Variable	Coefficient	SE	*t*-Statistics	Prob. values
	Dependent variable = LBIST100			
Full sample (1994–2017)				
C	0.838407	0.175079	4.788723	0.0000
LBIST100(−1)	−0.175044	0.031642	−5.532021	0.0000
LRER_P(−1)	−0.027070	0.111680	−0.242392	0.8087
LRER_N(−1)	0.258171	0.083364	3.096895	0.0022
LIPI_P(−1)	0.257581	0.094826	2.716349	0.0071
LIPI_N(−1)	0.037699	0.110940	0.339817	0.7343
LM3_P(−1)	0.107851	0.043763	2.464434	0.0144
LM3_N(−1)	−1.269157	0.479784	−2.645267	0.0087
DLBIST100(−1)	0.316614	0.055287	5.726687	0.0000
DLRER_N	1.095235	0.238732	4.587716	0.0000
DLM3_P(−2)	1.566487	0.280565	5.583336	0.0000
DLRER_P(−6)	0.743268	0.254714	2.918051	0.0038
DLM3_N(−1)	2.578035	0.866240	2.976121	0.0032
DLRER_N(−8)	0.513895	0.261200	1.967441	0.0502
DLM3_N(−8)	2.104187	0.895500	2.349734	0.0196
DLIPI_N(−2)	0.658916	0.239262	2.753956	0.0063
DLRER_P	0.740599	0.284833	2.600113	0.0099
DLM3_P(−9)	0.342380	0.223795	1.529880	0.1273
DLM3_P(−8)	0.637867	0.288165	2.213544	0.0278
DLBIST100(−3)	0.124320	0.053463	2.325332	0.0209
DLM3_P(−10)	0.445520	0.205016	2.173101	0.0307
Long-run asymmetric effects on BIST100				
LIPI_P	1.471524*	0.459913	3.199569	0.0016*
LIPI_N	0.215372	0.616321	0.349447	0.7271
LM3_P	0.616136*	0.183597	3.355924	0.0009*
LM3_N	−7.250516*	3.317582	−2.185482	0.0298*
LRER_P	−0.154649	0.646042	−0.239379	0.8110
LRER_N	1.474893*	0.383469	3.846191	0.0002*
Statistics and diagnostics	**Full sample (1994:01–2017:05)**			
Adj. R^2	0.399806**			
$\chi^2 LM$	10.74459 **(0.5509)*****			
$\chi^2 H$	263.4101 **(0.0537)*****			

'*' indicates the level of significance at 5%.
'**'*Adj.* R^2 represents the estimated value of the adjusted R^2 coefficient in the model.
'***'$\chi^2 LM$ and $\chi^2 H$ denote the Breusch–Godfrey serial correlation LM tests and heteroscedasticity, respectively.
LM: Lagrange Multiplier.

explanatory variables for full and subsamples, the NARDL method is used. The estimation results are presented in Tables 4 and 5, and the statistically significant long-run estimation results analysed with details for BIST100 in the following section. Overall, all results present the existence of asymmetrical effects of the changes in the independent factors, and the results are in line with the economic theory.

Table 4 shows the estimation results for BIST100 for the full sample period. In this period, the positive changes in the IPI and M3 have statistically significant effects on BIST100 returns. Additionally, negative changes in M3 and RER also have significant asymmetrical effects on BIST100 returns. Based on the NARDL estimation results reported in Table 4, while a 1% increase in IPI causes 1.47% increase in BIST100 returns, a 1% increase in M3 causes 0.61% increase in BIST100 returns. On the other hand, a 1% decrease in M3 causes a 7.25% decrease in BIST100 returns. These results about the changes in M3 show that positive changes in M3 cause an increase in BIST100 returns, but negative changes in M3 cause a decrease in stock returns, and the effect of a decrease in M3 is much larger than the increase in M3 on BIST100 returns. Regarding the effect of the RER changes, a 1% decrease in RER (a real depreciation) causes a 1.47% increase in BIST100 returns.

Table 5 shows the estimation results for BIST100 for the subsample period. For the subsample period, the positive changes in IPI and RER and the negative changes in M3 and RER have statistically significant asymmetrical effects on BIST100 returns. Based on the results reported in Table 5, a 1% increase in IPI increases BIST100 returns by 2%. On the other hand, a 1% decrease in M3 leads to 11.22% decrease in BIST100 returns. Regarding the effect of the RER changes, a 1% increase in RER decreases BIST100 returns by 1.91% and a 1% decrease in RER causes a 2.45% increase in BIST100 returns. The negative and positive changes in RER on BIST100 returns have correct signs in line with the theoretical expectations, and the effect of a decrease in RER on BIST100 returns is much higher than the increase in the RER.

On the bottom parts of Tables 4 and 5, the diagnostic tests of estimated NARDL model are presented. The test for the Breusch–Godfrey serial correlation LM test $\left(\chi^2_{LM}\right)$ and the heteroscedasticity test $\left(\chi^2_{H}\right)$ results indicates that there exist no serial correlation and heteroscedasticity so that the NARDL model used in the study is well specified.

The dynamic multipliers: response of the BIST100 stock returns

Besides the long-run NARDL estimation results, the dynamic multipliers can further summarize and explain the analysis of the dynamic effects of the explanatory variables on the stock returns. Figure A1 in the Appendix section plots the dynamic effects of positive and negative changes

Table 5. The NARDL estimation results for the BIST100 subsample period.

	Dependent variable = LBIST100			
Variable	Coefficient	SE	*t*-Statistics	Prob. values
Subsample (2002:01–2017:05)				
C	1.845045	0.385398	4.787381	0.0000
LBIST(−1)	−0.186769	0.041050	−4.549843	0.0000
LRER_P(−1)	−0.357987	0.161813	−2.212345	0.0283
LRER_N(−1)	0.458292	0.154162	2.972800	0.0034
LM3_P(−1)	0.247420	0.149657	1.653246	0.1002
LM3_N(−1)	−2.096904	0.729680	−2.873732	0.0046
LIPI_P(−1)	0.373661	0.115926	3.223258	0.0015
LIPI_N(−1)	−0.168227	0.120361	−1.397683	0.1641
DLRER_N	1.846239	0.228111	8.093614	0.0000
DLIPI_N(−5)	0.553609	0.308068	1.797032	0.0742
DLIPI_N(−2)	1.211503	0.294115	4.119145	0.0001
DLM3_N(−1)	4.187083	1.279706	3.271910	0.0013
DLM3_N(−2)	3.503405	1.224134	2.861946	0.0048
DLIPI_N(−1)	0.920892	0.297631	3.094067	0.0023
DLRER_P(−4)	−0.912296	0.273948	−3.330174	0.0011
DLBIST(−1)	0.180570	0.071464	2.526732	0.0125
Long-run asymmetric effects on BIST100				
LIPI_P	2.000658*	0.458966	4.359053	0.0000*
LIPI_N	−0.900724	0.745766	−1.207783	0.2289
LM3_P	1.324739	0.719341	1.841602	0.0674
LM3_N	−11.22727*	4.716762	−2.380291	0.0185*
LRER_P	−1.916739*	0.974584	−1.966726	0.0509*
LRER_N	2.453793*	0.629528	3.897831	0.0001*
Statistics and diagnostics		**Subsample (2002:01–2017:05)**		
Adj. R^2	0.430116**			
$\chi^2 LM$	14.13653 **(0.2921)*****			
$\chi^2 H$	160.6533 **(0.0653)*****			

'*' indicates the level of significance at 5%.
'**'*Adj.* R^2 represents the estimated value of the adjusted R^2 coefficient in the model.
'***' $\chi^2 LM$ and $\chi^2 H$ denote the Breusch–Godfrey serial correlation LM tests and heteroscedasticity, respectively.

in IPI, M3 and the RER to the BIST100 stock returns. These multipliers show the pattern of adjustment of the Turkish stock returns to their new long-run equilibrium following one-unit positive or negative shock in IPI, M3 and RER.

Regarding the dynamic impacts of IPI changes on BIST100 returns for both sample periods, the study of the dynamic multipliers presented in Figures A1(a,d), respectively, reveals that the positive changes in IPI cause stock returns to respond positively. The BIST100 returns respond mildly to positive changes in the IPI (1.47% and 2%), with adjustment to long-run equilibrium occurring around the 12-month time horizon. As it is seen from the Figure A1(a,d), the effect of a negative change in IPI on BIST100 stock returns in both sample periods is statistically insignificant.

Regarding the dynamic impact of M3 changes on BIST100 returns for the full sample period, presented in Figure A1(b), the positive and negative changes in M3 cause BIST100 stock returns to respond. The BIST100 stock returns respond less to the positive changes in the M3 than the negative changes (0.61% and −7.25%, respectively), with adjustment to long-run equilibrium occurring around the 18 months. More particularly, the absolute effect of a decrease in M3 is larger than that of an increase.

For the subsample period, the dynamic multipliers presented in Figure A1(e) reveal that only negative changes in M3 cause BIST100 returns to respond. The BIST100 returns respond to the negative changes by −11.22%, with adjustment to long-run equilibrium occurring around the 12 months. The absolute effect of a decrease in M3 is larger in the subsample period than the full sample period. For the subsample period, the effect of a positive change of M3 on BIST100 returns is statistically insignificant.

It is observed that stock returns of BIST100 respond significantly only to decreases in RER for the full sample period as depicted in Figure A1(c), achieving long-run equilibrium nearly after a 20-month time horizon. In the subsample period, the dynamic multipliers presented in Figure A1(f) reveal that both the positive and negative changes in RER cause BIST100 returns to respond. The BIST100 returns respond less to the positive changes than the negative changes (−1.91% and 2.45%, respectively), with adjustment to long-run equilibrium occurring around the 6 months.

V. Concluding remarks and policy implications

The study finds that the effects of the changes in IPI, M3 and RER on stock returns are asymmetric, and the effects and asymmetry of independent variables on stock returns are larger after the 2002:01 period compared to the full period of 1994:01–2017:05. Further, the results suggest that contractionary monetary policies appear to reduce the stock returns more than the expansionary monetary policies stimulate them. Also, these asymmetries are more pronounced in cases of contractionary monetary policy and currency appreciation occurred together.

The results of NARDL estimations show that the increase in IPI in Turkey causes BIST100 stock returns to increase. These results are consistent with the theory and in line with the empirical results. By using IPI as a proxy for measuring economic activity, theoretically and empirically, it is expected that the economic activity and stock prices are positively related.

The stance of monetary policy can be expansionary or contractionary. Generally, the expansionary monetary policy is designed to stimulate the economic activity through the traditional interest rate channel or the newer credit channel. An increase in money supply via these channels causes interest rates to decrease and leads to an expansion of the loan abilities of banks and credit borrowing abilities of the firms. The result is the increasing profit opportunities of the firms and, as a result, increasing share prices and returns. So, it is expected a positive relationship between a positive change in M3 and stock returns as this study's results indicate.

The NARDL estimation results show that a real appreciation of the Turkish Lira (TL) (an increase in RER) in Turkey causes BIST100 stock returns to decrease. These results are consistent with the theory and in line with the empirical results.

Findings of this article are in line with related literature and with the expectations of the economic theory. Like the findings of Koutmos (1998, 1999), Bahmani-Oskooee and Saha (2015, 2016), Ajaz et al. (2017), Bernanke and Kuttner (2005), Chen (2007), Ismail and Isa (2009), Chulia, Martens, and Dijk (2010), Zare and Azali (2015) and Ajaz et al. (2017), this study also finds the asymmetrical link between monetary policy and stock returns in Turkey, indicating that tight and easy monetary policies appear to have a different impact on the stock returns and also asymmetrical link between changes (real appreciation or depreciation) in RER and stock returns.

The result of much larger and more pronounced asymmetrical effects of the contractionary monetary policy and currency appreciation on stock returns in the subsample period compared to full period can be explained by the stance of monetary policy and the exchange regime in Turkey after the 2002 period. After the 2001 financial crisis, as Alp and Elekdağ (2011) argue, an inflation targeting framework and a flexible exchange rate regime are in place. The economy has been more stable, and the economic activity is less sensitive to the external shocks than the pre-2001 period. All these developments have increased the effectiveness of the central bank policies in Turkey.

Such findings do have implications for policymakers as well as market participants. Positive developments in economic activity, which are represented by increases in IPI, have positive effects on market returns. This implies the requirement in physical capital investment for the stock returns to rise.

Policymakers who try to manage the interest rate and the exchange rate will have a different dose of intervention if they know that effects of the tight monetary policy are different from the easy monetary policy or effects of currency depreciation are different from appreciation. Empirical findings indicate that the easy monetary policy and real depreciation of the currency together improve the stock returns, while the opposite shocks harm them. The harm of tight monetary policy is much larger than the benefit of easy policies. So, for a stable economic growth and stable positive stock returns, the expansionary monetary policies should be preferred compared to the tight policies.

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Appendix

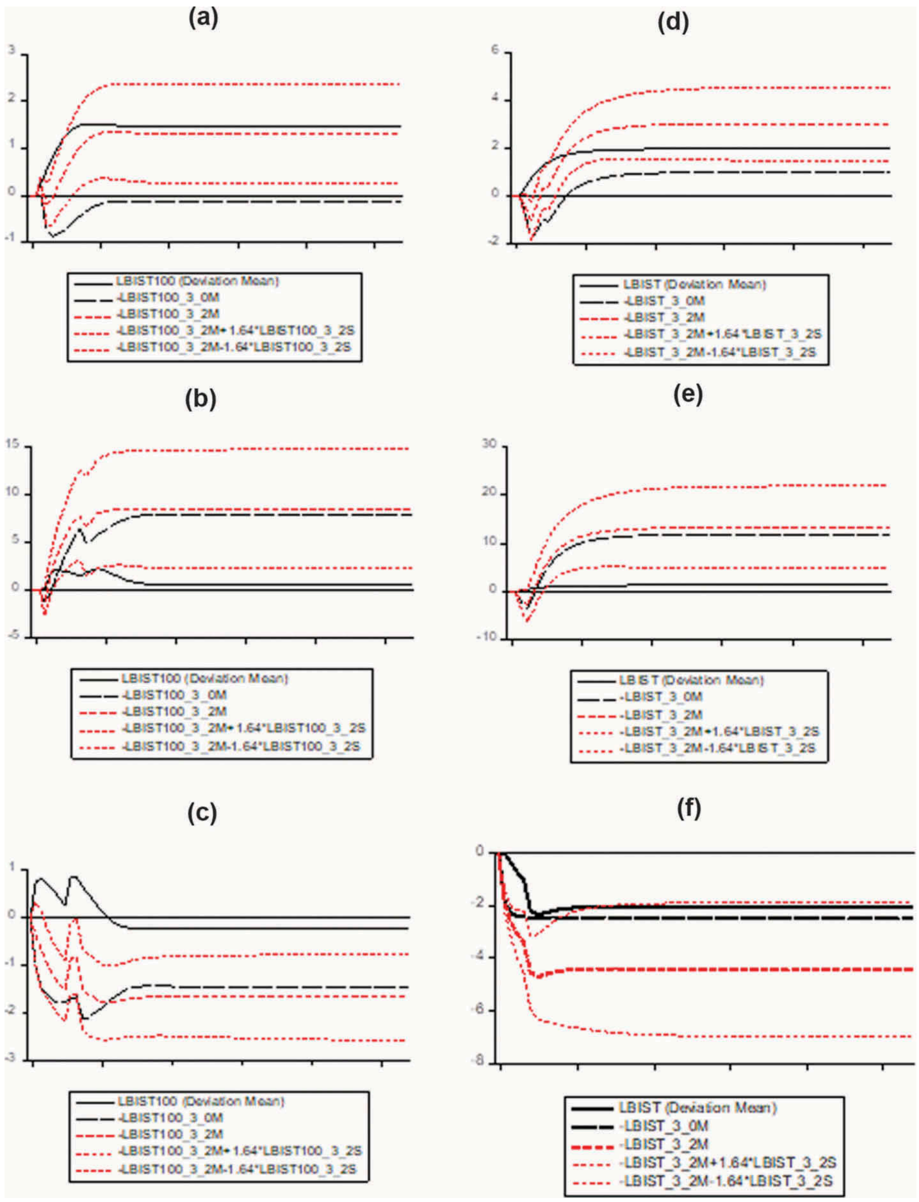

Figure A1. Dynamic multiplier for BIST100. (a) A positive shock from industrial production index (full sample). (b) A positive and negative shock from money supply (full sample). (c) A negative shock from real effective exchange rate (full Sample). (d) A positive shock from industrial poduction index (subsample). (e) A negative shock from money supply (subsample). (f) A positive and negative shock effective exchange rate (subsample).