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## Araştırma Makalesi • Research Article

### Macroeconomic Variables and Sector-Specific Returns: Evidence from Turkish Stock Exchange Market

*Makroekonomik Değişkenler ve Sektöre Özgü Hisse Senedi Getirileri: Borsa İstanbul Örneği*

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#### ÖZ

Bu çalışma, makroekonomik değişkenlere etki eden şokların Borsa İstanbul'daki sınai ve mali hisse senedi getirileri üzerindeki etkisini incelemektedir. Bu amaçla, genelleştirilmiş tahmin hatası varyans ayrıştırılmaları ile genelleştirilmiş etki-tepkiler kullanılmaktadır. Çalışma sonuçları, enflasyon, döviz kuru ve para arzı büyüme oranının BİST sınai ve mali endekslerindeki oynaklığı tahmin etmek için önemli bilgiler sağladığını göstermektedir. Sanayi üretiminin ise hisse senedi getirileri üzerindeki etkisinin hem kısa hem de uzun vadede ihmal edilebilir olduğu görülmüştür. Bu çalışma, gelişmekte olan bir ülkede sektörel borsa davranışına ilişkin anlayışımızı genişletmektedir.

#### ABSTRACT

This study investigates the impact of macroeconomic variable shocks on industrial and financial stock returns in Borsa Istanbul. To this end, we use the generalized forecast error variance decompositions and generalized impulse responses. The results show that inflation, the growth rate of the money supply, and the exchange rate provide significant information for forecasting industrial and financial stock market volatility. Industrial production (IP) growth does not provide significant information for financial sector investors. The study extends our understanding of sectoral stock market behavior in a developing country.

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**EXTENDED ABSTRACT**

The fundamental macroeconomic variables (MV) and stock returns (SR) nexus has been the subject of many papers in finance and economics. Even though the MV are considered as the leading indicators of SR (Lahmiri, 2011), empirical research has not yet reached a consensus on the magnitude and impact order of the MV on SR. The objective of this paper is, therefore, to identify the persistence of sector-specific SR in Borsa Istanbul as a response to innovations in several fundamental MV. For this goal, this paper explores the impact of monetary policy, economic growth, inflation, and real effective exchange rates on financial and industrial SR realized in Borsa Istanbul. Particularly, the role of money supply growth in explaining sectoral forecast error variances is of special interest. We use the growth rate of the money supply to measure the stance of monetary policy.

This study adopts the generalized forecast error variance decomposition technique and generalized impulse response functions of Koop et al. (1996), and Pesaran and Shin (1998). Unlike the orthogonalized technique, originally developed by Sims (1980), the results of the generalized methodologies are insensitive to the order of variables in which they are entered into the vector autoregression (VAR). This feature of the generalized approach enables us to make robust comparisons when assessing the impact of SR, industrial production, the money supply, inflation, and exchange rates on each dependent variable in the VAR at different horizons.

This research examines monthly data for the period from November 2008 to August 2020. This start date is chosen since the 2007 Global Financial Crisis started to have an impact on Turkish financial markets by the end of 2008, even though at the beginning of the crisis, the performance of the Turkish stock exchange was relatively better than that of other emerging countries, such as Brazil, Poland and South Korea (Macovei, 2009). Lee and Kim (1993) and Choudhry (1996) suggest that market behavior is different in pre-crash and post-crash periods, hence we determined the starting date of the data after the breakdown of the Turkish economy.

In this study, we use The Borsa Istanbul industrial and financial indexes to measure stock prices. We include measures of monetary policy, real output, and inflation in our VAR analysis, consistent with the literature on developed markets (see, e.g., Fama, 1981; Mauro, 2003; Wongbangpo and Sharma, 2002; Erbaykal et al., 2008). We also include the real effective exchange rate (RE) as a proxy for the exchange rate. The data used in this paper are obtained from the Central Bank of Turkey.

The novelty of this study is twofold. First, the paper utilizes Turkish data after the global breakdown in 2007. Economics and financial crisis refer to economies when they suffer from lower income and production, higher prices and unemployment rate, currency depreciation, debts, and financial institutions bankruptcies. An economic and financial crisis is a point of instability that changes the decision and consumption behavior of investors and consumers, respectively. These micro-level behavioral changes eventually will be reflected in the relationships between macro-level variables and their relations with stock exchange markets. Second, this paper employs the generalized forecast error variance decomposition techniques as well as generalized impulse response functions to determine the information content of the MV. The previous studies that employ VAR models and innovation accounting techniques for Turkish data are subject to the orthogonality critique of Lutkepohl (1991). The generalized method provides superior results when compared to the orthogonalized approach since the generalized approach provides more realistic results (Dekker et al., 2001).

The results of this study reveal that the exchange rate explains more of the forecast error variance of SR than any other macroeconomic variable for the financial and industrial sectors. Therefore, the findings suggest that investors wishing to invest in sector-specific SR in Borsa Istanbul should pay more attention to exchange rate fluctuations. Furthermore, narrowly defined monetary variable contains less information on the volatility of sector-specific SR. Hence, the investors in both sectors should be alert to the money supply announcements and closely watch a broader measure of money supply growth and inflation rates.

The generalized impulse response results reveal that the initial impact of exchange rates on the stock return in both sectors is positive and significant. Even though the exchange rate responses are negative in the second horizon, they are insignificant and die out after the 7th horizon in both markets. The money supply innovations, whether in M1 or M2, on both industrial and financial markets are negative and significant. If the innovation is in M2, investors should also pay attention to the 3rd horizon, during which the impact is still negative and significant. That is not the case if there is a shock in the narrowly-defined money supply. In all other cases, there is a variation of responses, and none of them are significant on any horizon. However, the volatility of the responses may still contain exploitable results by investors in the emerging market.

The findings of this study may be of importance to investors. The results reveal that investors should pay close attention to exchange rates as it explains more of the forecast error variance of returns in the financial and industrial sectors than any other MV. Additionally, those who want to invest in industrial stocks should carefully watch money supply, foreign exchange rates, and industrial production growth rates. However, the responses of SR to innovations in the growth of industrial production do not seem to provide useful information for those who wish to invest in financial stocks.

The findings are also likely to be of interest to policymakers. They should focus more on exchange rates than other MV if they desire to improve overall financial stability. If, however, the interest is to prioritize one of the two sectors, the differential effects of MV are also identified to do so. Thus, the results of this study may be useful for policymakers interested in encouraging long-term economic growth and market stability. Additionally, the significant interactions between the SR and the MV suggest that well-thought-out macroeconomic policies may yield impressive gains.

## Introduction

The effect of the fundamental macroeconomic variables (MV) on the stock market returns (SR) have been the subject of many papers in finance and economics. Macroeconomic developments simultaneously affect business cash flows, investment opportunities, and discount rates, and contribute to market risk (Flannery and Protopapadakis, 2002). Even though the MV are considered as the leading indicators of SR (Lahmiri, 2011), empirical research has not yet reached a consensus on the magnitude and impact order of these variables on SR. The main objective of this study is, therefore, to identify the persistence of sector-specific stock returns in Borsa Istanbul as a response to innovations in several fundamental MV. For this goal, this paper explores the impact of innovations in monetary policy, economic growth, inflation, and real effective exchange rates on financial and industrial SR realized in Borsa Istanbul. In particular, the role of money supply growth in explaining sectoral forecast error variances is of special interest. We use the money supply growth to measure the stance of monetary policy.

Monetary policy influences the economy through the monetary transmission. Expansionary monetary policy leads to interest rates to decline by creating excess liquidity, which leads to higher demand for stocks, thus to higher stock prices. On the other hand, a lower interest rate increases stock prices, while expansion in money supply (MS) may result in a higher inflation rate. Higher inflation rates cause the nominal interest rate to rise according to the Fisher equation and leads to a drop in stock prices. These explanations indicate that the total effect of innovations in MS on stock prices turns out to be an empirical question. There is growing empirical literature on the subject. Thorbecke (1997) utilizes a six variable VAR model and reports how much variation in SR accounts for innovations in monetary policy. The results are sensitive to the proxies used for monetary policy stances. Patelis (1997) reports that shocks to monetary policy variables account for 3 percent of the forecast error variance (FEV) of SR, which seems to be modest. Lastrapes (1998) investigates the responses of equity prices to innovations in monetary policy stances in Holland and G-7 countries and finds similar results to those reported by Thorbecke (1997), except for Japan and Holland. For Japan and Holland, monetary policy shocks account approximately 40 % and 60 % variations in SR, respectively. For all other countries, the portion explained is about 15 %. This lack of consensus in studies might be the use of different stances of monetary policy in different countries. In this study, we use the growth of M1 and M2 as the stance of monetary policy. Thus, using different monetary data from an emerging market, our study attempts to shed light on the relationship between monetary policy and stock returns.

Although the methodologies used in this area of research are diverse, Johansen's cointegration methodology, VAR analysis, and Granger causality tests have been the common methodological choices since the late 1990s (Thorbecke, 1997; Phylaktis and Ravazzolo, 2005; Paye, 2011; Lairellakpamand and Dash, 2012; Tuncer ve Turaboglu, 2014; Tripathi and Kumar, 2015; Cyrus and Kirwa 2015). A number of recent studies have applied more advanced methodologies, such as Autoregressive Distributed Lag (ARDL) approaches and Toda-Yamamoto procedure (Aydemir and Demirhan, 2009; Ozlen and Ergun, 2012; Bahmani-Oskooee and Saha, 2016; El Abed and Zardoub, 2019). Moreover, Ewing (2001a) applies the GIR analysis to examine the transmission of shocks among the fundamental state variables for the United States. Erdem et al. (2005) use the GARCH modeling approach to explore the impact of innovations in several MV on stock market prices.

Several studies have examined the relationship between MV and SR for the case of Turkey. They use various methodologies such as the VAR model (Kargi and Terzi, 1997), a multiple

regression model (Kandir, 2008; Büyükşalvarcı and Abdioğlu, 2010), the ARDL model (Ozlen and Ergun; 2012; Tursoy, 2017), Johansen cointegration method (Tuncer and Turaboglu; 2014), and Granger causality (Tuncer and Turaboglu; 2014; Tursoy, 2017). However, there is yet no consensus on whether and how fundamental MV affect SR.

Different from the previous studies, this study adopts the generalized forecast error variance decomposition (GVD) technique and generalized impulse response functions (GIR), developed in Pesaran and Shin (1998) and Koop et al. (1996) for the case of Turkey. Unlike the orthogonalized technique, originally developed by Sims (1980), the calculated values of the generalized methodologies are insensitive to the order of variables in the vector autoregression (VAR). As it is discussed in Hamilton (1994) and Enders (1995), the sensitivity order of variables in the orthogonalized method is due to the Cholesky decomposition which restricts the VAR model by preventing the contemporaneous effect of a variable on another. The insensitivity of the results to the ordering of the variable also makes them robust. This feature of the generalized approach enables us to make robust comparisons when assessing the impact of independent variables on each dependent variable in the VAR at different horizons.

The novelty of this study is twofold. First, the paper utilizes Turkish data after the global breakdown in 2007. Economic and financial crisis refers to economies when they suffer from lower-income and production, higher prices and unemployment rate, currency depreciation, debts, and financial institutions bankruptcies. An economic and financial crisis is a point of instability that changes the decision and consumption behavior of investors and consumers, respectively. These micro-level behavioral changes eventually will be reflected in the relationships among macro-level variables and their relations with stock exchange markets. Thus, using post-crisis data from an emerging market, our study attempts to provide a significant contribution to the literature. Second, to the best of our knowledge, this paper is the first to employ the GVD techniques as well as GIR *functions* to determine the information content of the MV. The previous studies that employed VAR models for Turkish data are subject to the *orthogonality* critiques as pointed out in Lutkepohl (1991). On the other hand, the *generalized* methods provide realistic results (Dekker et al., 2001). Moreover, the GVD techniques allow one to reveal the impact order of the variables on the returns.

The rest of the paper is outlined as follows: Next section reviews the related literature. The Methodology Section gives a brief explanation of the methodologies. The Data Section introduces the data utilized in this study. In The Result Section, we report the results of the preliminary analysis, the variance decompositions of the stock returns, and the generalized impulse responses to them. The last section provides concluding remarks.

### Literature Review

Many researchers have studied the relationship between MV and SR. By employing a multivariate arbitrage-pricing model, Chen et al. (1986) find a significant relationship between several fundamental MV and SR. IP, inflation, MS, real exchange rates, and long term interest rates are the utilized variables. They conclude that many macroeconomic sources of risk are significantly priced. For the United Kingdom, Cheng (1995) finds similar results, but both contradict those of Poon and Taylor (1991). Hamao (1988), Brown and Otsuki (1990), and Mukherjee and Naka (1995) for Japan, and Ulku and Demirci (2012) for Croatia, Hungary, the Czech Republic, Russia, Poland, Romania, Ukraine, and Turkey further verify the significant relationships between MV and SR.

Most studies on the relationship between SR and fundamental MV have been concentrating on developed markets. The literature on developing and emerging markets has been growing in recent years. Mookerjee and Yu (1997) find that M1, M2, foreign exchange reserves, and SR are cointegrated for Singapore. Their study does not indicate the presence of cointegration between exchange rates and SR. Darrat and Mukherjee (1987) employ a VAR model for Indian data between 1948 and 1984 and find significant causal relationships between SR and some fundamental MV. Wongbangpo and Sharma (2002) study the role of selected MV on SR for a couple of far-east countries. They observe long run and short run relationships between MV and SR. Their results show that MV have a significant impact on the forecast error variance of SR. In order to explore the relationship between the exchange rate and the total value of stock transactions, Mitra (2017) adopts the cointegration technique for South African data for the period of 1979 - 2014. They find a positive long run association between them. Kwofie and Ansah (2018) investigates the same relationships for Ghana using the ARDL approach and reveals a significant relationship between them.

Several studies have examined the interaction of MV with SR in Turkey. Kargi and Terzi (1997) utilize a VAR model and report that inflation explains a considerable portion of the variance of interest rate and SR. Metin and Muradoglu (2000) study the nexus between stock prices and MS, inflation rate, interest rates, exchange rates, and budget deficits. Using a multiple regression model, Kandir (2008) finds that exchange rate, interest rate, and inflation rate have significant effects on SR, unlike MS, IP, and oil prices. However, applying a similar approach to Istanbul Exchange 100-Index returns, Büyükşalvarcı and Abdioğlu (2010) report that MS and oil prices have significant relationships with SR. They also find that IP, interest rate, and the exchange rate have a negative impact on SR. Ozlen and Ergun (2012) apply the ARDL model to MV and SR of 45 companies, and find that the changes in the exchange rate and interest rate explain the fluctuations in their SR. Tuncer and Turaboglu (2014) employ the Johansen cointegration method and Granger causality tests to investigate the long run relationships between real effective exchange rate, GDP, and stock prices, and conclude that real effective exchange rates Granger-cause stock prices. Using ARDL methodology and Granger causality tests, Tursoy (2017) reaches a similar conclusion.

Hence, there is still a lack of knowledge and consensus on whether fundamental MV affect SR and the impact order of the variables on the returns.

### Methodology

We employ the GDV analysis, based on Koop et al. (1996), Pesaran and Pesaran (1997), and Pesaran and Shin (1998), to investigate the impact of innovations in IP, MS, inflation rate, and the real effective exchange rates on sector-specific SR variances. Generalized decompositions methodology allows us to identify the proportion of the movements over time as a result of innovations in returns and innovations in the other variables listed above. When unanticipated shocks occurred in the economy, we can assess the relative strength of MV in generating variations in their own and generating variations in sector-specific SR, which are industrial and financial returns in our case. It is expected that the results of the traditional orthogonalized method (Sims, 1980) are sensitive to the ordering of MV in the VAR system. Therefore the *generalized* methodology has an advantage over the orthogonalized approach by being insensitive to the ordering of the variables <sup>1</sup>.

<sup>1</sup> We do not technically discuss both the generalized and the orthogonalized approach here, since both are now well known, however, the textbook explanations can be found in Hamilton (1994) and Enders (1995).

Let Eq. 1 be a VAR model for  $x_t$ , which is a  $nx1$  vector of the variables. The variables are assumed to be jointly determined.

$$x_t = c + \sum_j^q \alpha_j x_{t-j} + \varepsilon_t \quad (1)$$

$c$  is a vector of constants.  $\alpha_j, j=1..q$  is a  $nxn$  matrix of the coefficients.  $\varepsilon_t$  is vector of disturbances with mean zero and covariance  $E(\varepsilon' \varepsilon) = \sigma_{ij}$ . In case  $x_t$  is covariance stationary, Eq. 1 can be written as the infinite moving average representation with  $nxn$  coefficient matrices  $M_n$ , which are calculated as follows:

$$M_i = \alpha_1 M_{i-1} + \alpha_2 M_{i-2} + \dots + \alpha_p M_{i-p}, i = 1, 2, .. \quad (2)$$

Then the  $nx1$  vector of the scaled generalized impulse of one standard error shock to the  $j - th$  equation at time  $t$  on expected value of  $x$  at time  $t + m$  ( $x_{t+m}$ ) is written as follows:

$$\sigma_{jj}^{-1/2} M_m \sum e_j, n = 0, 1, 2 \dots \quad (3)$$

In here,  $e_j$  is a vector with unity of its  $j$ -th element and zero as its other elements. The generalized impulses are used to generate the forecast error variance decompositions by

$$\frac{\sigma_{jj}^{-1} \sum_{k=0}^m (e_j' M_k e_i)^2}{\sum_{k=0}^m e_j' M_k \sum M_k e_j}, i, j = 1, \dots, n. \quad (3)$$

Pesaran and Shin (1998) states that “the generalized forecast error variance decompositions measure the proportion of the  $m$ -th step error forecast error variance of variable  $j$  by the innovations in variable  $i$  in the VAR.”.

### Data

This research examines monthly data from November 2008 to August 2020. This start date is chosen since the 2007 Global Financial Crisis started to have an impact on Turkish financial markets by the end of 2008, even though at the beginning of the crisis, the performance of the Turkish stock exchange was relatively better than that of other emerging countries, such as Brazil, Poland and South Korea (Macovei, 2009). Choudhry (1996) and Lee and Kim (1993) suggest that behavioral changes occur due to the crisis. That is, post-crash behavior is different than pre-crash behavior. Hence, we determine the starting date of the data after the breakdown of the Turkish economy.

In this study, we use The Borsa Istanbul industrial and financial indexes to measure stock prices, which are represented by IND and FIN, respectively. We include measures of monetary policy, real output, and inflation in our VAR analysis, consistent with the literature on developed markets (see, e.g., Fama, 1981; Mauro, 2003; Wongbangpo and Sharma, 2002, Erbaykal et al.,

2008). However, studies on developed markets commonly exclude exchange rates based on the assumption that the foreign exchange market is efficient and hence does not play an important role in the determination of SR. In Turkey, a developing market, the stock market is likely to be very responsive to international financial capital flows. Thus, we include the real effective exchange rate (RE) as a proxy for the exchange rate. M1 and M2 measure MS. The industrial production index (IP) measures real output activity. The consumer price index (CPI) captures the general price level and is used for the calculation of the inflation rate. The data set used in this paper is obtained from the Central Bank of Turkey.

## Results

To start the analysis, we first check the time series properties of the variables. For this purpose, we apply the commonly utilized Augmented Dickey-Fuller Unit Root Test (ADF). The results are given in Table 1. Since the data display a trending behavior over the period, intercepts and trends are used in the unit root tests in levels. The specifications without an intercept and trend are incorporated into the models for tests in the first differences. The Schwarz Criteria is utilized for the lag lengths determination.

As the results in Table 1 suggest, the initial diagnostic tests do not indicate the presence of stationarity in level for all series. Thus, the analyses are carried out in growth rates and returns. Returns are calculated by taking the first difference of natural logarithms.

**Table 1:** ADF Tests Results

Level	ADF test statistics	In first difference	ADF test statistics
IND	-2.52761	GIND	-9.76161***
FIN	-2.96637	GFIN	-11.09604***
IP	-2.24543	GIP	-19.03404***
M1	-3.82194**	GM1	-4.14926***
M2	-2.03805	GM2	-3.69321***
CPI	-0.48434	INF	-2.42967**
ER	-2.49002	GER	-9.52013***

Notes: GIND and GFIN are the first difference of natural logarithms of stock market price indexes IND, and FIN, respectively. GIP, GM1, INF and GER denote the growth of industrial production, M1, general price index and exchange rate, respectively. \*, \*\*, and \*\*\* denote significance at 1%, %5, and 10% level.

## Variance Decompositions

The impacts of MV on industrial SR are reported in Tables 2 and 3 for the models with M1 (VAR1) and M2 (VAR2), respectively. The results reveal that the parameters converge to a steady-state value in the 7th horizon. However, we report the results up to the 12th horizon to cover a full year and to be able to compare with the existing literature.

The results reveal that the real effective exchange rate has the largest initial impacts and reaching approximately 5.3 percent in VAR1 and 6.8 percent in VAR2. This finding is consistent with Ozlen and Ergun (2012), who find that the exchange rate is one of the most significant factors in the stock price fluctuations. After three months, the real effective exchange rate still accounts for more than 6.4 percent of the variation in SR and explains more than 6.6 percent by the 12th horizon in VAR1. This magnitude is comparable to the findings in Wongbangpo and Sharma (2002), which are a somewhat higher impact of exchange rates on returns for Indonesia, Philippines, Singapore, and Malaysia by the 10th month. Slightly more pronounced effects are found when M2 is used in the VAR.

Monetary policy has the second-highest initial impact on SR in VAR1 and the third in VAR2. The results indicate that the M2 has a stronger impact than narrowly defined money M1 does. The impact of M2 reaches 6.3 percent by the 4th month, while the same steady-state horizon holds for M1 which reaches 4.0 during the same period. Even though different proxies are used for monetary policy, the results confirm that monetary policy has a considerable impact on SR. This finding is consistent with Patelis (1997) and Sari and Malik (2003) in which they investigate the impact of monetary policy on returns of ISE 100, the general index of the Istanbul Stock Exchange.

The initial impacts of inflation and IP are relatively lower. Inflation accounts for more than 1.1 percent of the variation in SR by the 4<sup>th</sup> month, while the impact of IP remains below 1 percent (approximately 0.2%) in all horizons with less variation. When M1 is used as a monetary policy stance instead of M2, IP accounts for an almost similar initial impact, approaching 0.23 percent after the 4<sup>th</sup> month.

Additionally, for both M1 and M2, the impact of IP on SR appears to be negligible, both in the short and long horizons. The relatively strong effect of inflation is consistent with Darrat and Mukherjee (1987), who also find a strong impact of inflation on Indian SR. Consistent with these results, Wongbangpo and Sharma (2002) find inflation effects within a comparable time frame as 1.97% for Indonesia, 0.56% for Malaysia, 6.63% for the Philippines, 2.39% for Singapore, and 4.8% for Thailand.

**Table 2:** GVD of Industrial Stock Returns –VAR1

Horizon	GIND	GIP	GM1	GER	INF
0	1.00000	0.00034	0.01530	0.05335	0.00089
1	0.98433	0.00033	0.01921	0.05142	0.00693
2	0.95714	0.00213	0.04039	0.06154	0.00719
3	0.94686	0.00218	0.03995	0.06428	0.01285
4	0.94455	0.00234	0.04046	0.06630	0.01311
5	0.94405	0.00234	0.04044	0.06670	0.01320
6	0.94398	0.00235	0.04044	0.06673	0.01322

7	0.94396	0.00235	0.04044	0.06675	0.01322
8	0.94396	0.00235	0.04044	0.06675	0.01322
9	0.94396	0.00235	0.04044	0.06676	0.01322
10	0.94396	0.00235	0.04044	0.06676	0.01322
11	0.94396	0.00235	0.04044	0.06676	0.01322
12	0.94396	0.00235	0.04044	0.06676	0.01322

Notes: The order of VAR, based on Akaike's information criterion (AIC), is 2. GIND and GFIN are the sector specific market returns. GIP, GM1, INF and GER denote the growth of IP, M1, general price index and exchange rate, respectively.

**Table 3:** GVD of Industrial Stock Returns –VAR2

Horizon	GIND	GIP	GM2	GER	INF
0	1.00000	0.00004	0.03271	0.06834	0.00144
1	0.98013	0.00013	0.03527	0.06799	0.00720
2	0.94926	0.00186	0.06164	0.07789	0.00721
3	0.94342	0.00204	0.06218	0.07953	0.01107
4	0.94078	0.00205	0.06311	0.08154	0.01141
5	0.94029	0.00206	0.06331	0.08202	0.01153
6	0.94021	0.00206	0.06331	0.08204	0.01156
7	0.94019	0.00206	0.06332	0.08207	0.01157
8	0.94018	0.00206	0.06332	0.08207	0.01157
9	0.94018	0.00206	0.06332	0.08207	0.01157
10	0.94018	0.00206	0.06332	0.08207	0.01157
11	0.94018	0.00206	0.06332	0.08207	0.01157
12	0.94018	0.00206	0.06332	0.08207	0.01157

Notes: The order of VAR, based on AIC, is 2. GIND and GFIN are the sector specific market returns. GIP, GM1, INF and GER denote the growth of IP, M1, general price index and exchange rate, respectively.

Tables 4 and 5 provide the GVD of financial SR. Tables 4 reports the impacts of the MV for the model with M1 (VAR3) while Table 5 for the model with M2 (VAR4) instead of M1. The results indicate similarity to the results provided for industrial market SR. Once again, the real effective exchange rate has the highest initial impact. Its initial impacts are approximately 16 percent and 19 percent in VAR3 and VAR4. It still accounts for more than 19 percent of forecast error variance in financial SR by the 6th month and remains almost unchanged afterward.

**Table 4:** GVD of Financial Stock Returns - VAR3

Horizon	GFIN	GIP	GM1	GER	INF
0	1.00000	0.01150	0.06098	0.16746	0.00888
1	0.97537	0.01370	0.07108	0.16523	0.00935
2	0.93943	0.01485	0.09941	0.16443	0.00970
3	0.92695	0.01492	0.09865	0.16272	0.01823
4	0.92401	0.01509	0.09891	0.16606	0.01815
5	0.92354	0.01508	0.09891	0.16591	0.01836
6	0.92337	0.01509	0.09889	0.16603	0.01835
7	0.92336	0.01509	0.09890	0.16603	0.01835
8	0.92336	0.01509	0.09890	0.16603	0.01835
9	0.92336	0.01509	0.09890	0.16603	0.01835
10	0.92336	0.01509	0.09890	0.16603	0.01835
11	0.92336	0.01509	0.09890	0.16603	0.01835
12	0.92336	0.01509	0.09890	0.16603	0.01835

Notes: The order of VAR, based on AIC, is 2. GIND and GFIN are the sector specific market returns. GIP, GM1, INF and GER denote the growth of IP, M1, general price index and exchange rate, respectively.

**Table 5:** GVD of Financial Stock Returns – VAR4

Horizon	GFIN	GIP	GM2	GER	INF
0	1.00000	0.01665	0.16480	0.19558	0.01121
1	0.96918	0.01706	0.16583	0.19832	0.01125
2	0.92419	0.01770	0.19188	0.19557	0.01170

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3	0.91619	0.01823	0.19000	0.19357	0.01721
4	0.91217	0.01817	0.19142	0.19730	0.01715
5	0.91180	0.01816	0.19120	0.19716	0.01743
6	0.91159	0.01817	0.19126	0.19736	0.01743
7	0.91157	0.01817	0.19125	0.19735	0.01743
8	0.91157	0.01817	0.19125	0.19736	0.01743
9	0.91157	0.01817	0.19125	0.19736	0.01743
10	0.91157	0.01817	0.19125	0.19736	0.01743
11	0.91156	0.01817	0.19125	0.19736	0.01743
12	0.91156	0.01817	0.19125	0.19736	0.01743

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Notes: The order of VAR, based on AIC, is 2. GIND and GFIN are the sector specific market returns. GIP, GM1, INF and GER denote the growth of IP, M1, general price index and exchange rate, respectively.

The second highest initial impact on SR again results from monetary policy. M2 accounts for over 19.5 percent of the variance in returns, which is much higher than when M1 is used (6.0 percent). The impact of monetary policy on the variance in returns goes up to 19.7 percent in the long horizon when M2 is used in the model (Table 4).

Inflation explains over 0.9 percent of the variance in SR in the short horizon and 1.8 in the long horizon in VAR3. The estimated effects remain similar when M2 is utilized. The effect of IP growth (GIP) is non-negligible in the latter models. The impact of the IP on financial SR is narrowly ranging between 1.1 percent and 1.8 percent, depending on the monetary policy and horizon.

### Generalized Impulse Responses

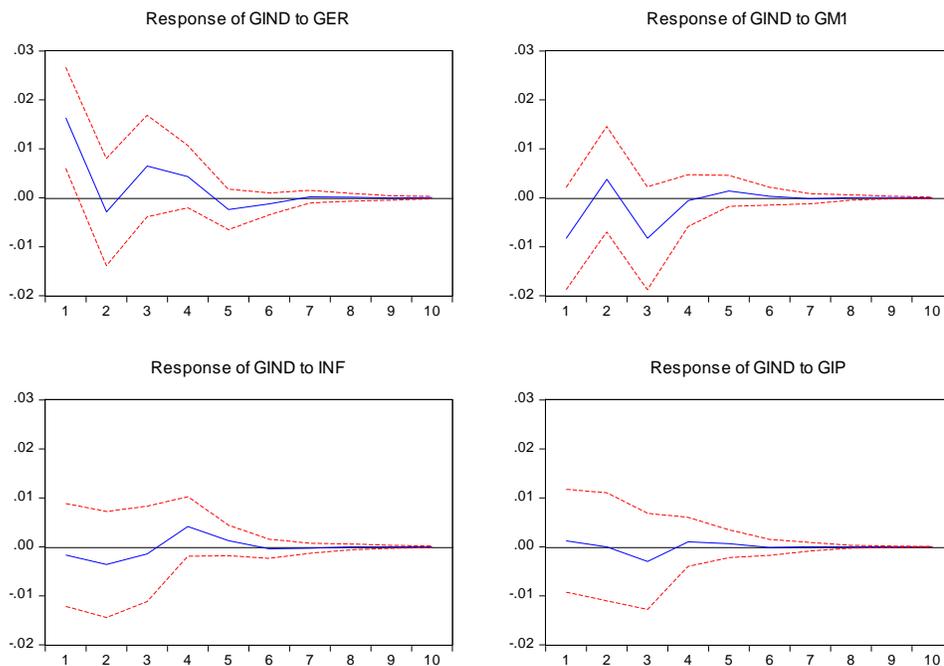
The generalized impulse response results are illustrated in Figure 1-4. As with the variance decomposition case, the investors must pay attention to exchange rates since the initial impact of exchange rates on the stock return in both sectors are positive and significant. Even though the exchange rate responses are negative in the second horizon, they are insignificant and die out in the 7th horizon in both markets. This finding is in line with those of Bahmani-Oskooee and Saha (2016). Phylaktis and Ravazzolo (2005) also find a positive relationship between exchange rate and SR for a group of Pacific countries whereas Tripathi and Kumar (2015) find a negative relationship for the cases of Brazil, Russia, India, China, and South Africa (BRICS) markets.

The money supply innovations, whether in M1 or M2, on both industrial and financial markets are negative and significant. If the innovation is in M2, investors should also pay attention to the 3rd horizon, during which the impact is still negative and significant. That is not the case if there is a shock in the narrowly-defined MS. Maghayereh (2002) for Jordan, Humpe and Macmillan (2007) for the USA, Abugri (2008) for Brazil and Argentina also find that negative responses of

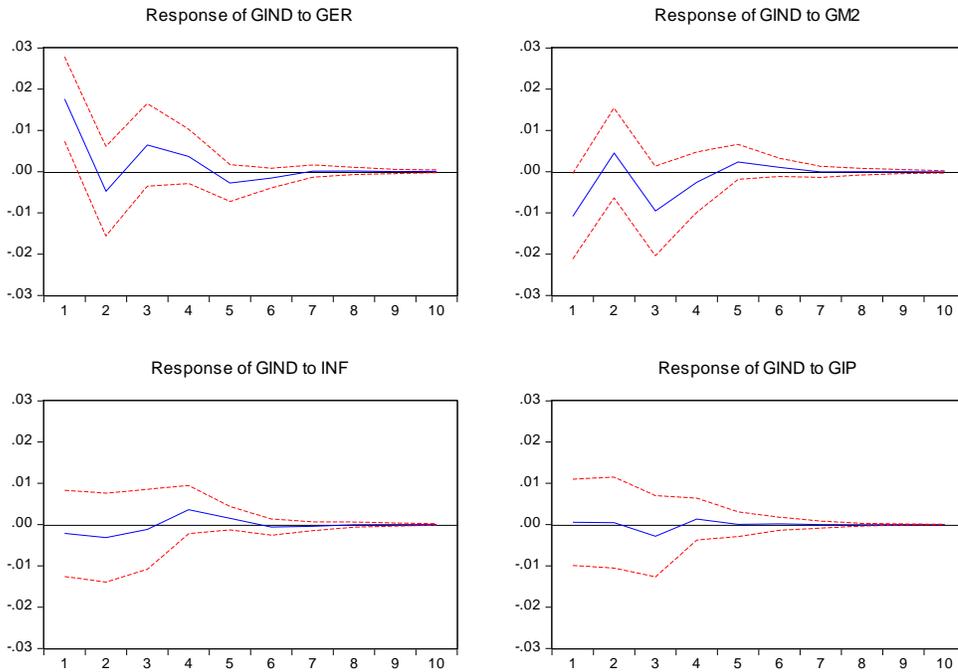
MS, while Maysami et al. (2004) for Singapore, Tripathi and Kumar (2015) for Brazil, Russia, India, China, and South Africa (BRICS) markets conclude that they are positive. Moreover, Muradoglu and Metin (1996) find a positive relationship between MS and SR for the case of Turkey.

In all other cases, there is a variation of responses, and none of them are significant on any horizon. However, the volatility of the responses, as illustrated in figures, may still contain exploitable results by investors in the emerging market.

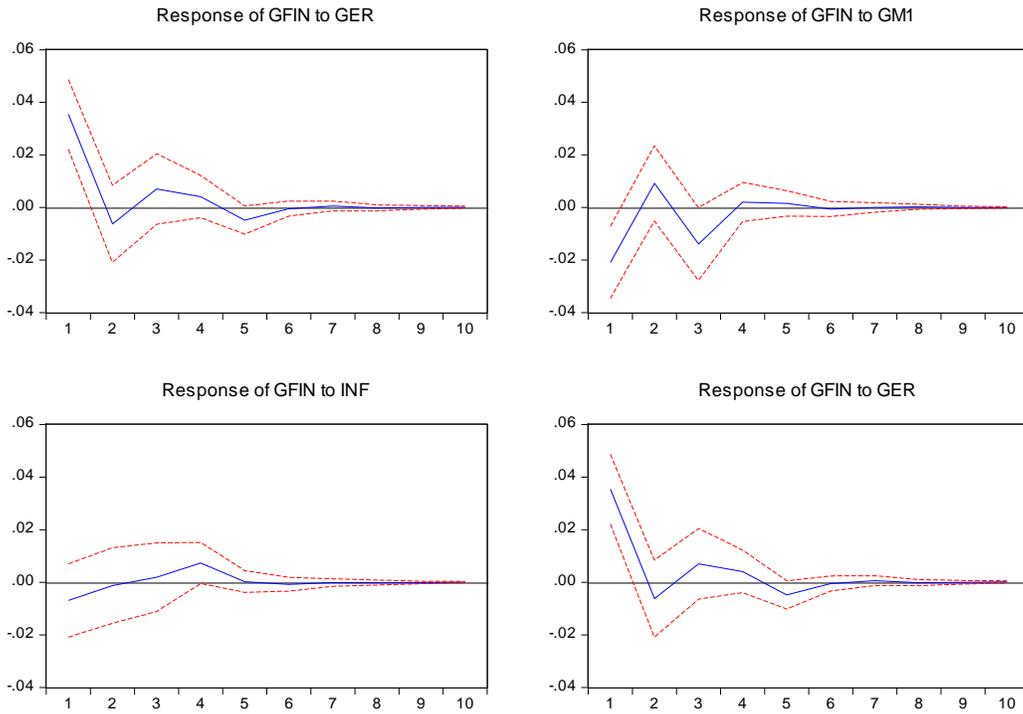
In sum, the results reveal that the exchange rate explains more of the FEV of SR than any other macroeconomic variable for the financial and industrial sectors. Therefore, the findings suggest that investors wishing to invest in sector-specific stock returns in Borsa Istanbul should pay more attention to exchange rate fluctuations. Furthermore, narrowly defined monetary variable contains less information on the volatility of sector-specific stock returns. Hence, the investors in both sectors should be alert to the MS announcements and closely watch a broader measure of MS growth and inflation rates.



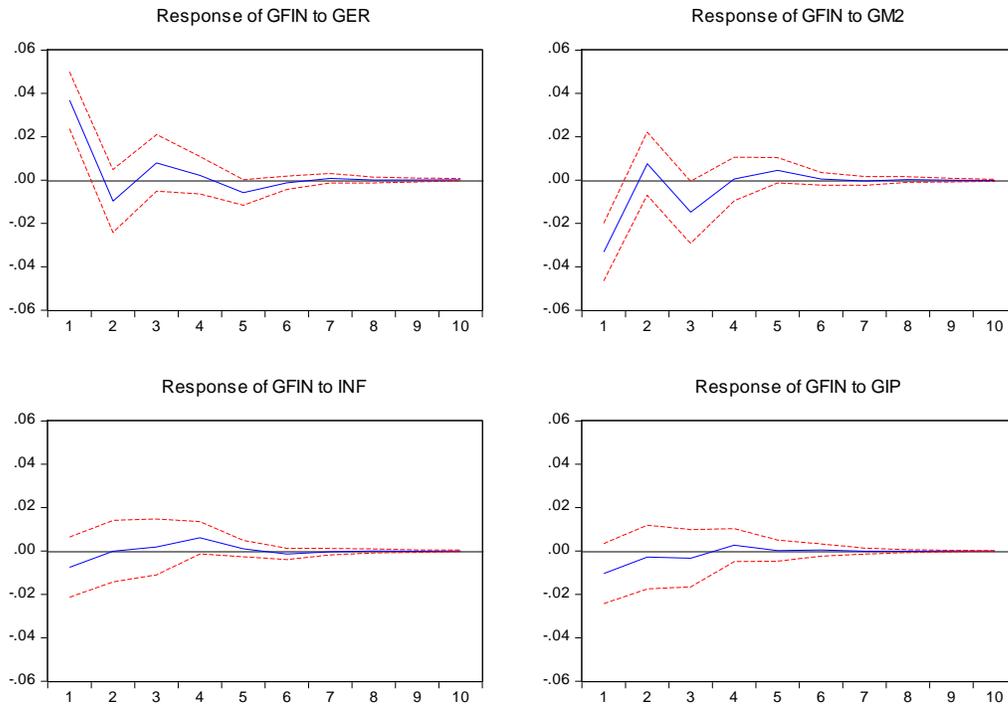
**Figure 1.** Responses of GIND to GER, GM1, INF and GIP



**Figure 2.** Responses of GIND to GER, GM2, INF and GIP



**Figure 3.** Responses of GFIN to GER, GM1, INF and GIP



**Figure 4.** Responses of GFIN to GER, GM2, INF and GIP

### Conclusion

This paper examines and documents the effect of macroeconomic variables on sector-specific stock returns in the Istanbul Stock Exchange. The analysis employs the *generalized* forecast error variance decomposition analysis by utilizing the Istanbul Stock Exchange data after the global economic crisis in 2007. The *generalized* approach is not sensitive to the order of variables entering into the VAR. Thus, the results are robust and allow a more accurate analysis of the relationship between macroeconomic variables and the sectoral stock returns.

The paper contributes to the existing literature in two ways. First, it examines the impact of macroeconomic variables on sector-specific stock returns in an emerging market and provides important information on the linkages between several fundamental state variables and stock returns in the Turkish market. Second, it applies a superior *generalized* methodology to Turkish data.

The findings of this study may be of importance to investors. The results reveal that investors should pay close attention to exchange rates as it explains more of the forecast error variance of returns in the financial and industrial sectors than any other macroeconomic variables. Additionally, those who want to invest in industrial stocks should carefully watch money supply, foreign exchange rates, and industrial production growth rates. However, the responses of stock returns to innovations in the growth of industrial production do not seem to provide useful information for those who wish to invest in financial stocks.

The findings are also likely to be of interest to policymakers. They should focus more on exchange rates than other macroeconomic variables if they desire to improve overall financial stability. If, however, the interest is to prioritize one of the two sectors, the differential effects of macroeconomic variables are also identified to do so. Thus, the results of this study may be useful for policymakers interested in encouraging long-term economic growth and market stability.

Additionally, the significant interactions between the stock returns and the macroeconomic variables suggest that well-thought-out macroeconomic policies may yield impressive gains.

Our research is limited by data availability. Future studies using data with higher frequencies for more countries over a longer period are needed to provide more insights into the relationship between fundamental macroeconomic variables and stock returns. As a result, the literature might reach a consensus on it. The impact of the crises on the relationships between the variables is another avenue of future research.

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