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RELATIONSHIP BETWEEN COVID-19 AND MONEY SUPPLY IN TURKEY: EVIDENCE FROM ARDL BOUNDS TESTING APPROACH

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ABSTRACT
Purpose- COVID-19 has been a devastating process. During this period, there was a significant increase in the money supply. So, in this process, is there a relationship between COVID-19 and the money supply? This study intends to investigate if COVID-19 and the money supply have both a short- and long-term relationship.
Methodology- Logarithmic conversions were used to examine the number of COVID-19 new cases obtained from the Association of Public Health Professionals (HASUDER) and the Turkey Republic Ministry of Health, as well as M2 weekly money supply data from the Central Bank of the Republic of Turkey (CBRT) Electronic Data Distribution System (EVDS). For stationarity tests, the Augmented Dickey-Fuller (ADF), Phillips Perron (PP), and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) unit root tests were used. Due to the different degrees of stationarity of the series, cointegration was not possible, so the long-term relationship was evaluated using Autoregressive Distributed Lag (ARDL). Short-term analyzes included the VAR Model and the Granger Causality Test.
Findings- COVID-19 and the money supply, according to the findings, are not cointegrated in the long term. It has been discovered that the series do not move together over the long run. But in the short term, COVID-19 is a Granger cause of the money supply.
Conclusion- The increase in COVID-19 cases positively affects the money supply. An increase in the money supply also leads to inflation. Therefore, in order to cope with the inflationary process triggered by the pandemic, measures to prevent the increase in COVID-19 cases are important. These findings will be "confirming" in the design of policies in this process. This study is also a contribution to the literature due to the lack of studies investigating the response of the money supply to COVID-19.

Keywords: Covid-19, money supply, ARDL bounds testing approach, VAR model, Granger Causality.
JEL Codes: E51, E52, I15, I18, C22

1. INTRODUCTION

In December 2019, a new form of coronavirus was discovered in Wuhan, China, and the virus rapidly spread worldwide. COVID-19 was declared as a pandemic on March 11, 2020 (WHO, 2020). According to studies, the mutated virus is more deadly and spreads faster. On April 6, 2021, the total number of confirmed cases around the world was approximately 132.5 million, up 15%, while the death toll was approximately 2.9 million, up 37% (WHO) (Figure 1). The economic consequences of the epidemic are spreading at least as quickly as the epidemic itself, thanks to globalization. Following the announcement of COVID-19 as a pandemic, in addition to public health, COVID-19 has caused deepening effects in many economic areas from growth to unemployment and social welfare.

COVID-19, which started as a health problem and spread rapidly all over the world, brought a global depression with it. Following the shock of uncertainty, the efforts to hold onto life and prevent the pandemic brought various restrictions with it. While these restrictions led to firm shutdowns and bankruptcies, they caused mass unemployment and global economic problems (Çiğdem, 2020). These economic problems create a domino effect due to the interdependence between countries (Ugarteche and Ocampo, 2020), and they are becoming widespread through the aggravation of contractions in global trade, and the decline of aggregate demand on a global scale (Buchholz, 2020). The disrupted global production chains caused an unprecedented deep contraction in world trade volume and major decreases in the Gross Domestic Product (GDP) of the countries (Saad-Filho, 2020; Taymaz, 2020). The crisis created by the pandemic is based on mechanisms very different from the crises experienced before. The starting point of this crisis;

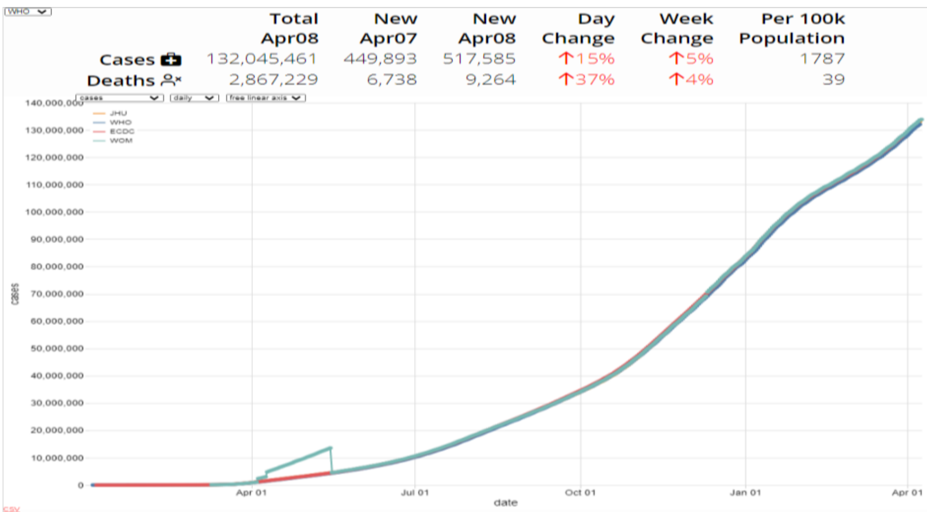
i. Cessation of activities in some sectors as a result of restrictions,

ii. Contraction in demand due to loss of income,

iii. The damage in chains and the supply system and employment losses, the damage in chains and the supply system and employment losses, and

iv. In financial markets, they are experienced simultaneously due to the collapse in asset values and commodity prices (Voyvoda and Yeldan, 2020).

Figure 1: COVID-19 Cases and Deaths Globally (WHO)



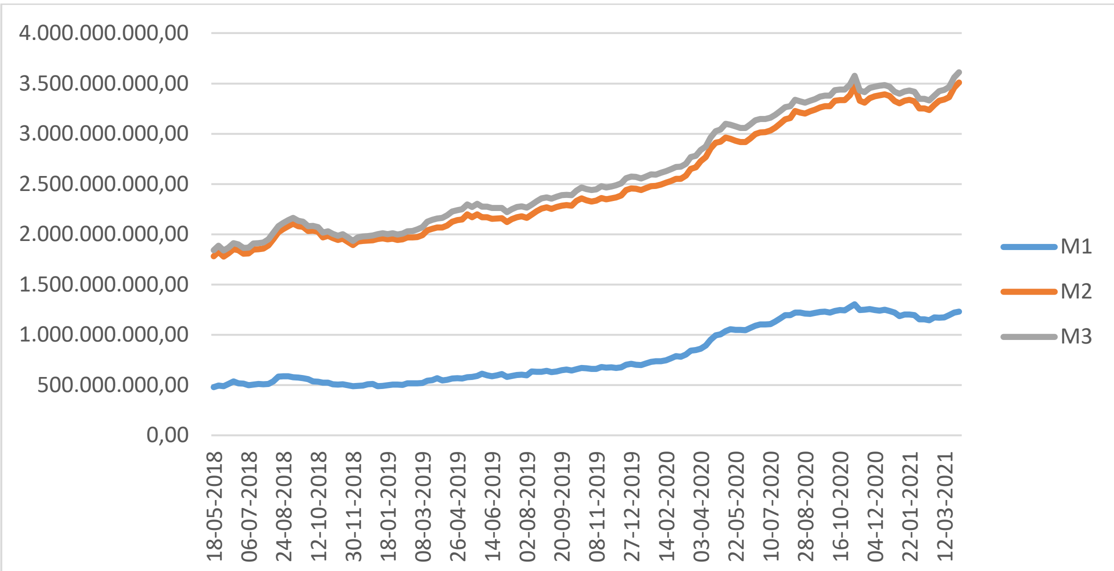
Source: World Health Organization (WHO).

COVID-19 sparked the most severe and deepest economic downturn in capitalism's history (Roubini, 2020). Under these conditions, countries implement fiscal, financial, and monetary measures to stabilize financial markets or ensure economic stability, and transfer liquidity to the markets (Elgin et al., 2020; Ugarteche and Ocampo, 2020). The process that started with COVID-19 brought a supply and demand shock with it. While the rupture of global supply chains affected the economy from the supply side, mass unemployment and loss of income affected the demand side. As a consequence of production chains' negative effects on the supply side, and consumption and investment expenditures on the demand side, COVID-19 further clarifies the ongoing recession process. In this environment, the COVID-19 Crisis affects Turkey's economy in a conjuncture in which the effects of the financial crisis of 2018 is not resolved literally (Voyvoda and Yeldan, 2020). In the face of the uncertainty created by the pandemic, whose rate of transmission has increased and is more deadly, although it has only been a year since its identification, country administrators have used different methods in combating COVID-19. Different methods brought different results. The most prominent common policy that countries have turned to has been monetary expansion.

The response of the money supply to COVID-19 and the growing inflation anxiety have not yet received sufficient attention from the researchers in the environment of uncertainty we are in. The fact that the COVID-19 process is still ongoing, as well as a lack of sufficient data, could also be factors. As a result, there is currently no established literature. Anser et al. (2021) used a cross-sectional panel in their empirical study covering 115 countries to investigate the response of the money supply to COVID-19. The study also employed innovation accounting techniques and robust least square regression. According to the findings, infected cases were the primary factor reducing the money supply. On the other hand, Saito (2021) analyzed the components of the money supply that had increased rapidly in Japan since mid-2020 and found that this increase was due to the increase in deposit money.

This increase resulted from the growth of deposits held by individuals and non-financial firms. The encouragement of bank loans, which is among the measures taken by the central bank of Japan during the pandemic process, increased bank loans. Increasing loans brought about an increase in the number of deposits. As a result, "the Helicopter Money" type of measures increased the money supply.

Figure 2: Money Supply in Turkey



Turkey has also admitted to the monetary expansion process in the COVID-19, 2019 at the end of December, which is about TL 2.5 trillion per defined M3 money supply has increased to approximately TL 3.6 trillion (Figure 2). This research aims to test empirically whether COVID-19 affects monetary expansion. The research's conceptual framework will be created first. Following that, the methodological framework will be explained. In the final section, we'll talk about the conclusions we came to from the analysis we used.

2. CONCEPTUAL FRAMEWORK OF THE MONEY SUPPLY AND ITS RESPONSE TO COVID-19

The money supply is the amount of money in circulation in a given economy at a given time (Eğilmez, 2018); a total of banknotes, coins, deposits of households and firms in circulation (CBRT, 2013). The control of the money supply, which is an effective tool of monetary policy, is in the hands of the central banks. Central Banks determine the policy rate by increasing/decreasing the money supply. The determined interest rates also affect the total expenditures. Using the money supply, central banks affect economic activity and inflation. As the inflation problem came to the fore after the 1960s, there were changes in the choice of indicators, money definitions, and determination of targets (Parasız, 2003). The money supply can be measured in a variety of ways, but in general, the money supply is classified as narrow money supply and broad money supply. The narrowest money supply, M0 (Equation 1) and M1 (Equation 2) form the narrowly defined money supply. The large money supply is also measured through the M2 and M3 channels.

Since M1 (Equation 2), which is known as the sum of money with a narrow scope, excludes money-like amounts as a result of economic developments, a broader money supply definition has become required, and M1's scope has been extended and M2 established. The M2 money supply also includes payment instruments with weaker liquid properties than M1. M2 is the sum of savings and short-term deposits in addition to M1 (Equation 3). M2 has come to the fore as an important factor in defining the money supply. Friedman suggested that M2 be the basis for controlling money supply (Orhan and Erdoğan, 2002).

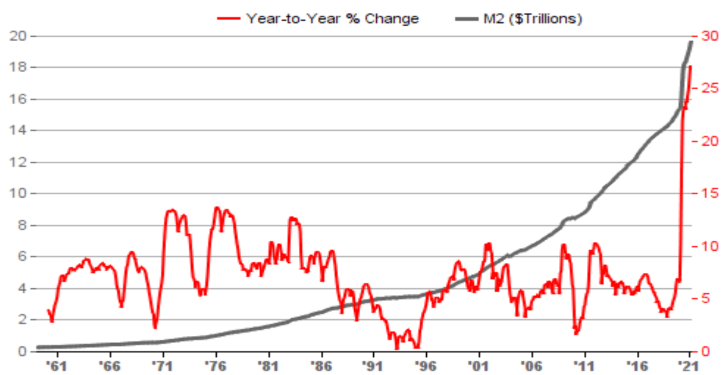
M0= Money in Circulation (Banknote + Coin) - Cash in bank vaults (1)

M1= Money in Circulation (Banknote + Coin) + Demand Deposit (TL, Foreign Currency) (2)

M2= M1 + Time Deposit (TL, Foreign Currency) (3)

Identification and measurement of money are extremely important. The changes in the amount of money are a critical factor in determining the course of economic variables. Price stability, the balance of payments, and economic growth are all affected by adjustments in monetary growth, either directly or indirectly (Orhan and Erdoğan, 2002). Therefore, the money supply is a frequently used tool. The growth in the world's money supply (in the Australia, China, Europe, Japan, and USA) increased by 14%, which is quite high compared to the past (Mousina, 2020). This expansion is thought to be related to the rapid spread of COVID-19 around the world, as well as the measures put in place. However, there hasn't been enough empirical research done on the subject.

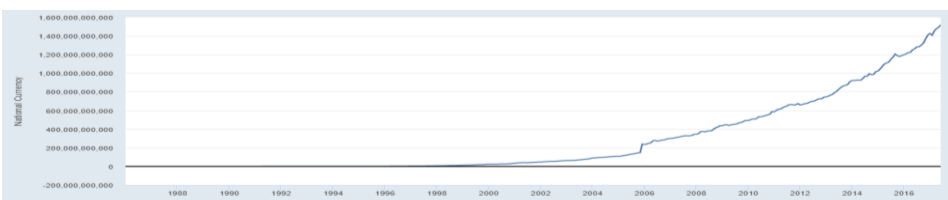
Figure 3: M2 Money Supply, Monthly Average Seasonally Adjusted (1959:01-2021:02)



Source: Shadow Government Statistics (www.shadowstats.com).

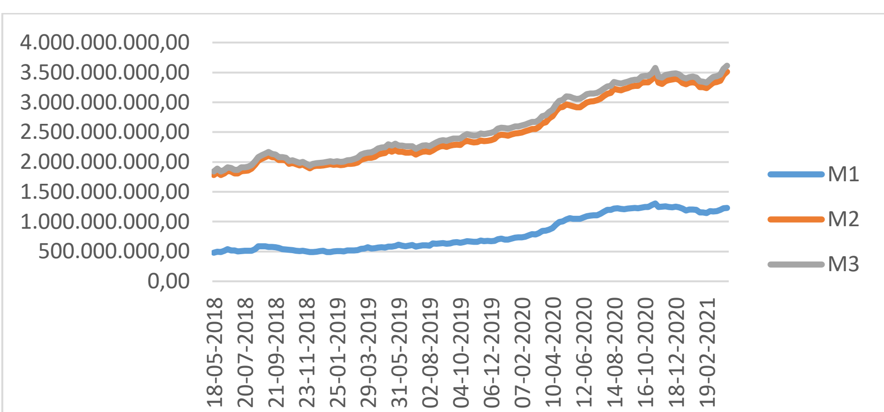
Figure 3 shows strikingly the money supply's response to COVID-19 in the USA. While Figure 4 shows the historical process of the money supply in Turkey, Figure 4 shows the shift in Turkey's money supply during the COVID-19 process. Accordingly, the beginning of an upward trend in money supply in the 2000s in Turkey, it is observed that increases in pandemic period.

Figure 4: M2 Money Supply in Turkey



Source: International Monetary Fund (IMF).

Figure 5: Money Supply in Turkey During COVID-19



As can be seen from Figure 5, M2 and M3 money supplies were 2.45 and 2.57 trillion TL, respectively, at the end of December 2019, when COVID-19 emerged, and as of April 2, 2021, these figures reached 3.5 and 3.61 trillion TL, respectively. Is this increase in money supply directly related to COVID-19? This question will be analyzed empirically in the next section.

3. DATA, METHODOLOGY AND EMPIRICAL RESULTS

To question the relationship between money supply and COVID-19 in Turkey, the number of new cases daily data were obtained from Association of Public Health Professionals (HASUDER) and the Ministry of Health and were converted to weekly data. Based on Friedman's advice, weekly M2 money supply data was provided from the Central Bank of the Republic of Turkey (CBTR) electronic data distribution system (EDDS), and subjected to analyses. Table 1 shows the variables used in the analysis, their abbreviations used and the sources obtained. COVID-19 data starting from the date of the first cases seen in Turkey as of March 11, 2020, and includes 52 observations between 13.03.2020-05.03.2021. The M2 money supply is based on billion TL, to reduce the size and stabilize it, the series will be analyzed by taking their logarithms.

Table 1: Variables

Variable Name	Data Frequency	Code	Unit	Source
COVID-19 New Cases	Annually	COVID	Ratio	HASUDER, TR Ministry of Health
M2	Annually	M2	Ratio	Central Bank of Republic of Turkey

Before starting the analysis, the graph was examined and whether the variables had a trend or not.

Figure 6: Time Path Plots of COVID-19

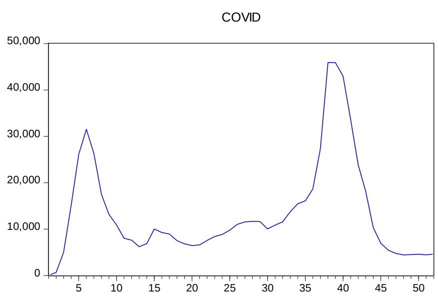
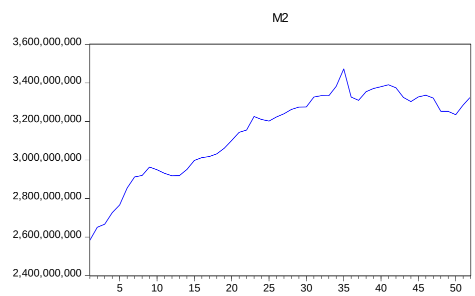


Figure 6: Time Path Plots of Money Supply



Figures 6 and 7 show that the COVID-19 variable does not have a trend, while the M2 money supply variable has a trending structure. This will be taken into account during the series' stationarity checks.

3.1. Theory

In this section, theoretical details about econometric methods used in analysis will be given.

3.1.1. Unit Root Tests

The unit-roots of variables are the first and most critical step. The degree of stationary of time series was determined using the Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) unit root tests, which are the most widely used and widely accepted stagnation tests in the literature (Enders, 1995) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) unit root test.

ADF and PP unit root tests include the following hypotheses in which the alternative hypothesis is that the assertion that the series is stationary is tested.

H_0: The time series is not stationary

H_1: The time series is stationary

In the Augmented Dickey-Fuller (Augmented Dickey Fuller-ADF) test developed by Dickey and Fuller (1981), the following equations (10) and (11) (with constant and constant trend) were estimated for the ADF test (Dickey and Fuller, 1981).

$$\Delta X_t = \beta_0 + \beta_1 X_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta X_{t-i} + u_t \quad (10)$$

$$\Delta Xt = \beta_0 + \beta_1 X_{t-1} + \beta_2 \text{ trend} + \sum_{i=1}^{k} \lambda i \, \Delta X_{t-i} + u_t \quad (11)$$

In the equations, X; the series under consideration, Δ; difference operator and *k*; dependent variable delays added to the equation, *β* and *λ* parameters, trend; linear time trend and u_t; represents the error term.

The Phillips and Perron unit root test was also used in the analysis to remove the ADF test's flaws and establish an alternative. Phillips and Perron (1988) developed the Dickey-Fuller method and developed the PP test based on more moderate assumptions in the distribution of errors (Çil Yavuz, 2015).

The PP test has hypothesis tests that are identical to the ADF and are expressed in the equations below (Phillips and Perron, 1988):

$$y_t=\hat{\mu}+\hat{\alpha}y_{t-1}+\hat{u}_t \quad (12)$$

$$y_t=\tilde{\mu}+\tilde{\beta}\left(t-\frac{1}{2}\lambda\right)+\tilde{\alpha}y_{t-1}+\tilde{u}_t \quad (13)$$

If the test statistic in both tests is greater than the critical values, the null hypothesis of the unit root is rejected.

Schwert (1989) revealed that the ADF unit root test is weak and sensitive to lag length selection. It is assumed to be no trend. In this context, the KPSS Unit Root Test, which was introduced into the literature by Kwiatkowski, Phillips, Schmidt, and Shin (1992), is more powerful. The KPSS test is based on the models below;

$$y_t=\alpha+ +\varepsilon_t \quad (14)$$

$$y_t=\alpha+ \beta_t + \mu_t +\varepsilon_t \quad (15)$$

$$\mu_t = \mu_{t-1} + \mu_t \qquad \mu_t \sim IID(0, \sigma_u^2) \quad (16)$$

In equation number 14, *α* includes the constant term, in equation number 15 it includes both the constant term and the deterministic trend. Although ε_t is stationary time, it may also have heteroscedasticity (Equations 14, 15). μ_t is a pure random walk model. The fact that y_t is a stationary process forms the basic hypothesis (Çil Yavuz, 2015) and is the reverse of the ADF unit root hypothesis.

H_0: $\sigma_u^2 = 0 \ (stationary)$ (17)

H_1: $\sigma_u^2 = 0 \ (stationary)$ (18)

3.1.2. Autoregressive Distributed Lag Model (ARDL)

The results of the analysis show that the sequence is stationary at different levels. In the ARDL test developed by Pesaran et al. (2001); the cointegration relationship of series which are at different levels can be questioned. Variables still need to be tested against the possibility of being stationary I2 in the second difference. In the second difference, ARDL model cannot be applied in stationary variables. Small samples can produce healthy and successful results in the ARDL test, which can be combined with long-run equilibrium error correction (ECM) and short-run dynamics.

"H_0: No cointegration between variables", as a result, ignoring the H_0 hypothesis demonstrates the existence of such a cointegration. H_0 is rejected if the F statistic bigger than the critical upper limit. H_0 is accepted when the F statistic smaller than the critical lower value. Other cointegration tests should be considered where the F statistic is between the upper critical value and lower critical value, as there is insufficient evidence to reject or fail to reject the H_0 hypothesis (Pesaran et al., 2001).

3.1.3. VAR Model

Vector autoregressive models (VAR), which are the generalized form of autoregressive models for more than one variable, have been developed as an alternative to the traditional simultaneous equation system and brought to the literature by Sims (1980). VAR model allows making predictions for more than one variable (Çil Yavuz, 2015). The VAR model is a preferred model in time series because it does not impose any restrictions and can give dynamic relationships (Keating, 1990). The Granger causality test model is the foundation of the model. If the model contains two endogenous variables, each is correlated with both its own and the lagged values of the other endogenous variable up to a certain period.

$$Y_t = \alpha + \sum_{j=1}^{m} \beta_j Y_{t-j} + \sum_{j=1}^{m} \delta_j X_{t-j} + \varepsilon_{1t} \quad (19)$$

$$X_t = \alpha + \sum_{j=1}^{m} \theta_j Y_{t-j} + \sum_{j=1}^{m} \vartheta_j X_{t-j} + \varepsilon_{2t} \quad (20)$$

When the lagged values of the dependent variables are used in the VAR model, it is possible to make accurate predictions (Kumar et al., 1995). The relationship between series can be revealed by correlations obtained as a result of these strong predictions. For the VAR model to be used for a structural analysis, three techniques are required;

i.Granger Causality Test,

ii. Impact-Response Analysis and

iii. Variance Decomposition.

3.1.4. Granger Causality Test

Due to its ease of use, it is a widely used test developed by Granger (1969) and Sims (1972) that determines the direction of the relationship between variables. One of the uses of VAR models is; it is to predict the future and provides information about predictive adequacy. The predictive adequacy of a variable is based on Granger (1969).

3.1.5. Variance Decomposition and Impact-Response Analysis

Variance decomposition “shows the rates of shocks originating from the other variable against shocks caused by itself of a series” (Çil Yavuz, 2015). If it explains the value of nearly 100 percent of the change in variance on its own, it is considered as an "exogenous variable". In this analysis, the ordering of variables is done from exogenous to endogeneous. Variance decomposition is the second function targeted in VAR. It can also be used as a side assessment about whether the variables are endogenous or exogeneous (Tarı, 2006).

Impulse-response functions are obtained after finding the appropriate lag lengths in the VAR model. With the support of tables and graphics, impact-response functions expose the shocks and their impact on variables and when they will lose their influence. This analysis demonstrates how the variables react to shocks.

In analyzing the relationships between economic variables, variance decomposition and impact-response analysis are very useful tools. In the literature, using these two analyses together is known as shock accounting (as quoted in Enders: Çil Yavuz, 2015).

3.2. Empirical Findings

This section contains the empirical findings of the research. ADF, PP, and KPSS tests were used in stationarity tests, which is the first and mandatory step in the analyzes, and the analysis results are shown in Table 2;

Table 2: ADF, PP, and KPSS Unit Root Test Results

Variables	**ADF**			
	Test Statistic	**%1**	**%5**	**%10**
LNCOVID, *Level*	-1.801869	-3.568308	-2.921175	-2.598551
LNCOVID, *1st diff*	-18.42789	-3.568308	-2.921175	-2.598551
LNM2, *level*	-2.172751	-4.148465	-3.500495	-3.179617
LNM2, *1st diff*	-5.312501	-4.156734	-3.504330	-3.181826
Variables	**PP**			
	Test Statistic	**%1**	**%5**	**%10**
LNCOVID, *Level*	-7.423539	-3.565430	-2.919952	-2.597905
LNM2, *level*	-2.169650	-4.148465	-3.500495	-3.179617
LNM2, *1st diff*	-6.633331	-4.152511	-3.502373	-3.180699
Variables	**KPSS**			
	Test Statistic	**%1**	**%5**	**%10**
LNCOVID, *Level*	0.224599	0.739000	0.463000	0.347000
LNM2, *level*	0.231968	0.216000	0.146000	0.119000

Note: In ADF research, the number of lags is determined using the Schwarz criteria, which is a more efficient criterion that produces better results than the others. The number of lags found in conjunction with Newey-West Bandwith is received in the Phillips Perron tests. The maximum lag length is nine.

Different results (ADF I_1; PP and KPSS I_0) were obtained as a result of the unit root analysis applied to LNCOVID. Since the KPSS test has higher power, it was determined that LNCOVID was stationary at the I_0 level because the results of this test, as well as the PP test, were both I_0. According to the results of all three studies, LNM2 is stationary at the I_1 level. Due to the different stationarity levels of the series, cointegration tests could not be achieved.

The series' long-term relationship was investigated using ARDL Bounds Test, and LNM2 was taken as the dependent variable because the stationarity test result was I_1. The results obtained are shown in Table 3.

Table 3: ARDL Bounds Test Results

Predicted Equality		
F Statistic	4.324785	
Significance Level	Critical Value	
	Lower Value	Upper Limit
%1	7.435	8.46
%5	5.125	6.045
%10	4.155	4.925

Dependent Variable: LNM2.

In case LNM2 is the dependent variable, it has been determined that there is no cointegrated relationship between the series (F statistics<Lower Value 5%). In the long term, it has been determined that the series do not move together.

Table 4: Error Correction Model (ECM) and Long Run Coefficients

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.522404	0.510783	2.980529	0.0045
D(LNCOVID)	0.005258	0.002013	2.611814	0.0121
CointEq(-1)*	-0.070515	0.023725	-2.972138	0.0047
	Value	Signif.	I_0	I_1
t-Statistic	-2.972138	10%	-2,57	-2,91
		5%	-2,86	-3,22
		1%	-3,43	-3,82
Long-Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LNCOVID	0.036754	0.035577	1.033095	0.3068

Dependent Variable: LNM2.

In the analysis of the short-term relationship, the error correction model obtained from the ARDL model was used. The results regarding the model are shown in Table 4.

It is seen that the error correction coefficient is negative and statistically significant as expected (0.0047 <0.05). In addition, t-Statistic is also significant at 10% level (2.972138> 2.91). It is understood that the established model meets the requirements for the ARDL Bounds Test.

A deviation from a short-term balance reaches the long-term balance after 14.18 (1/0.070515=14.18) weeks.

When COVID-19 increases by 1%, LNM2 increases by 0.036754%, but the coefficient is not statistically significant (0.3068> 0.05). The sign of the long-term coefficient shows that COVID positively affects M2.

CUSUM and CUSUM Square graphs were used to investigate the presence of structural breaks related to variables (Fig.8, 9).

Figure 8: CUSUM Test

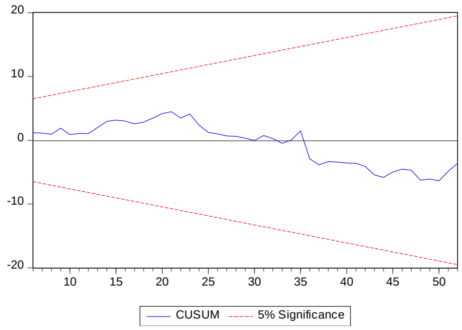
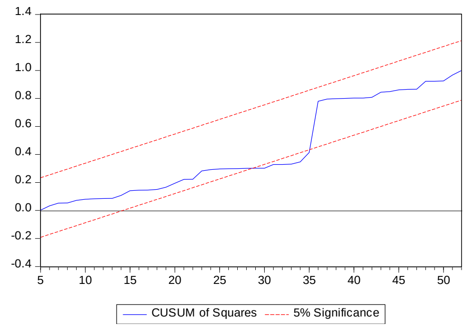


Figure 9: CUSUM Suqare Test



A break in the CUSUM Square graph was observed when the residuals of the variables were examined, but it was ignored due to the absence of any break in the CUSUM graph.VAR model was applied for short-term analysis between variables. First of all, the series has been made stationary. The appropriate lag length is decided (Table 5) and the VAR model was estimated.

Table 5: Determining the VAR Model Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	148.8721	NA	6.62e-06	-6.249878	-6.171149	-6.220252
1	165.0244	30.24248*	3.95e-06*	-6.766995*	-6.530806*	-6.678115*
2	167.6503	4.693055	4.19e-06	-6.708521	-6.314873	-6.560389
3	171.8785	7.197088	4.16e-06	-6.718236	-6.167128	-6.510850
4	173.7210	2.979303	4.59e-06	-6.626426	-5.917859	-6.359787

The appropriate lag length is decided as 1 as shown in Table 5. The VAR model should meet certain econometric assumptions based on this lag length. Four assumptions must be met for this VAR model to be accurate and usable;

1) There should be no autocorrelation,

2) There should be no heteroscedasticity problem,

3) Remains of the VAR model should conform to normal distribution, and

4) The obtained AR roots must be in the unit circle.

Since the heteroscedasticity problem emerged in the tests, the problem was eliminated by taking the lag length as 2. Analysis results testing whether there is a deviation from the assumption obtained with 2 lag lengths are given in Table 6;

Table 6: Autocorrelation

Null hypothesis: No serial correlation at lags 1 to h						
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	2.407513	4	0.6613	0.603335	(4, 82.0)	0.6613
2	8.933202	8	0.3480	1.136829	(8, 78.0)	0.3485

*Edgeworth expansion corrected likelihood ratio statistic.

According to the results seen in Table 6, since the probability value is greater than 0.01, there is no autocorrelation problem.

Table 7: Heteroscedasticity

Joint test:		
Chi-sq	df	Prob.
22.47520	24	0.5509

Since the probability value (0.5509) is greater than the critical value (0.05), H_0 cannot be rejected, the constant variance is valid, there is no heteroscedasticity problem (Table 7).

Table 8: Normality Test

Component	Jarque-Bera	df	Prob.
1	70.16381	2	0.0000
2	2.925638	2	0.2316
Joint	73.08945	4	0.0000

H_0 was rejected because the probability value (0.0000) was less than the critical value (0.05) (Table 8). And, the remains of the VAR model were not normally distributed, so the Kolmogorov-Smirnov Test was used. Table 9 shows the outcome of the tests.

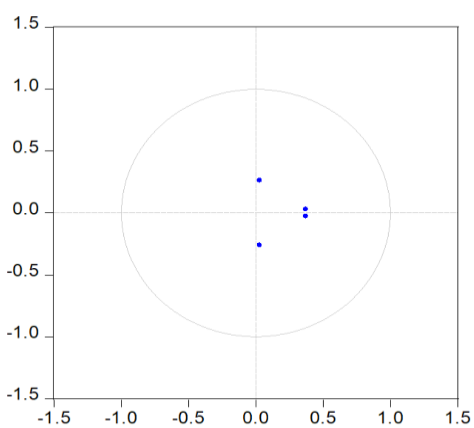
Table 9: Kolmogorov-Smirnov Test Results

		VAR00001
N		52
Normal Parameters [a,b]	Mean	.0000
	Std. Deviation	.07086
Most Extreme	Absolute	.178
Diferences	Positive	.122
	Negative	-.178
Kolmogorov-Smirnov Z		1.280
Asymp. Sig. (2-tailed		.075

[a] Test distribution is Normal.
[b] Calculated from data.

Since the probability value of the Kolmogorov-Smirnov Test (0.075) is higher than the critical value (0.05), it is seen that the model's residues are normally distributed (Table 9).

Figure 10: Inverse Roots of AR Characteristic Polynomial



Inverse roots are in the unit circle, as shown in Figure 10. As a result, the VAR model can be defined as stable, or a stationary model. The Granger Causality Test (Granger, 1980; 1981) was conducted to determine whether the variables affect each other.

Table 10: VAR/Granger Causality Analysis Results

Dependent variable: DLNM2

Excluded	Chi-sq	df	Prob.
DLNCOVID	6.384049	2	0.0411

Dependent variable: DLNCOVID

Excluded	Chi-sq	df	Prob.
DLNM2	3.914695	2	0.1412

As demonstrated from Table 10; the calculated probability value (0.0411) is less than the critical value (0.05), H_0 is rejected, a causality relationship from COVID-19 to the money supply has been determined. So COVID is a Granger cause of the money supply (M2) (Fig. 11).

Figure 11: Granger Causality Analysis Results.

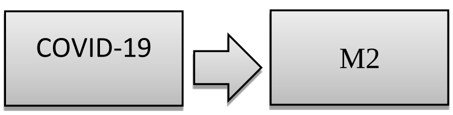


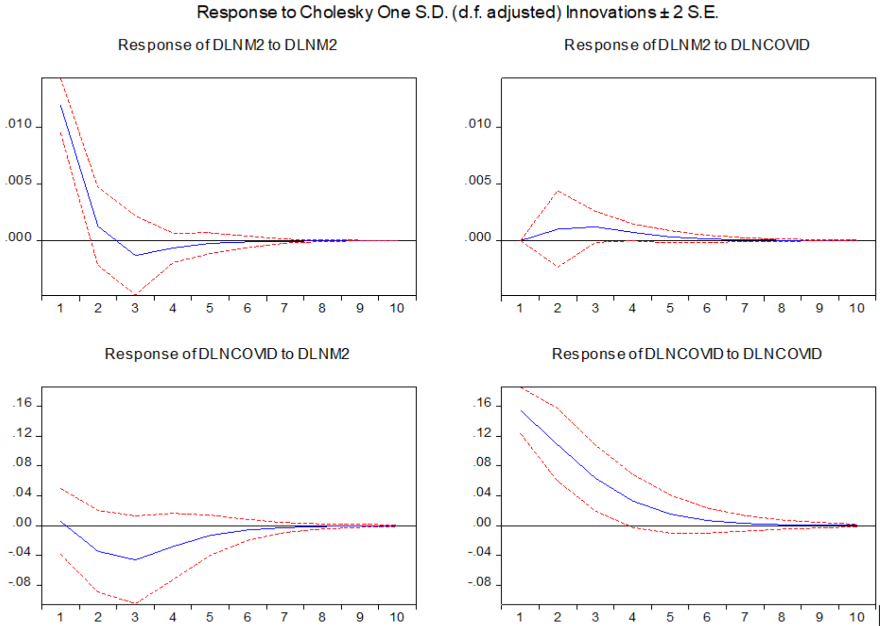
Table 11: Variance Decomposition Results

	Variance Decomposition of DLNM2			Variance Decomposition of DLNCOVID		
Period	S.E.	DLNM2	DLNCOVID	S.E.	DLNM2	DLNCOVID
1	0.011936	100.0000	0.000000	0.154278	0.141046	99.85895
2	0.012046	99.29625	0.703749	0.191409	3.270396	96.72960
3	0.012178	98.31665	1.683350	0.206874	7.715943	92.28406
4	0.012217	97.98006	2.019940	0.211348	9.130632	90.86937
5	0.012224	97.90869	2.091313	0.212305	9.416487	90.58351
6	0.012225	97.89463	2.105373	0.212492	9.472410	90.52759
7	0.012225	97.89182	2.108181	0.212527	9.483803	90.51620
8	0.012225	97.89129	2.108711	0.212534	9.485986	90.51401
9	0.012225	97.89120	2.108803	0.212535	9.486369	90.51363
10	0.012225	97.89118	2.108819	0.212535	9.486433	90.51357

The money supply can explain the whole variance (100%) by itself in the short run. The rate that can be explained by money supply falls to 97.89 percent at the end of the tenth period, while the rate that can be explained by COVID-19 increases to 2.11 percent (Table 11).

99.86% of the variance of COVID-19 is explained by itself in the short term. At the end of the 10th period, the rate that can be explained by the money supply increases to 9.49 (Table 11). Impulse-response functions were used to determine the response of the variables, despite a standard error shock given to the variables (Fig. 12).

Figure 12: Impact-Response Analysis Results



Following our analysis that we found that COVID-19 is a Granger cause of the money supply, we take into account the second graph in Fig. 11; accordingly, a standard deviation shock to COVID-19, the money supply (M2) will increasingly react and this increase will continue until the 2nd period. After the 2nd period, it will begin to decrease and the effect of this shock will decrease and disappear in the 8th period.

4. CONCLUSION

This research aims to see if there is a relationship between COVID-19, which is responsible for the deepest recession in capitalism's history, and the rise in the money supply that occurs as a result of it. The Association of Public Health Professionals (HASUDER) provided daily new case numbers for this reason. The weekly numbers were derived from this. Weekly M2 money supply data have also been obtained from the CBRT. Various analyzes have been applied by taking the logarithms of the series. First, the Augmented Dickey-Fuller (ADF), Philip-Perron (PP) unit root tests, and KPSS unit root tests were used to determine stationarity. Because of the different stability levels, cointegration could not be used, so the ARDL Bounds Test and VAR Model were used instead. The money supply variable was used as a dependent variable in the analyses since the stationary level is I1. The study discovered that COVID-19 and the money supply are not cointegrated in the long run. COVID-19, on the other hand, has been determined as a short-term Granger cause of the money supply. The rise in COVID-19 cases has a positive impact on the money supply. This result does not coincide with the study findings of Anser et al. (2021). Since an increase in the money supply often leads to inflation, policies and procedures should be designed accordingly.

REFERENCES

Anser, M. K., Khan, M. A., Zaman, K. Nassani, A. A., Askar, S. E., Abro, M. M. Q., & Kabbani, A. (2021). Financial development during COVID-19 pandemic: the role of Coronavirus testing and Functional labs. Financial Innovation, 7(1), 1-13. doi: 10.1186/s40854-021-00226-4

Buchholz, C. (2020). The Coronavirus and carceral capitalism. Developing economics. https://developingeconomics.org/2020/04/11/the-coronavirus-and-carceral-capitalism/

CBRT. (2013). Bulletin No.31. https://www.tcmb.gov.tr/wps/wcm/connect/23fa999c-481e-478b-ba87-9f61951ca8e7/Bulten31.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-23fa999c-481e-478b-ba87-9f61951ca8e7-m3fB9EG

Çiğdem, G. (2020). A Double-edged sword: COVID-19 and emission: proofs from Turkey. Eurasian Journal of Researches in Social and Economics (EJRSE), 7(7), 1-12.

Çil Yavuz, N. (2015). Finansal ekonometri. İkinci Basım. İstanbul: Der Yayınları.

Dickey, D. A. & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49(4), 1057-1072.

Eğilmez, M. (2018). Para arzı nedir ve nasıl ölçülür? https://www.mahfiegilmez.com/2018/07/para-arz-nedir-ve-nasl-olculur.html

Elgin, C., Basbug, G. & Yalaman, A. (2020). Economic policy responses to a pandemic: developing the Covid-19 economic stimulus index. Centre for Economic Policy Research. https://voxeu.org/article/economic-policy-responses-pandemic-covid-19-economic-stimulus-index

Enders, W. (1995). Applied econometric time series. New York: Wiley.

Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. Econometrica, 37(3), 424-438. doi:10.2307/1912791

Granger, C. W. J. (1980). Testing for causality: a personal viewpoint. Journal of Economic Dynamics and Control, 2, 329-352.

Granger, C. W. J. (1981). Some properties of time series data and their use in econometric model specification. Journal of Econometrics, 16(1), 121-130.

Keating, J. W. (1990). Identifying VAR models under rational expectations. Journal of Monetary Economics, 25(3), 453-476.

Kumar, V., Leone, R. P., & Gaskins, J. N. (1995). Aggregate and disaggregate sector forecasting using consumer confidence measures. International Journal of Forecasting, 11(3), 361-377.

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: how sure are we that economic time series have a unit root? Journal of Econometrics, 54(1-3), 159-178.

Mousina, D. (2020). Econosight: inflation in the COVID-19 world, https://www.ampcapital.com/americas/en/insights-hub/articles/2020/july/inflation-in-the-covid-19-world

Orhan, O. Z. & Erdoğan, S. (2002). Para politikası. İstanbul: Avcılar Ofset.

Parasız, İ. (2003). Para politikası. 6. Basım. Bursa: Ezgi Kitabevi.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326.

Phillips, P. C. B. & Perron, P. (1988). Testing for a unit root in time series regression. Biometrika, 75(2), 335–346.

Roubini, N. (2020). Coronavirus pandemic has delivered the fastest, deepest economic shock in history. The Guardian. https://www.theguardian.com/business/2020/mar/25/coronavirus-pandemic-has-delivered-the-fastest-deepest-economic-shock-in-history

Saad-Filho, A. (2020). From COVID-19 to the end of Neoliberalism. Critical Sociology, SAGE Journals, 46(4-5), 477-485. https://doi.org/10.1177%2F0896920520929966

Saito, J. (2021). COVID-19 and money supply. Japan Center for Economic Research. https://www.jcer.or.jp/english/covid-19-and-money-supply

Schwert, G. W. (1989). Tests for unit root: a Monte Carlo investigation. Journal of Business and Economic Statistics, 7(2), 147-160.

Sims, C. A. (1972). Money, income, and causality. The American Economic Review, 62(4), 540-552.

Sims, C. A. (1980). Macroeconomics and reality. Econometrica, 48(1), 1–48.

Tarı, R. (2006). Ekonometri. 4. Baskı. İstanbul: Avcı Ofset.

Taymaz, E. (2020). COVID-19 tedbirlerinin Türkiye Ekonomisine etkisi ve çözüm önerileri. Sarkaç. https://sarkac.org/2020/04/covid19-tedbirlerinin-turkiyeekonomisine-etkisi-cozum-onerileri/

Ugarteche, O. & Ocampo, A. (2020). COVID-19: the beginning of domino effect. Observatorio Economico Latinoamericano, OBELO Discussion Paper. http://www.networkideas.org/wp-content/uploads/2020/04/covid19_domino_effect.pdf

Voyvoda, E. & Yeldan, E. A. (2020). COVID-19 salgınının Türkiye Ekonomisi üzerine etkileri ve politika alternatiflerinin makroekonomik genel denge analizi, https://yeldane.files.wordpress.com/2020/05/covid_voyvodayeldan_v2_31mayis.pdf

WHO. Coronavirus (COVID-19) dashboard, https://covid19.who.int/?gclid=CjwKCAjw07qDBhBxEiwA6pPbHi-cJAt5BTH7UFUqyiqQZUWTqMNNq0d7KJweiIu3NNJ8QAmhVzvw3hoCuKsQAvD_BwE

WHO. (2020). Archived: WHO timeline-COVID-19, https://www.who.int/news-room/detail/27-04-2020-whotimeline---covid-19?gclid=EAIaIQobChMIotiQ-rfh6gIVCIBQBh2Ciwm_EAAYASAAEgIimfD_BwE