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The relationship between the purchasing managers' index (PMI) with economic and financial indicators in Turkey: A Var analysis

Satın alma yöneticileri endeksinin (PMI) ekonomik ve finansal endekslerle ilişkisinin Türkiye için Var analizi

Volkan DAYAN [1], **Serdar Erdoğan** [2]

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ABSTRACT

In this study, the relationship between Turkey's Purchasing Managers' Index (PMI) and various economic and financial indicators was investigated. The data for the period 2018.4 - 2021.2 were used in the analysis, and the Vector Autoregression (VAR) method was preferred. According to the results, although there is a significant relationship between various indicators, it has been determined that the most effective index on PMI is the Export Climate Index. A positive relationship was found between PMI and the Export Climate Index in the short run. There is also a unidirectional causality relationship from the Export Climate Index to PMI. This situation has revealed that exports are influential on the investment decisions of purchasing managers, and therefore market-oriented strategies have an important place in business policies. It is thought that this study will make important contributions to policymakers, researchers and literature.

Keywords: Purchasing Managers' Index, Economic-Financial Indicators, VAR Analysis.

Jel Classification: C32, E44, P24.

ÖZ

Türkiye'de 2018-2021 yılları arası döneme yönelik Satın Alma Yöneticileri Endeksinin (PMI) çeşitli ekonomik ve finansal endekslerle aralarındaki ilişkileri VAR analizi ile incelenmiştir. Çalışmada elde edilen sonuçlara göre, çeşitli endekslerin aralarında anlamlı ilişkiler bulunmakla birlikte, PMI üzerinde en etkili olan endeksin ihracat iklimi endeksi olduğu tespit edilmiştir. PMI ve EXI arasında kısa dönemde pozitif yönlü bir ilişki bulunmuştur. Ayrıca EXI'den PMI'a doğru tek yönlü bir nedensellik ilişkisi de bulunmaktadır. Bu durum satın alma yöneticilerinin yatırım kararları üzerinde ihracatı etkili olduğunu, dolayısıyla pazar odaklı stratejilerin işletme politikalarında önemli bir yeri bulunduğu ortaya koymuştur. Çalışmanın ekonomide karar vericilere, araştırmacılara ve literatüre önemli katkılar sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Purchasing Managers' Index, Economic-Financial Indicators, VAR Analysis.

Jel Sınıflaması: C32, E44, P24.

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1. Doç. Dr, Trakya Üniversitesi Uzunköprü Uygulamalı Bilimler Yüksekokulu, Edirne.

2. Dr. Öğr. Üyesi, Trakya Üniversitesi Uzunköprü Uygulamalı Bilimler Yüksekokulu, Edirne.

Corresponding Author / Sorumlu Yazar

Volkan Dayan, Trakya Üniversitesi Uzunköprü Uygulamalı Bilimler Yüksekokulu, Edirne.

E-mail: volkandayan@trakya.edu.tr

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1. Introduction

Not only purchasing but also top managers in Turkey consider general economic indicators such as foreign trade, exchange rates, prices levels, and stock market values. Especially in inflationary periods, the investment decisions to be taken by both portfolio investors and real sector investors can be in mutual interaction with each other.

PMI is an indicator that is used especially by investors to obtain clear information about the state of global markets in matters related to economic activities. An indicator above 50 indicates an improvement in the real sector compared to the previous period, while an indicator below 50 is considered as a sign of deterioration (ISO, 2023a).

The export climate index is an indicator of the improvement in the export environment of investors in the manufacturing sector. National PMI values are used in the calculation of this index. An index value above 50 indicates an improvement in exports, while an index value below 50 indicates a deterioration in exports (ISO, 2023b).

The US Dollar index is derived from the currencies of 6 different countries. It provides investors with information about the value of the dollar in the international market. If the FED sells dollars to the market and buys bonds, the dollar index decreases, while if it buys dollars and buys bonds, the dollar index increases. (Albforex, 2023).

TUFE is the monthly consumer price index (CPI) representing economic stability and XU100 is the BIST stock market index representing the capital market.

For investors, the export environment, price stability, the development of capital markets and the stability of the exchange rate are important factors to consider.

According to this study, while examining the relationship between various economic and financial indicators and the purchasing managers' index, it was included on various financial and economic variables such as exports, exchange rate, inflation, and stock market value, which are thought to be particularly influential on PMI. Also, the relationship between all variables among themselves was examined. VAR model and Granger (1969) Wald causality methods are used.

The relationship between PMI and GDP and stock market variables has been extensively studied in the literature. In this study, the relationship between PMI and various more financial and economic indices is examined. Today, especially in the developing financial market, there are many alternative investment tools when investors are creating their portfolios. The fluctuations in the prices of these investment instruments also determine the returns of these instruments. Accordingly, different investment instruments and the relationship between inflation and PMI are examined.

In the study, primarily domestic and foreign literature on PMI will be mentioned. Afterwards, the data set will be introduced, and the VAR model and causality tests will be applied together with the stationarity analysis of the series. Finally, the findings obtained at the end of the study will be evaluated.

2. Literature Review

Although there are studies on PMI, few studies are related to economic and financial indicators with VAR analysis.

Many studies on PMI have been conducted in the literature. However, there are a limited number of studies using the PMI index and VAR method and revealing the short and medium-term effects. The relationship between PMI and the indexes used in the study was also not used much.

Peláez (2003), in this study, discussed the effects of a new index with PMI. It is explored that this index dominates PMI. Ordinary least squares regression, forecast statistics, Diebold-Mariano Test were used to estimate relationships between and among variables. According to the analysis, more successful results were obtained with a constant-weighted index than PMI.

Habanabakize & Meyer (2017), in their studies, analyzed the impact of the South African PMI on economic growth and employment. Correlation analysis, ARDL model, Granger causality test, Augmented Dickey & Fuller (ADF) methods were used to determine variables. According to results PMI is not found to be an important determinant of the economic growth but the cause of employment in the manufacturing industry.

Lupu (2018), in this study, analyzed dynamics of macroeconomic indicators in terms of the sentiment index and the PMI in European stock markets. GARCH (1,1) model are used to analyse variables. According to the results of the study, PMI is effective only on certain dates and different findings were obtained from country to country.

Wei et al. (2021), in their studies, examined the selecting Chinese manufacturing PMI and its five component PMI. GARCH - MIDAS model was used econometrically. According to results of study PMI has negative effects on industrial stock volatility and more successful in forecasting industrial stock volatility than other variables.

Cho & Ogwang (2006), in their studies, showed the options of principal variables for computing the PMI. Principal components analysis technique was used to for correlation of variables. According to the results of the study, the most successful result was obtained with the employment diffusion index with PMI.

De Bondt & Schiaffi (2015), in their studies, Real GDP growth in the euro area and the United States is also examined. PMI was chosen as the data source. Ordinary least squares regression was used to analyze variables. According to the results of the study, It is determined that PMI has a high correlation with industrial production growth and is effective in increasing GDP in this way.

Sahin et al. (2020), in their studies, analyzed the relationship between the Industrial Index in Borsa Istanbul and the PMI. Fully Modified Ordinary Least Squares and asymmetric causality test were used econometrically. Based on the results of the study one way relationship was determined that there is a one-way causality relationship from PMI to Borsa Istanbul Industrial index and PMI is a predictor of stock prices.

Joseph et al. (2011), in their studies, estimated the impact of interest rates and on PMI. Regression models and network models were used to determine variables. In the study, more successful results were obtained with the CWI index compared to the PMI.

Islamoglu (2019), in this study the effect of the change in GDP on PMI in six countries is discussed from an financial-economic perspective. Panel data analysis was used for the analysis.

According to the results of the study, there is a positive relationship between credit expansion and economic growth.

Akdag et al. (2020), in their studies, analyzed the effects of the industrial index published in Borsa Istanbul on PMI and other indices. Granger Causality and Frequency Domain Causality were used to determine variables. PMI is correlated with many indices. PMI is found to be determinant for the real sector, but not very effective for the financial sector.

Siliverstovs (2018), in this study, examined the economic variables of many countries, including America and non-American, and focused on PMI among them. They considered the variability between PMI and multiple data. MIDASSO approach was preferred in the analysis. According to the results of the study, except for one variable, it was determined that the changes in PMI affected the GDP growth.

Chen et al. (2021), in their studies, described the result of how high-frequency carbon emission trading data perform when foreshadowing GDP and PMI growth in China. The MIDAS regression model was used econometrically. It reveals that combination estimates from groups with high-frequency trade data have better forecast performance than groups with only common macroeconomic factors.

Erkan & Mandaci (2020), in their studies, determined whether the PMI is a leading indicator for the returns of stock, bond and foreign exchange markets in Turkey. Unit Root Tests, Causality Tests were used to analyze variables. According to the study, it has been determined that PMI is the leading indicator of bond, stock and foreign exchange markets.

Sobko & Klonowska-Matynia (2021), in their studies, analyzed and evaluated the relationship between PMI and Gross Domestic Product dynamics in the Polish economy. The analysis contained in this article was performed using the ARDL and ECM models. According to the analysis, the model based on the PMI indicator is not suitable for forecasting the economic situation in Poland.

Wang et al. (2021), in their studies, measured the asymmetric effect of PMI in the Chinese stock market. Baseline regression model was used. They found that variables such as low stock prices, liquidity, and firm size are effective.

Shaikh (2021), in this study, analyzed the relationship between PMI and trade policy uncertainty. Regression model was used. According to the results of this study it is found that Japan and China's purchasing manager index is more responsive to trade policy uncertainty.

Goncu 2023), in this study, conducted a literature review on the use of PMI to make sectoral forecasting. Solutions have been proposed, especially in terms of economic growth.

3. Empirical Analysis

This section in order of data set, stationary analysis, VAR analysis, impulse response function, variance decomposition and causality analysis of this study will be investigated.

3.1. Data Set

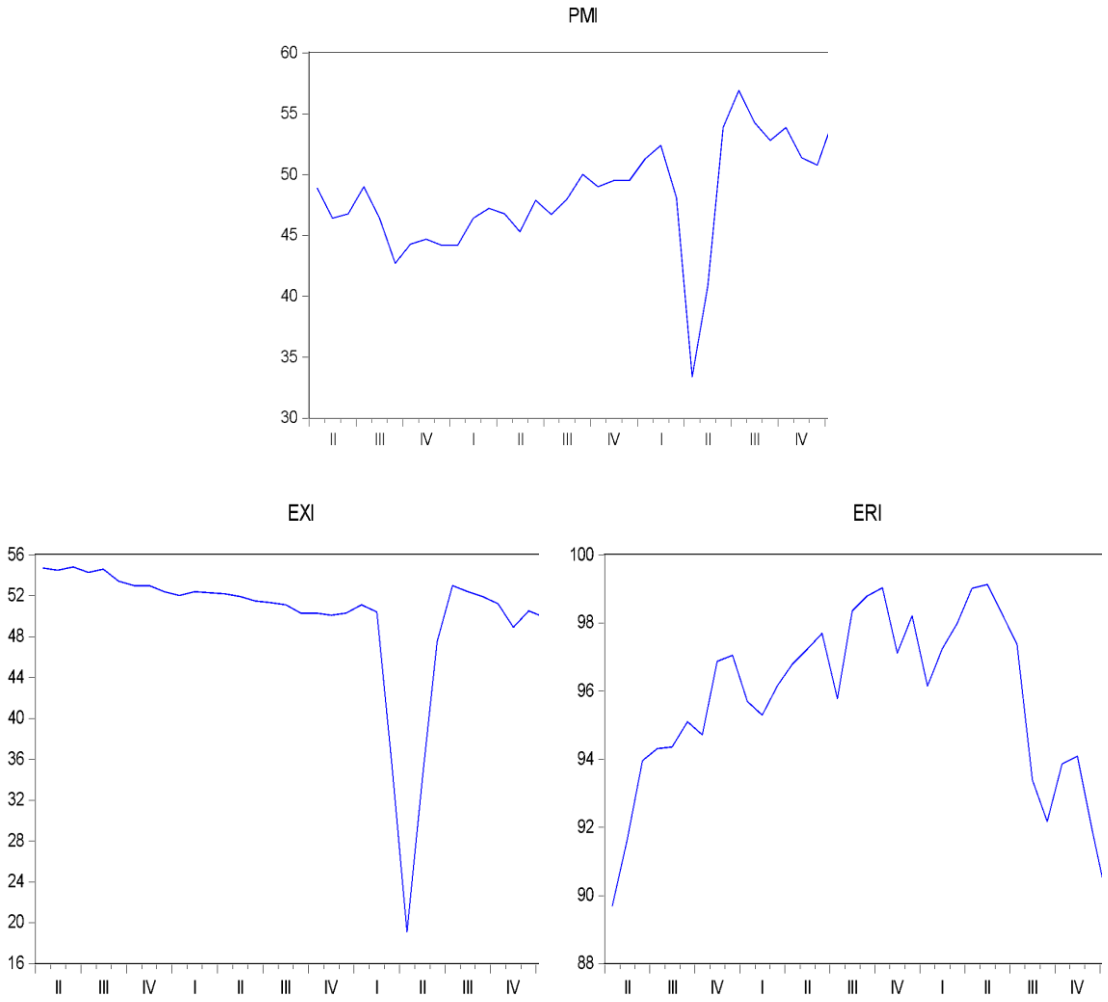
In table 1, the data description that used in this study is showed.

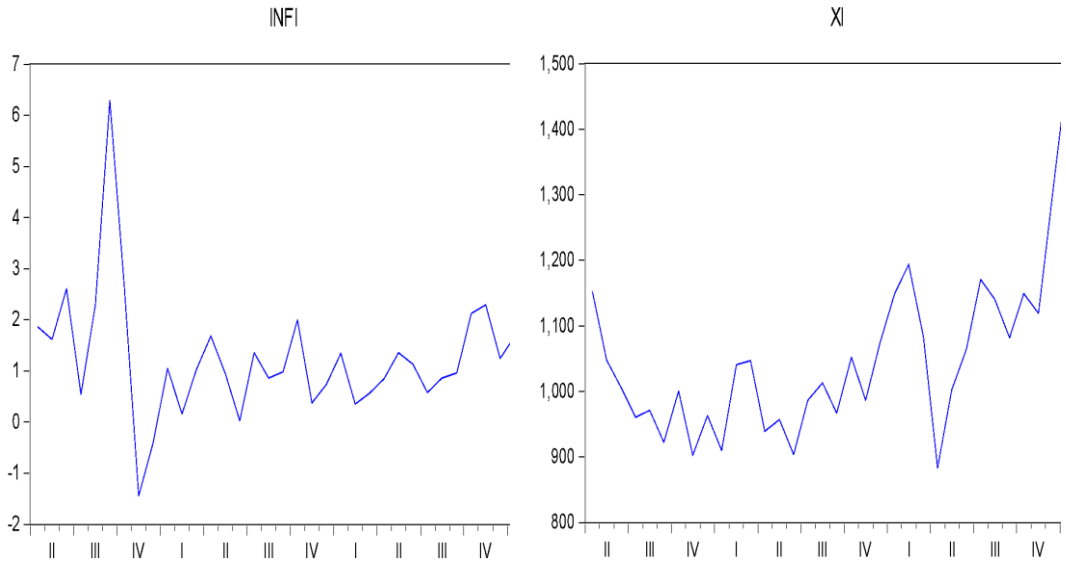
Table 1: Data Description

Variables	Sample: 2018.M4-2021.M2	Name of Index	Source
	PMI	Purchasing Managers Index	Istanbul Chamber of Industry (ISO)
	EXI	Export Climate Index	bloomberght.com
	ERI	Dollar Index	investing.com
	INFI	Consumer Price Index	Turkish Statistical Institute (TUIK)
	XI	XU100 Index	investing.com

The graphical view of the series in Table.1 is given in Graphic 1. All these variables are included in the analysis as index numbers. There are 5 variables in the study. The data of these variables were selected as of the same period. In addition, the mentioned period range was preferred due to data constraints, albeit partially.

Graphic 1. View of Series





As seen in graphic 1, the graphical situation of the series was taken into consideration in determining the model types in stationarity tests. Accordingly, constant and trend effects in unit root tests were considered.

3.2. Stationary Analysis

The series in which trend or seasonal effects are seen on the series used in econometric studies are not stationary. One of the methods used to test stationarity is unit root tests, which are generally accepted. (Tari, 2005: 210)

In unit root test estimations, Gujarati (2004) stated how to determine the stationarity of the series. When estimating in unit root tests, if α=0 and greater than Mckinnon value and H1 is accepted, the series is stationary and there is no unit root. The opposite happens if H0 is accepted. The series is not stationary and has a unit root.

Dickey & Fuller (1979) was determined that the series was not stationary, according to the break unit root test by Perron (1989), where the break time of the same series is known, the series was found to be stationary as a result of taking the break periods into account.

Perron 89-unit root test is an exogenous break and a stability test whose break time is known; Z&A 92 test, on the other hand, is an endogenous unit root test with an unknown breaking time (Zivot and Andrews, 1992: 40).

While determining the model type in the unit root test of the variables, their series in graphic 1 were taken into account. In addition, the length of the lag was determined in line with the Akaike information criterion. Results are given in Table 2.

Table 2: Unit Root Test

TESTS	Zivot-Andrews Unit Root Test			Breakpoint Unit Root Test (Perron 89)				ADF (79) Unit Root Test		
Variables	Model	t-St.	B.D.	Model	t-St.	Prb.	B.D.	Model	t-St.	Prb.
PMI	Intercept	-5.42*	2020.6	Model A	-7,32	0,01*	2020.4	Intercept	-3,84	0,00*
EXI	Intercept	-5,19*	2020.9	Model A	-5,73	0,01*	2020.4	Intercept	-3,76	0,00*
ERI	Intercept	-4,68*	2020.8	Model A	-4,13	0,11	2020.7	Intercept	-1,94	0,30
INFI	Intercept	-7,83*	2018.11	Model A	-4,24	0,08*	2019.6	Intercept	-4,24	0,00*
XI	Intercept + trend	-4,54	2020.4	Model B	-4,50	0,05*	2020.10	Intercept + trend	-2,31	0,41
D(ERI)				Model A	-5,98	0,01**	2020.8	Intercept	-5,28	0,00**
D(XI)	Intercept + trend	-5,10*	2020.4					Intercept + trend	-3,35	0,08**

Critical values according to ADF 79 unit root test; Intercept model %1: -3,63, %5: -2,95 and %10: -2,615; Intercept + Trend model %1: -4,25, %5: -3.54 and %10: -3.20. Critical values according to Perron 89 (Breakpoint) unit root test; Intercept Model, %1: -4,949, %5: -4.443 and %10: -4.193, Intercept +Trend Model; %1: -5.067, %5: -4.524 and %10: -4.261. Critical values according to Zivot Andrews unit root test; Intercept Model %1: -5,34, %5: -4,93 and %10: -4,58 ; Intercept + Trend Model %1: -5,57, %5: -5,08 and %10: -4,82.

Stationary analysis and the results of the unit root test can be seen in Table 2. The unit root test results show that the variables marked with * in Table 2 are stationary at the I (0) level. ** indicates that they are stationary with 1 difference at the I (1) level. According to ADF (79) and Perron (89) tests, PMI, EXI, and INFI variables are stationary at the I (0) level. ERI variable is stationary at the I (1) level in the ADF (79) and Perron (89) unit root tests. Also XI variable is stationary at the I (1) level in the ADF (79) and Zivot-Andrews unit root tests.

3.3. Vector Autoregressive (VAR) Analysis

Sims (1980) discovered Vector Autoregressive (VAR). It analyzes the relationships between external exogen and internal endogenous variables in the analysis of macroeconomic values (Baltagi, 2008: 45).

The interaction between the variables can be determined by VAR analysis. (Enders, 2004: 46). The VAR model is shown with the following equations (Gujarati, 2004: 47).

(3.1) $M_{1t} = \alpha_0 + \sum_{i=1}^{k} \beta_{1i} M_{t-i} + \sum_{i=1}^{k} \gamma_{2i} R_{t-i} + u_t$

(3.2) $R_t = \alpha_1 + \sum_{i=1}^{k} \theta_{1i} M_{t-i} + \sum_{i=1}^{k} \gamma_{2i} R_{t-i} + u_{2t}$

Table 3: VAR Lag Order Selection Criteria

End. Var.s: PMI EXI ERI INFI XI Date: 04/05/21 Time: 13:08 Inc. obs.: 31				Exo.var.: C Samp.: 2018M04 2021M02		
Lag	LogL	Sequential modified LR test statistic	Final prediction error	Akaike information criterion	Schwarz information criterion	Hannan-Quinn information criterion
0	-485.1842	NA	37337689	31.62479	31.85608	31.70018
1	-425.0390	97.00832	3963741.	29.35736	30.74509*	29.80972
2	-387.1261	48.91996*	1975194.	28.52426	31.06843	29.35360
3	-359.4593	26.77429	2451045.	28.35221	32.05283	29.55852
4	-309.3911	32.30209	1220318.*	26.73491*	31.59196	28.31819*

According to Table 3, except for Schwarz criterion, the lag is maximum 4 in VAR. VAR analysis was obtained from the model with lag value 3.

Table 4. and Graphic 2 shows characteristic polynomial of VAR Model, and unit circle.

Graphic 2. Unit Circle of VAR Model

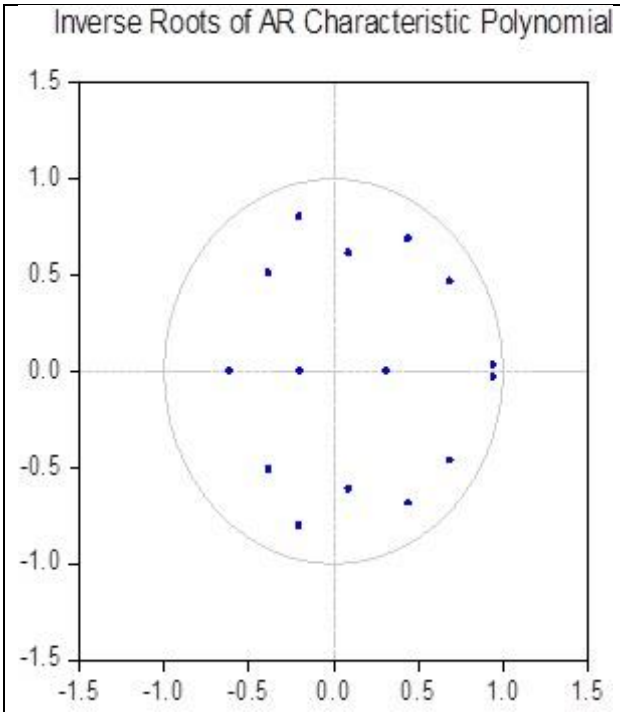


Table 4: Characteristic Polynomial of VAR Model

End. Var.: PMI EXI ERI INFI XI Exo. Var.: C Lag spec.: 1-3 Date: 04/05/21 Time: 14:27	
Root	Modulus
0.946057 - 0.032100i	0.946602
0.946057 + 0.032100i	0.946602
0.691795 - 0.466302i	0.834277
0.691795 + 0.466302i	0.834277
-0.202559 - 0.803170i	0.828319
-0.202559 + 0.803170i	0.828319
0.443608 - 0.686558i	0.817405
0.443608 + 0.686558i	0.817405
-0.381839 - 0.510898i	0.637823
-0.381839 + 0.510898i	0.637823
0.090168 - 0.613262i	0.619855
0.090168 + 0.613262i	0.619855
-0.616321	0.616321
0.311541	0.311541
-0.197775	0.197775
There are no roots outside the unit circle. The stability requirement is satisfied by VAR	

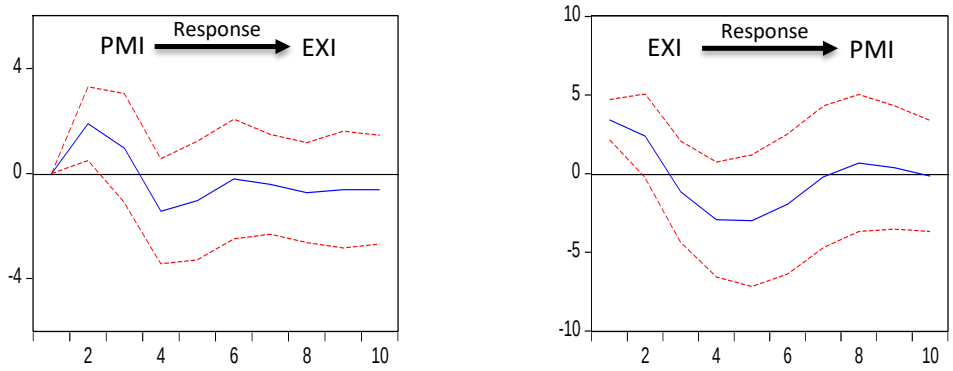
According to graphic 2 and table 4., The VAR model was found to be stable and has a significant mean. Therefore, the model turned out to be interpretable.

3.4. Impulse Response Functions of Variables

Graphic 3. Shows all impulse response functions. In the VAR analysis, the impulse-response method is used by the estimators for why it is difficult to interpret the coefficients while the model is being estimated. (Gujarati, 2004: 67). Graphic 3.1. shows impulse response function of PMI and EXI.

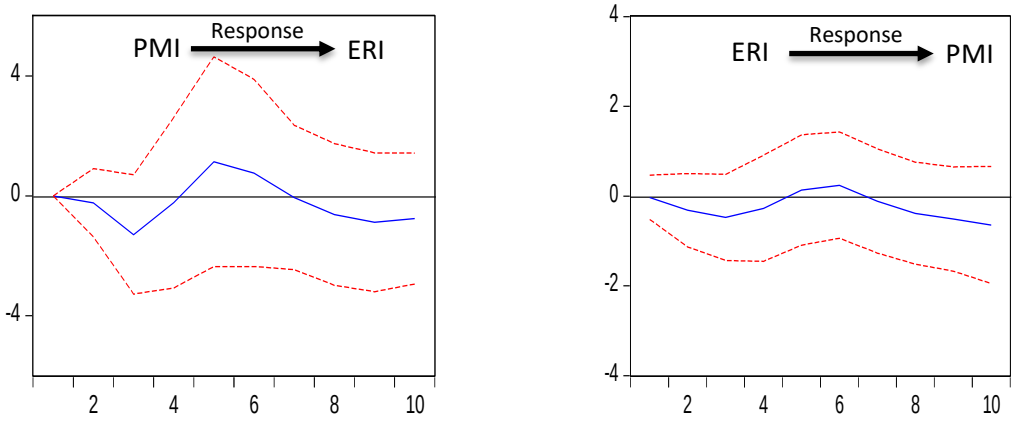
Graphic 3. Impulse Response Functions

Graphic 3.1. PMI and EXI



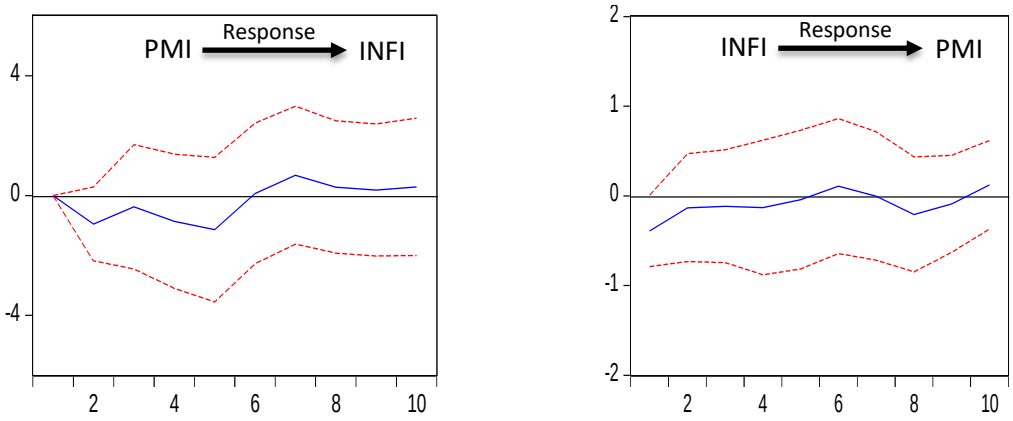
Graphic 3.1. shows the impulse response function of PMI and EXI. According to the response of PMI to EXI, PMI reacts positively in the short run. This response turned negative from the 3rd period and continued in the long run. Similarly, according to the response of EXI to PMI, EXI reacts positively in the short run. This reaction turned negative from the 2nd period and continued until the 6th period.

Graphic 3.2. PMI and ERI



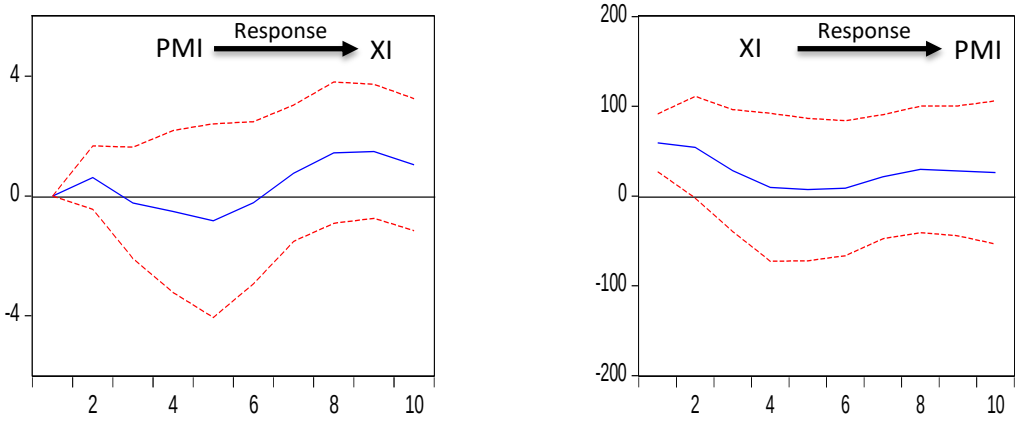
Graphic 3.2. illustrates impulse response function of PMI and ERI. According to the response of PMI to ERI, PMI reacts negatively in the short run. Between the 4th and the 6th period, this response turned positive but turned negative again in the long run. On the other side, according to the response of ERI to PMI, ERI response negatively in the short run and negative again in the long run except for the 4th and 5th terms.

Graphic 3.3. PMI and INFI



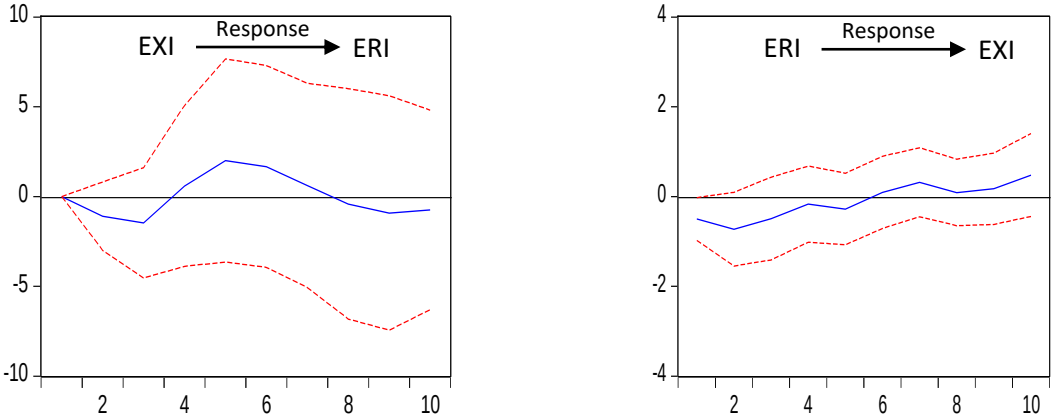
Graphic 3.3. illustrates impulse response function of PMI and INFI. According to response of PMI to INFI, PMI responses negatively in the short run. This response turned positive from the 5th period. Similarly, according to the response of INFI to PMI, INFI response negatively both in the short run and long run except for the 4th and 5th terms. It is observed that it responses negatively in the short and the long term except for the 5th term.

Graphic 3.4. PMI and XI



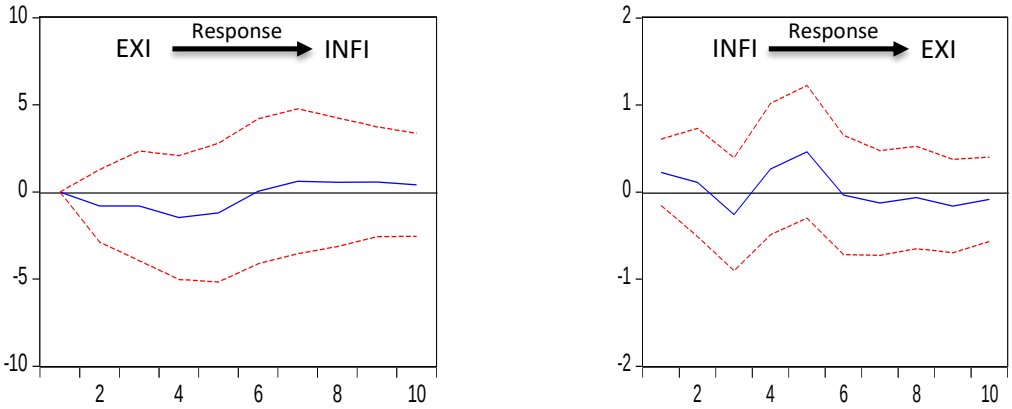
Graphic 3.4. illustrates the response function of PMI and XI. According to response of PMI to XI, PMI responses positively in the short run. This response is negative between the 2nd and the 5th period. However, this situation has turned positive again in the long-term starting from 6 periods. The response of XI to PMI is completely positive.

Graphic 3.5 EXI and ERI



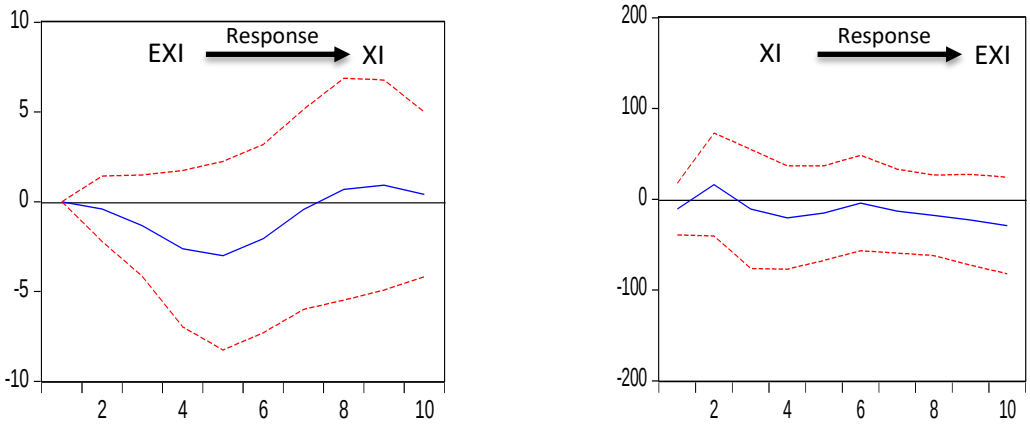
Graphic 3.5. shows impulse response function of EXI and ERI. According to response of EXI to ERI, EXI responses negatively in the short run. However, with the 7th period, it was determined that it turned into a negative response again. The response of ERI to EXI is negative in the short run. It has been observed that this response is positive since the 5th term.

Graphic 3.6. EXI and INFI



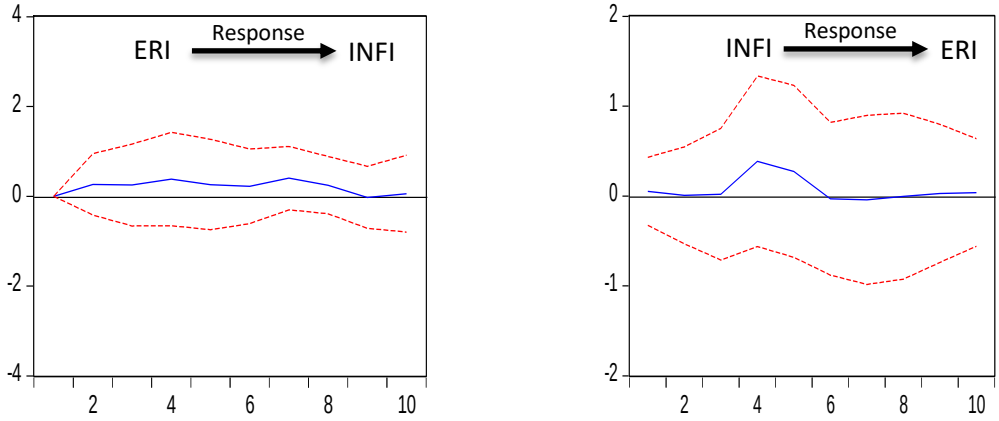
Graphic 3.6. illustrates impulse response function of EXI and INFI. According to response of EXI to INFI, EXI responses negatively in the short run. Since the 5th period, it has been observed that this response is positive at a low level. The response of INFI to EXI, In the short run. INFI responses a positive in general, except for the 3rd period. However, since the 5th term, it has been observed that this response is in a negative direction.

Graphic 3.7. EXI AND XI



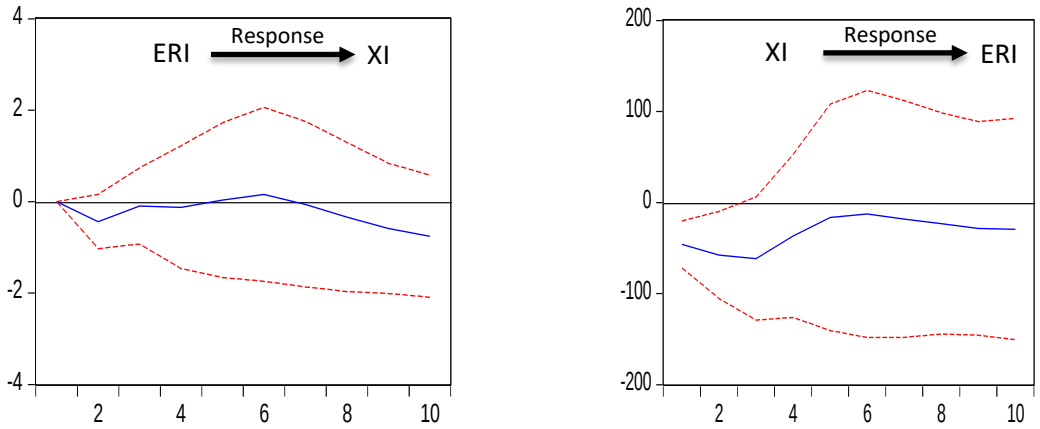
Graphic 3.7. shows impulse response function of EXI and XI. According to response of EXI to XI, EXI responses negatively in the short run. However, with the 7th period, it was determined that it turned into a positive response. According to the response of XI to EXI, except for the 2nd period, it has been determined that XI gives a negative response in the short and the long term in general.

Graphic 3.8. ERI and INFI



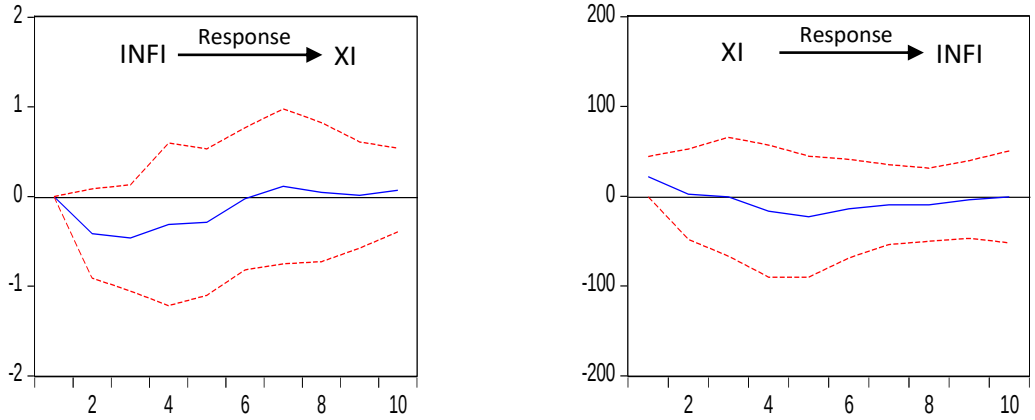
Graphic 3.8. illustrates impulse response function of ERI and INFI. According to response of ERI to INFI, ERI responses positively both in the short and also in the long run. According to response of INFI to ERI, INFI responsed neutrally in the short run. Although it was seen that this response was positive in the 4th and 5th periods, it was found that this response was neutral again after the 6th period.

Graphic 3.9. ERI and XI



Graphic 3.9. shows impulse response function of ERI and XI. According to response of ERI to XI, ERI responses negatively both in the short and long run. This response was neutral in the 5th and 6th periods. According to the response of XI to ERI, it has been determined that XI gives a negative response in the short and the long term in general.

Graphic 3.10. INFI and XI



Graphic 3.10. illustrates impulse response function of INFI and XI. According to response of INFI to XI, XI reacts negatively in the short run. In the 7th period, this reaction is positive, but in the long run, the reaction is neutral in general. According to the response of XI to INFI, INFI responsed positively in a short time. However, this response was found to be lower than the 3rd period and negative.

3.5. Variance Decomposition

In the decomposition of variance analysis, the percentage changes in the error term of the target variable are explained by a shock effect that occurs in the error term of the variables in the model in a certain period (Bozdaglioglu & Ozpinar, 2011: 44).

Table 5 shows other tests of VAR analysis.

Table 5: Variance Decomposition of Table

Variance Decomposition of PMI:						
Period	S.E.	PMI	EXI	ERI	INFI	XI
1	2.502809	100.0000	0.000000	0.000000	0.000000	0.000000
2	4.409260	74.55186	18.57860	0.286397	4.643482	1.939664
3	4.716954	65.16101	20.38911	7.806508	4.706053	1.937319
4	5.165388	59.16401	24.78333	6.703985	6.712542	2.636136
5	5.631051	51.92659	24.22997	9.714923	9.747984	4.380533
6	5.706158	51.09267	23.73493	11.24207	9.505629	4.424701
7	5.843801	49.83830	23.13386	10.72816	10.41805	5.881629
8	6.258038	48.36286	21.54410	10.36467	9.285745	10.44263
9	6.613994	45.97525	20.15587	11.06805	8.391658	14.40918
10	6.794983	44.22167	19.91508	11.73544	8.133158	15.99465
Mean		59,02	19,64	7,96	7,15	6,23
Variance Decomposition of EXI:						
Period	S.E.	PMI	EXI	ERI	INFI	XI
1	4.340729	62.22218	37.77782	0.000000	0.000000	0.000000
2	6.611239	39.87591	55.51617	2.771614	1.464109	0.372201
3	7.269226	35.52820	51.90245	6.401338	2.450469	3.717541
4	8.414916	38.59445	38.73618	5.263290	4.902012	12.50407
5	9.714883	38.46179	29.15136	8.210779	5.195325	18.98075
6	10.29070	37.83000	26.65917	9.944745	4.631329	20.93476
7	10.36216	37.35125	26.75308	10.15757	4.912805	20.82529
8	10.43931	37.22368	26.53104	10.16726	5.121983	20.95605
9	10.54498	36.61219	26.04277	10.72292	5.314884	21.30724
10	10.58823	36.33494	25.83113	11.13310	5.423236	21.27759
Mean		40,00	34,48	7,47	3,95	14,10
Variance Decomposition of ERI:						
Period	S.E.	PMI	EXI	ERI	INFI	XI
1	1.391323	0.045410	13.02152	86.93307	0.000000	0.000000
2	1.942387	2.701879	20.83665	69.47659	1.850170	5.134718
3	2.256687	6.485221	20.18948	66.74404	2.593471	3.987788
4	2.470711	6.649083	17.32137	67.89447	4.547457	3.587619
5	2.585701	6.338604	17.00246	68.20760	5.161429	3.289915
6	2.669133	6.768107	16.07847	68.21534	5.517336	3.420745
7	2.747664	6.557615	16.49460	66.32227	7.350817	3.274698
8	2.837661	7.982765	15.55929	64.34197	7.624683	4.491294
9	3.024580	9.892885	14.02258	61.61915	6.720599	7.744790
10	3.316077	12.04449	13.73297	56.89981	5.618954	11.70378
Mean		5,97	16,57	67,83	4,86	4,77
Variance Decomposition of INFI:						
Period	S.E.	PMI	EXI	ERI	INFI	XI
1	1.160718	11.39868	3.798325	0.204758	84.59824	0.000000
2	1.321287	9.816240	3.620233	0.160705	76.60046	9.802359
3	1.575116	7.455928	5.225186	0.127326	71.65910	15.53246
4	1.752275	6.587892	6.486059	4.957348	66.25672	15.71198
5	1.860239	5.900301	11.92623	6.551760	59.30329	16.31842
6	1.865300	6.197325	11.89434	6.546560	59.11202	16.24976
7	1.876749	6.122383	12.20714	6.522069	58.73012	16.41829
8	1.892269	7.238811	12.12188	6.415827	58.01104	16.21244
9	1.906166	7.356274	12.66972	6.343980	57.64752	15.98251

10	1.913700	7.707462	12.76947	6.334216	57.19676	15.99209
Mean		7,57	9,26	4,42	64,92	13,83
Variance Decomposition of XI:						
Period	S.E.	PMI	EXI	ERI	INFI	XI
1	100.2377	34.85003	1.179411	21.12347	4.693699	38.15339
2	136.4939	34.51197	2.016083	29.36394	2.554421	31.55359
3	159.8276	28.28844	1.930017	36.27842	1.865059	31.63807
4	166.7768	26.30779	3.273299	38.18868	2.714382	29.51585
5	170.0791	25.47023	3.957174	37.64906	4.420262	28.50327
6	171.3895	25.33282	3.959094	37.61479	5.021774	28.07153
7	175.2210	25.73129	4.361285	37.06312	5.099190	27.74511
8	182.4556	26.37470	4.981055	35.79374	4.976946	27.87357
9	191.6123	26.03747	5.928952	34.66547	4.553015	28.81509
10	201.1918	25.31309	7.476924	33.55920	4.131276	29.51950
Mean		27,82	3,91	34,13	4,00	30,14

According to Table 5, approximately 60% of the changes in PMI are caused by itself, while 20% are due to changes in EXI. In addition, 8% is due to changes in ERI, 7% in INFI, and 6% in XI. While 40% of EXI changes are caused by itself, 35% is due to changes in PMI. In addition, 14% is due to changes in XI, 7.5% in ERI, and 4% in INFI. While 68% of the changes in ERI are caused by itself, 16.5% are due to the changes in EXI. In addition, 6% is due to changes in PMI, and the remaining 10% is due to changes in INFI and XI. While 65% of INFI changes are caused by itself, 14% are caused by the changes in XI. In addition, 9% is due to changes in EXI, 7.5% in PMI, and 4.5% in ERI. While 30% of the changes in XI are caused by itself, 34% is due to changes in ERI. In addition, 28% is caused by changes in PMI, and the remaining 8% is due to changes in EXI and INFI.

In table 6 below, the descriptive test statistics results for the validity of the VAR model prediction results are given. From these tests, LM test autocorrelation, Heteroscedasticity White, and Jarque-Bera validity of normality assumptions in models are the basic conditions of model estimation in VAR analysis (Greene, 2000: 215). The following table 6 shows other tests of VAR analysis.

Table 6: VAR Autocorrelation, Heteroscedasticity and Normality Tests

Tests	Lag	Test Statistics	df	Probability
LM1	1	31.83650	25	0.1628
LM2	2	29.95582	25	0.2259
LM3	3	24.24191	25	0.5054
J.Bera		10.00409	10	0.4401
White		457.1163	450	0.3981

According to the Table 6, it has been seen that the probability values are higher than 5%. Thus, it was determined that there are no problems such as autocorrelation, changing variance, and normal distribution in the VAR model. In short, there are no structural and descriptive problems in the model. Lagrange Multiplier (LM), normality and heteroscedasticity assumptions, VAR model was found to be statistically significant.

3.6. Causality Analysis

Cause and effect relationships among macroeconomic variables in economics are examined by causality tests. This test helps to predict whether the lagged values of one variable in VAR are the cause of another variable. (Verbeek, 2012: 67).

The causality analysis representation will be explained with the equations given below, and then the results obtained in the analysis will be shown in the table 7.

$$X_t = \mu_i + \sum_{i=1}^{n} \mu_i X_{t-i} + \sum_{i=1}^{n} \beta_i ZX_{t-i} + e_{1t} \quad (3.3)$$

$$ZX_t = \beta_i + \sum_{i=1}^{n} \beta_i ZX_{t-i} + \sum_{i=1}^{n} \mu_i X_{t-i} + e_{2t} \quad (3.4)$$

Table 7 shows the Granger causality Wald tests of this study.

Table 7: VAR Causality Granger Wald Test

Date: 04/05/21 Time: 14:56 Sample: 2018M04 2021M02 Included observations: 32			
	Dep. Var.*: PMI		
Excluded	Chi-sq	df	Prob.
EXI	24.62425	3	0.000*
ERI	1.163037	3	0.761
INFI	4.192778	3	0.241
XI	1.920911	3	0.589
All	37.24878	12	0.002*
	Dep. Var.*: EXI		
Excluded	Chi-sq	df	Prob.
PMI	3.614919	3	0.306
ERI	4.918400	3	0.177
INFI	0.378133	3	0.944
XI	2.267567	3	0.518
All	12.18055	12	0.431
	Dep. Var.*: ERI		
Excluded	Chi-sq	df	Prob.
PMI	6.920945	3	0.074*
EXI	8.105799	3	0.043*
INFI	2.181565	3	0.535
XI	2.440813	3	0.486
All	14.95360	12	0.244
	Dep. Var.*: INFI		
Excluded	Chi-sq	df	Prob.
PMI	6.244170	3	0.100*
EXI	5.204859	3	0.157
ERI	4.842465	3	0.183
XI	5.166955	3	0.160
All	9.107426	12	0.693
	Dep. Var.*: XI		
Excluded	Chi-sq	df	Prob.
PMI	1.923006	3	0.588
EXI	4.924241	3	0.177
ERI	2.744256	3	0.432
INFI	0.297303	3	0.960
All	8.325145	12	0.759

* Dep. Var.: Dependent Variable

According to the causality analysis results obtained in Table.7, a one-way causality relationship from the EXI variable to PMI and ERI variables was determined. In addition, a one-way causality relationship from the PMI variable to ERI and INFI variables was determined. Apart from this, a causality relationship has not been found.

4. Conclusion

The development of financial markets and economic stability are of great importance in terms of the reliability of the economy in increasing the attractiveness of investments made in a country. Today, various economic and financial factors that real investors take into account when making investment decisions are also important. These factors also reveal both the size of the investment volume and the position of the investor against the risk. This study was also carried out with this aim.

In this study, firstly, information about the data set was given and then the stationarity tests were conducted. Three different stationarity tests were performed in the analysis, and especially according to the Z&A test, all variables were found to be stationary at the I(0) level. VAR analysis was conducted to examine the relationship between the indices, and the model was found to be stable. Afterward, the study was concluded by applying impulse response, variance decomposition, and VAR causality tests.

According to the results obtained in this study, although there are significant relationships between various indices, it has been seen that the most effective index on the Purchasing Managers' Index (PMI) is the export climate index. A positive relationship was found between PMI and EXI in the short run. In addition, it has been observed that the reasons for the purchasing managers index in total are the reasons for the other variables, especially the export climate index. This situation has revealed that other economic indices, especially exports, are also influential on the investment decisions of purchasing managers. According to other results, it is found that the most explanatory variable on the change in the export climate index is PMI. Besides, the most explanatory variable on the Dollar index was found to be the export climate index. The dollar index reacted negatively to the shock effect of the PMI and export climate index in the short run. It was determined that the most influential variable on the XU100 index is the Dollar index. These variables reacted negatively to the shock effect of the stock market index on the dollar, inflation, and export climate indices in the short run. It is concluded that the most explanatory variable on the inflation index is the stock market index, and these variables reacted negatively to the shock effect of inflation on the PMI and export climate index.

Studies on PMI in the literature are limited. In this study, according to other studies, contribution has been made to the literature, especially about examining the relationship between PMI and different economic and financial indices. Similar results were obtained with De Bondt & Schiaffi (2015), Sahin et al. (2020), Akdag et al. (2020), Wang et al. (2021). In addition, the VAR method used in the study has not been used much in the literature. It is thought that handling the subject with a different method will contribute significantly to the literature.

Policymakers will be effective in increasing the volume of investments in the country, especially in the financial markets and the economic policies they implement in stabilizing the economic environment. It is of great importance for policymakers to consider this situation in terms of the development of economy. As a result, in terms of international investors, as well as the stable economic structure of the country in which they invest, the composition and size of the export goods of that country, the stability of the traded currency of the trading partners, the development of the

capital markets, as well as the integration of all sectors with each other depending on the risk and confidence level of the markets. is of great importance.

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