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The Effects of Industrial Production, Gold Prices and Oil Prices on Turkish Stock Market

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Stock market, Oil prices, Gold prices, Non-linear ARDL.

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Abstract
This paper aims to investigate the asymmetric effects of industrial production, gold prices and oil prices on Turkish stock market returns by employing nonlinear Autoregressive Distributed Lag (NARDL) model. The monthly data are used for the period from 2003:01 to 2018:08. The empirical findings indicate that the industrial production and gold prices have asymmetrical effects on Turkish stock returns. However, the findings of this study imply that oil prices doesn't have any asymmetrical effects on Turkish stock returns. The empirical results support the evidence of the significant relation between industrial production, gold prices and stock returns in Turkey. Empirical findings suggest that gold plays important role for portfolio decisions for investors.

1. Introduction

The dynamic interactions between macroeconomic variables such as industrial production, oil prices, gold prices changes and stock market returns play a crucial role for both policymakers and investors, especially after the 2008 financial crisis. The aim of this paper is to examine empirically the dynamic relationship between the selected macroeconomic variables and the stock market returns in Turkey by using nonlinear Autoregressive Distributed Lag (NARDL) model over the monthly period from 2003 to 2018.

Theoretical and empirical relationship between industrial production and stock returns are expected to be positive since the industrial production as a proxy for measuring real economic activity is procyclical. Fama (1981,1990) and Schwert (199O) provided an evidence for the positive relationship between the stock market returns and real economic activity. They also discussed the correlation between stock returns and growth rates of production that reflect the impact of industrial production on the expected future cash flows. There are also some empirical findings that support the positive significant relation between industrial production and stock market returns such as Kwon et al. (1997), Kwon and Shin (1999), Chen (1991), Mukherjee and Naka (1995), Apergis (1998), Gjerde and Saettem (1999), Wongbangpo and Sharma (2002), Sari and Soytas (2005) and

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among others. On the other hand, Flannery and Protopapadakis (2002) and Kandır (2008) found that industrial production doesn't have any significant effect on stock market returns.

Theoretically the stock market returns and gold prices are negatively related. Previous empirical studies from Moore (1990) and Büyükşalvarcı (2010), Rahman and Mustafa (2018) and Tursoy and Faisal (2018) found an evidence that both short-run and long-run results confirm the negative relationship between the gold price and stock prices. Additionally, Raza et al. (2016) showed that gold prices have a positive impact on stock market prices of large emerging BRICS economies but gold volatilities have negative impact on stock markets of all emerging economies in both the short-run and the long-run. On the other hand, gold is also considered as a store of value, a safe haven and a hedge for the stock markets. Hillier et al. (2006), Batten et al. (2010), Baur and Lucey (2010), Baur and McDermott (2010), Ciner et al. (2013), Hood and Malik (2013), Gokmenoglu and Fazlollahi (2015) and Arouri et al. (2015) found that the gold asset is regarded as a safe haven for stocks for most developed markets during the peak of the 2008 global financial crisis. Chkili (2016) examined the optimal hedging strategies between gold and the BRICS stock markets and found an evidence that investors should add gold in their portfolios in order to reduce the risk without lowering the anticipated returns.

Besides the above listed variables, another variable included in the study is oil prices. The theoretical relationship between oil prices and stock returns can be positive or negative. Changes in oil prices can affect stock market returns via different channels such as stock valuation, output, monetary, fiscal and uncertainty (see Degiannakis et al., 2018). Oil price changes may affect stock market returns through income effect and production cost effect. The effect depends on whether the country is oil-importer or oil-exporter. Degiannakis et al. (2018) point out that an increase in oil prices causes to an increase in production costs (production cost effect) and also leads to higher disposable income and economic growth through income effect. If the income effect is smaller than the production cost effect, it leads to lower stock market returns for oil-importing country. On the contrary, when the income effect dominates the production cost effect, it causes to higher stock market returns for oil-exporting country. Some recent empirical studies provide an evidence for the positive and statistically significant relationship between oil prices and stock returns (Narayan and Narayan, 2010; Aloui et al. 2012; Zhu et al. 2014; Jain and Biswal (2016), Silvapulle et al. 2017; Tursoy and Faisal 2018). However, Jones and Kaul (1996), Papapetrou (2001), Nandha and Faff (2008), Driesprong et al. (2008), Park and Ratti (2008), Bjornland (2009), Chen (2010), Basher et al. (2012), and Cunado and De Gracia (2014) found a significant negative relationship between oil prices and stock market returns. On the other hand, El-Sharif et al. (2005), Degiannakis et al. (2013) and Sukcharoen et al. (2014) found no significant relationship between oil prices and stock market returns.

This paper examines the asymmetric relationship between industrial production index (IPI), gold prices (GOLDP) and oil prices (OILP) and stock market returns in Turkey by using the NARDL approach. The empirical results support that IPI and

GOLDP have asymmetrical effects while OILP doesn't have any asymmetrical effects on Turkish stock market returns.

The rest of the paper is organized as follows. The data and empirical methodology are described in Section 2. Section 3 reports the empirical results. Section 4 includes the concluding remarks.

2. The Data and the Empirical Methodology

The main aim of this study is to examine the asymmetric effects of industrial production index (IPI), gold prices (GOLDP), oil prices (OILP) on the stock market returns (BIST100) in Turkey over the period 2003:01 and 2018:08 by using the NARDL approach developed by Shin et al. (2014). The monthly data used in the study is downloaded from the web site of https://www.investing.com , the Federal Reserve Bank of St. Louis Economic Data (FRED) and the statistical database of the Organization for Economic Co-operation and Development (OECD). In this study, the NARDL model is used to test whether the positive and negative shocks of IPI, GOLDP and OILP have any asymmetrical effects on the BIST100. The basic model used in the study is given as follows;

$$LBIST100_t = a_0 + a_1 IPI + a_2 GOLDP + a_3 OILP + \varepsilon_t \quad \textbf{(1)}$$

In equation (1), LBIST100, IPI, GOLDP and OILP represent the stock prices, industrial production index, gold price, and oil price for Turkey respectively.

Following Shin et al. (2014), equation (1) can be extended to the nonlinear co-integrating regression in the NARDL model. This can be written as follows:

$$y_t = \alpha^+ z_t^+ + \alpha^- z_t^- + u_t \quad \textbf{(2)}$$

In equation (2), $\alpha^+$and α^- represent the long-run coefficients associated with the positive and negative changes and z_t is the vector of regressors which is decomposed as:

$$z_t = z_0 + z_t^+ + z_t^- \quad \textbf{(3)}$$

In equation (3), z_t^+ and z_t^- denote the positive and negative partial sums in z_t. This can be specified as:

$$z_t^+ = \sum_{i=1}^{t} \Delta z_i^+ = \sum_{i=1}^{t} \max(\Delta z_i, 0) \text{ and } z_t^- = \sum_{i=1}^{t} \Delta z_i^- = \sum_{i=1}^{t} \min(\Delta z_i, 0) \quad \textbf{(4)}$$

Then, the asymmetric error correction model in the NARDL form used in the study can be designed as

$$\Delta y_t = \delta_0 + \theta y_{t-1} + \rho^+ z_{t-1}^+ + \rho^- z_{t-1}^- + \sum_{i=1}^{p-1} \mu_i \Delta y_{t-i} + \sum_{i=0}^{q-1} (\beta_i^+ \Delta z_{t-i}^+ + \beta_i^- \Delta z_{t-i}^-) + u_t$$

(5)

In order to estimate the asymmetric effects of IPI, GOLDP and OILP on stock market returns in Turkey, the NARDL model in equation (5) covers some steps. First, the equation (5) is used to determine co-integration relations between the variables by ordinary least squares (OLS) and then the bounds test procedure developed by Pesaran et al. (2001) is applied by using the F-statistics (F_{PSS}). The F-statistics (F_{PSS}) can be conducted the joint null hypothesis of no co-integration

$(H_0: \rho = \theta^+ = \theta^- = 0)$ against the alternative of co-integration $(H_1: \rho \neq \theta^+ \neq \theta^- \neq 0)$. Second, the Wald test is used to examine the null hypothesis is $\sum_{i=0}^{q-1} \beta^+ = \sum_{i=0}^{q-1} \beta^-$ and $\rho = \theta^+ = \theta^-$ for the short-run symmetry and the long-run symmetry respectively. Third step includes to derive asymmetric cumulative dynamic multipliers effect of a unit change in z_t^+ and z_t^- on y_t by using the equation (5) as follows:

$$m_k^+ = \sum_{j=0}^{k} \frac{\partial y_{t+j}}{\partial z_t^+}, \text{ and } m_k^- = \sum_{j=0}^{k} \frac{\partial y_{t+j}}{\partial z_t^-} \qquad (k = 0,1,2 \ldots..) \qquad \textbf{(6)}$$

where if $k \to \infty$, then $m_k^+ \to \alpha^+$ and $m_k^- \to \alpha^-$, the long-run parameters of α^+ and α^- are calculated as $\alpha^+ = -\frac{\rho^+}{\theta}$ and $\alpha^- = -\frac{\rho^-}{\theta}$.

3. The Empirical Results

3.1. The Zivot and Andrews Unit Root Tests Results

The Zivot and Andrews (1992) unit root test is used to determine the order of integration of the variables at level and first difference. Table 1 presents the Zivot-Andrews (ZA) unit root tests results at level and first difference. The ZA unit test results show that LBIST100, LIPI, LGOLDP and LOILP are stationary at the first difference I(1). So, the ZA unit root tests results provide an evidence for the use of the NARDL model since LBIST100, LIPI, LGOLDP and LOILP are not found to be I(2).

Table 1: Zivot-Andrews Unit Root Test Results

Variables	LEVEL (INTERCEPT)	Break Dates	FIRST DIFFERENCE (INTERCEPT)	Break Dates
LBIST100	-3.659081 (10)	2015:M02	-14.43514* (0)	2009:M03
LIPI	-4.118511 (1)	2008:M07	-16.76970* (0)	2009:M04
LGOLDP	-2.816127 (1)	2013:M02	-16.43224* (0)	2011:M09
LOILP	-4.198080 (1)	2014:M07	-10.67645* (0)	2016:M02

Note: The numbers in parentheses indicate the chosen lag length.
"*" indicates the critical values -5.34, -4.93 and -4.58 at 1%, 5% and 10% significance levels respectively.

3.2. The Bounds Test for Co-integration and The Wald Tests Results

Table 2 displays the bounds test for co-integration and the Wald tests results. In table 2, the test results provide an evidence for the existence of asymmetric long-run relationships between stock returns and the variables of IPI, GOLDP and OILP since the F_{PSS} statistics (5.142932) exceeds the bounds critical value at 5% significance level. Table 2 also reports the Wald statistics for the long-run asymmetry between the stock markets returns and the variables of IPI, GOLDP and OILP. The test results indicate that the null hypotheses of long-run symmetry can be rejected except OILP at 5% significance level.

Table 2: Bounds Test for Co-integration and The Wald Tests Results

Bounds Test for Co-integration	
LBIST100=f(LIPI, LGOLDP, LOILP)	
F-statistics (F_{PSS})	5.142932 **
The Wald Test for Long-run Asymmetry	
LIPI	8.796322 (0.0035)
LGOLDP	7.699499 (0.0061)
LOILP	2.425504 (0.1212)

Note: "*"The bounds critical values are taken from Pesaran et al. (2001) with unrestricted intercept and no trend (Case III). Upper (lower) bound with k=3 is 4.35 (3.23) at 5% significance level.
"**"The numbers in parentheses are p-values and denote the rejection of the null hypothesis of long-run symmetry at the 5% significance level.

3.3. The NARDL Estimation Results for BIST100

Table 3 displays the NARDL estimation results for the BIST100 stock market returns. In table 3, both IPI and GOLDP have statistically significant effects while OILP doesn't have any significant effects on BIST100 returns at 5% significance level. Based on the estimation results, a 1% increase in IPI leads to an increase (2.20%) in BIST100 returns. On the other side, a 1% decrease in IPI and GOLDP causes a decrease (4.51%) and an increase (1.48%) respectively. The estimation results for the changes in IPI indicate that both positive changes in IPI cause an increase in BIST100 returns, but negative changes in IPI causes a decrease in stock returns and the effect of a decrease in IPI is much higher than the increase in IPI on BIST100 stock market returns.

Table 3: The NARDL Estimation Results

Dependent variable = LBIST100				
Variable	**Coefficient**	**Std. Error**	**t-statistics**	**Prob. values**
C	1.481412	0.368881	4.015966	0.0001
LBIST100(-1)	-0.145701	0.038206	-3.813595	0.0002
LIPI_P(-1)	0.321811	0.154546	2.082302	0.0388
LIPI_N(-1)	-0.658326	0.217312	-3.029410	0.0028
LGOLDP_P(-1)	-0.004563	0.049517	-0.092149	0.9267
LGOLDP_N(-1)	0.216297	0.076978	2.809844	0.0055
LOILP_P(-1)	-0.056204	0.041914	-1.340926	0.1817
LOILP_N(-1)	0.013850	0.026955	0.513824	0.6080
DLGOLDP_N	0.616679	0.186269	3.310681	0.0011
DLIPI_N(-1)	1.160079	0.455966	2.544221	0.0118
DLIPI_N(-2)	0.978409	0.460372	2.125259	0.0350
DLGOLDP_P(-4)	-0.347401	0.173620	-2.000924	0.0470
Long-Run Asymmetric Effects on BIST100				
LIPI_P	2.208711 *	0.874319	2.526208	0.0124 *
LIPI_N	-4.518332*	1.908210	-2.367838	0.0190*
LGOLDP_P	-0.031317	0.338630	-0.092482	0.9264
LGOLDP_N	1.484528*	0.531024	2.795596	0.0058*
LOILP_P	-0.385745	0.324421	-1.189028	0.2361
LOILP_N	0.095059	0.181273	0.524393	0.6007
Statistics and diagnostic				
$Adj.R^2$	0.195503 **			
χ^2_{LM}	15.99215 **(0.1916)****			

Note: "*" indicates the level of significance at 5%.
"**" $Adj.R^2$ represents the estimated value of the adjusted R^2 coefficient in the model.
"***" χ^2_{LM} denotes the Breusch-Godfrey serial correlation LM tests.

Figure 1 in Appendix summarizes the dynamic effects of positive and negative changes in IPI, GOLDP and the OILP to the BIST100 stock market returns. Dynamic multipliers in figure 1 denote the pattern of adjustment of the BIST100 stock returns to one unit positive or negative shock in IPI, GOLDP and OILP from an initial level to its long-run equilibrium at 5% significance level. The dynamic multipliers in figure (1.a.) show that industrial production index has positive and negative impact on BIST100 stock market returns The multiplier graph shows that the negative effects of industrial production index are greater than the positive effect. However, the dynamic multipliers in figure (1.b.) for the gold prices confirms a negative impact on the BIST100 stock returns. In figure (1.c.), the BIST100 stock market returns respond less to the negative changes than the positive changes in OILP.

4. Concluding Remarks

This paper examines the asymmetric impact of industrial production , gold prices and oil prices on stock market returns in Turkey. The NARDL model is used to determine the asymmetric co-integration relations among the selected macroeconomic variables and stock market returns for the period 2003:01 and 2018:08.

The empirical results indicate that the industrial production and gold prices have asymmetrical effects on Turkish stock returns while oil prices doesn't have any asymmetrical effects on Turkish stock returns. The NARDL estimation results are in line with the theoretical expectations that confirm the positive relationship between IPI and BIST100. Additionally, the estimation results indicate that there is a negative relationship between GOLDP and BIST100. However, the results also show that there is no significant relationship between OILP and BIST100.

Empirical findings suggest that gold can be regarded as a store of value or a safe haven to protect investors from any risks. Also, gold prices should be considered as an important indicator for both individuals, investors, policymakers and managers who try to manage their portfolio and investment decisions.

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Appendix:

Dynamic Multipliers

Figure 1.a. A Positive and Negative Shock from Industrial Production Index

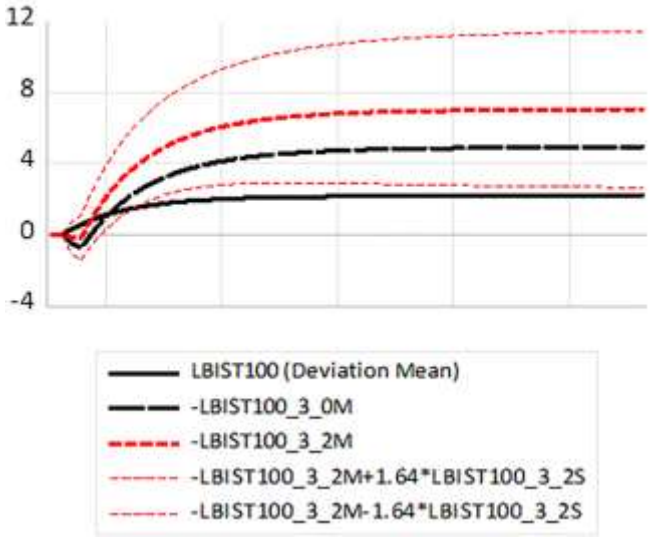

Figure 1.b. A Positive and Negative Shock from Gold Prices

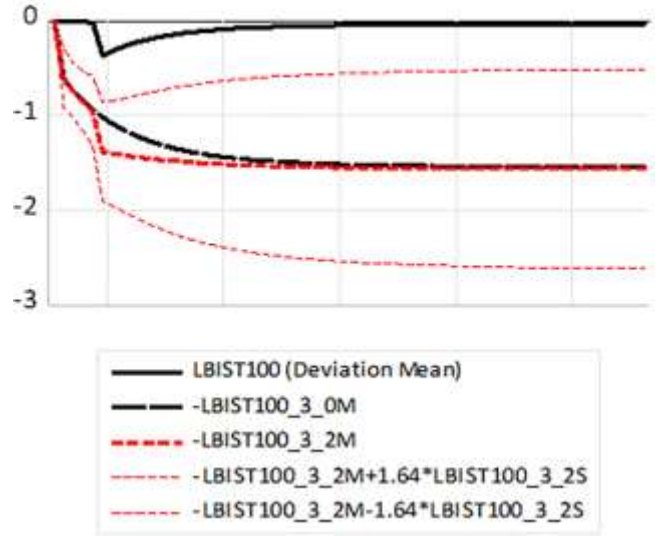

Figure 1.c. A Positive and Negative Shock from Oil Prices