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RELATIONSHIP BETWEEN MONETARY POLICY AND MACROECONOMIC VARIABLES FOR EMERGING COUNTRIES

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Abstract

Monetary policy determinants determine economic and monetary policies by taking some variables as reference. In this regard, fourteen developing countries with similar characteristics with Turkish economy and the relationships between macroeconomic variables and monetary policy shall be described. In this study, relationships between monetary policy and macroeconomic variables are investigated for emerging countries. We used 2010M1-2018M12 period and analyzed the relationship between panel data analysis methods, money supply, inflation, interest rate, exchange rate, export, import and oil prices. A cointegration analysis was used to investigate the long-term relationship between variables. According to the results of the panel data analysis, long term relationship was found between the variables. Inflation, interest rate and oil prices had a decreasing effect on money supply, while exchange rate and exports had a positive effect on money supply.

Keywords: Monetary Policy, Macroeconomic Variables, Emerging Countries

1. INTRODUCTION

Monetary and fiscal policies are determined and implemented depending on the economic conjuncture. The implementation of the determined policies is reflected in the preferred period, monetary and financial conditions. Money supply is one of the important building blocks of macroeconomics due to being the main argument of monetary policy. Money supply plays a role in determining asset prices such as inflation rate, interest rate, open economy model, foreign trade, exchange rate, oil prices, which we consider as a variable in our work, as well as investment prices,

savings and total demand. In dedicating this important role, the determination of money supply has been one of the main topics of economic theory.

According to modern macroeconomics, the most widely accepted view is that money supply is determined and executed by central banks. According to the internal monetary theory, which gained power in the 1970s, the money supply was determined by loans that were not fluid by the central bank. More precisely, deposits generated within the banking system through credit flow create money supply. Thus, as mainstream economics argues, central banks are not the absolute rulers of the money supply process.

The main starting point of this paper is: Does monetary policy effect macroeconomic variables? Moreover, according to the hypothesis of the study, monetary policy is expected to play an active role in macroeconomic variables. As a result of this study, the effects of inflation, interest rate, exchange rate, export, import and oil prices on money supply meet our expectations.

The aim of this study is to investigate whether there is a relationship between macroeconomic variables and monetary policy in emerging countries. We will use panel data analysis methods. To the best of our knowledge, this is the first study to analyze the relationship between macroeconomic variables and monetary policy using panel data and a monthly data set. In this study, we will first review the literature. Second, we will present the data and descriptive statistics. Third, we will give econometric methods and empirical results. Finally, we will give a brief summary of the article and the recommendations.

2. LITERATURE

There is no single study explaining the relationship between macroeconomic variables and money supply in this study. For this reason, the studies explaining the relationship between money supply and macroeconomic variables will be explained. Studies generally focus on the relationship between inflation and money supply.

Papapetrou and Hondroyiannis (1997), in their work covering the years 1957-1993, found a long-term relationship between the money supply and the level of prices for the Greek economy and obtained a one-way causality relationship from the money supply to the price level.

Favero and Spinelli (1999), in their study on Italy, pointed out a long-term relationship between money supply and price level in the 1875-1994 period and emphasized the importance of supply-side factors in determining inflation.

Tekin, Koru and Özmen (2003) by using 1983: 1-1999: 4 period with quarterly data in their study for the Turkish economy, have found a long-term relationship between inflation and monetary growth. In the study, separate estimates were made for narrow and large money supply. Money supply and inflation have moved in the same direction, resulting in a contrary to the monetarist view.

Grauwe and Polen (2005) investigated the relationship between money growth rate and inflation with 160 countries and 30 years of data. They identified a monetary relationship between monetary growth and inflation in the long run.

Çatalbaş (2007), Turkish economy in 1999: 1-2006: 3 for the period investigated the relationship between money supply and inflation. The relationship between CPI and money supply was found to be positive.

Tüzün (2007), with Turkish economy in the 1980-2004 period, the money supply has explored the relationship between inflation. It found a negative relationship between money supply and inflation.

Altintas et al. (2008) pointed the existence of a positive and significant relationships in both long and short period between the inflation and money supply in ARDL studies made for Turkey with by using 1992: 1 2006 12 monthly data.

Lozano (2008) has analyzed the inflation and money supply relationships by using quarterly data of 1982: 1-2007: 4 in the study concluded on the economy of Colombia and obtained a long period relation.

Thornton (2011), in his study, analyzed the relationship between money supply and inflation in the long run. Cross-sectional results revealed that money supply was determinative for inflation in economies with low inflation.

Saeed et al. (2012) used the ARDL boundary test for the Pakistan economy. Money supply, foreign exchange reserves and debts are the determinants of exchange rate.

Kia (2013) used regression analysis in his study of Canadian economy. The rise in interest rates and the increase in the money supply had a negative effect on exchange rates.

Şahin and Karanfil (2015), Turkish economy in the 1980-2013 period investigated the effect of money supply on inflation. Johansen cointegration and Granger causality analysis methods used. In the long run, there was no correlation between the two variables, but there was no direct causality between the two variables.

3. DATA AND DESCRIPTIVE STATISTICS

In the study, fourteen developing countries (Brazil, Chile, China, Colombia, Czech Republic, Hungary, India, Indonesia, Republic of Korea, Mexico, Poland, Russia, South Africa and Turkey) were selected. Data related with variables for all countries (money supply, inflation, interest rates, exchange rate, export, import and oil prices) has been obtained from OECD and IMF IFS database for the period 2010: M1-2018: M12. Money supply, export and import data was obtained from OECD database; inflation (consumer price index), interest rates and exchange rate data were taken from the IMF IFS database.

Descriptive statistics that summarize the changes of variables in the relevant periods are one of the methods frequently used in the analysis of time series. Thus, descriptive statistics are calculated by the authors of the variables (mean, standard deviation and minimum and maximum values) and are summarized according to the countries in Table 1.

Table 1 Descriptive Statistics

Variables	Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Money Supply (MS)	1512	92.11335	23.65465	41.1194	176.0971
Inflation(INF)	1512	120.3487	19.91544	96.63667	224.9271
Interest Rate (IR)	1512	4.670563	3.375298	0.0265	22.5
Exchange Rate (ER)	1512	1142.317	3009.191	1.422984	15178.87
Export (X)	1512	29.89027	43.44367	2.196667	259.3865
Import (M)	1512	27.56781	36.08505	2.955535	190.8257
Oil Prices (OP)	1512	78.12106	24.94580	29.78000	117.7850

Source: authors' calculations

4. ECONOMETRIC METHODS AND EMPIRICAL RESULTS

In line with the objectives of the study, monthly time series data, econometric techniques and panel data analysis were performed.

We used the following model for developing countries to examine whether the money supply has an explanatory effect on inflation, interest rates, exchange rate, exports, imports and oil prices.

$$MS = a_i + \beta_{1i}INF_{it} + \beta_{2i}IR_{it} + \beta_{3i}ER_{it} + \beta_{4i}X_{it} + \beta_{5i}M_{it} + \beta_{6i}OP + \varepsilon_{it} \quad (1)$$

Here i shows the countries and t shows the time period.

Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), Hadri (2000), Maddala and Wu (1999) and Choi (2001) panel unit root tests were used to examine the stasis of the series. Table 2 shows the unit root test results. According to the results of the unit root test conducted outside the Hadri unit root test, the variables become stationary in both the constant and the constant trend model.

Table 2 Unit Root Test Results

Variable	Test	Constant		Constant and Trend	
Level					
		Statistic	p-value	Statistic	p-value
Money Supply	LLC	5.13783	1.0000	0.71894	0.7639
	IPS	11.2107	1.0000	2.10843	0.9825
	Maddala and Wu	3.12325	1.0000	20.8426	0.8318
	Choi	10.4194	1.0000	2.12358	0.9831
	Hadri	25.3248	0.0000	18.8615	0.0000
Inflation	LLC	1.36586	0.9140	-1.49883	0.0670
	IPS	5.26694	1.0000	1.44520	0.9258
	Maddala and Wu	17.3893	0.9405	26.6820	0.5356
	Choi	4.80476	1.0000	1.28871	0.9013
	Hadri	25.1203	0.0000	14.7614	0.0000
Interest Rate	LLC	-0.00849	0.4966	-1.82570	0.0339
	IPS	1.23370	0.8913	0.02473	0.5099
	Maddala and Wu	33.0075	0.2355	64.3962	0.0001
	Choi	1.09841	0.8640	0.06741	0.5269
	Hadri	11.7473	0.0000	8.23421	0.0000
Exchange Rate	LLC	1.51429	0.9350	-0.69875	0.2424
	IPS	2.69427	0.9965	-0.27854	0.3903
	Maddala and Wu	18.6610	0.9083	26.9741	0.5197
	Choi	2.63768	0.9958	-0.31827	0.3751
	Hadri	23.5812	0.0000	0.93301	0.0000
Export	LLC	-1.52412	0.0637	-1.55355	0.0601
	IPS	-1.97539	0.0241	-1.19717	0.1156
	Maddala and Wu	39.3470	0.0755	29.8695	0.3695
	Choi	-1.98630	0.0235	-1.23170	0.1090
	Hadri	17.7289	0.0000	11.0672	0.0000
Import	LLC	-1.74185	0.0408	-2.24605	0.0124
	IPS	-2.05198	0.0201	-0.60526	0.2725
	Maddala and Wu	37.3205	0.1120	23.9518	0.6841
	Choi	-2.07976	0.0188	-0.61472	0.2694
	Hadri	5.70181	0.0000	7.58397	0.0000
Oil Prices	LLC	-1.13044	0.1291	-4.79024	0.0000
	IPS	0.90400	0.8170	-1.16959	0.0112
	Maddala and Wu	13.4984	0.9904	28.1299	0.4576
	Choi	1.11840	0.8683	-1.27964	0.1003
	Hadri	12.8280	0.0000	7.80300	0.0000

First Difference					
		Statistic	p-value	Statistic	p-value
Money Supply	LLC	-13.0538	0.0000	-17.2212	0.0000
	IPS	-13.8205	0.0000	-15.2401	0.0460
	Maddala and Wu	281.116	0.0000	285.574	0.0000
	Choi	-12.1999	0.0000	-12.6147	0.0000
	Hadri	8.76211	0.0000	0.44549	0.3280
Inflation	LLC	-19.1767	0.0000	-20.9322	0.0000
	IPS	-20.9962	0.0000	-21.9632	0.0000
	Maddala and Wu	441.427	0.0000	419.012	0.0000
	Choi	-18.3258	0.0000	-17.9933	0.0000
	Hadri	7.97026	0.0000	5.06661	0.0000
Interest Rate	LLC	-11.9082	0.0000	-1.97919	0.0000
	IPS	-16.7779	0.0000	-19.4271	0.0000
	Maddala and Wu	344.913	0.0000	371.792	0.0000
	Choi	-13.8944	0.0000	-14.3055	0.0000
	Hadri	2.35437	0.0000	2.58823	0.0000
Exchange Rate	LLC	-30.4307	0.0000	-33.6220	0.0000
	IPS	27.9012	0.0000	-27.9772	0.0000
	Maddala and Wu	62.2990	0.0000	557.532	0.0000
	Choi	-23.2765	0.0000	-21.8608	0.0000
	Hadri	-1.01199	0.8442	3.74768	0.0001
Export	LLC	-44.1544	0.0000	-52.3479	0.0000
	IPS	-46.5459	0.0000	-51.2305	0.0000
	Maddala and Wu	974.242	0.0000	926.027	0.0000
	Choi	-29.5719	0.0000	-28.7613	0.0000
	Hadri	1.40474	0.0000	1.78737	0.0369
Import	LLC	-52.1318	0.0000	-58.0423	0.0000
	IPS	-46.3907	0.0000	-48.5408	0.0000
	Maddala and Wu	870.370	0.0000	792.464	0.0000
	Choi	-26.6377	0.0000	-25.0164	0.0000
	Hadri	-0.22923	0.5907	1.55566	0.0549
Oil Prices	LLC	-29.1802	0.0000	-33.3600	0.0000
	IPS	-24.0248	0.0000	-23.6081	0.0000
	Maddala and Wu	514.689	0.0000	449.308	0.0000
	Choi	-20.9730	0.0000	-19.4044	0.0000
	Hadri	1.20507	0.1141	-23.6081	0.0000

Source: authors' calculations

After determining whether the variables were equally stable, we determined whether there was a cointegration relationship between the variables.

We used the test developed by Pedroni (1999) to determine the presence of panel cointegration. For the cointegration test in the panel, Pedroni (1999) developed seven tests. 4 of them are panel and three of them are group test statistics. All tests show normal distribution.

The basic hypotheses of Pedroni tests are:

H_o: there is no co-integration for all units of panel.

H_1: there is co-integration for all units of panel.

Table 3 shows that according to the 7 tests proposed by Pedroni (1999), the money supply in the constant model and the inflation, interest rate, exchange rate, export, import and oil prices are cointegrated. In the constant and trend model, cointegration relationship was found only according to the panel v statistic.

Table 3 Pedroni Cointegration Test Results

Method	Test Statistic	Probability	Test Statistic	Probability
	Constant		Constant and Trend	
Panel v test	2.445740	0.0072	17.11294	0.0000
Panel rho test	-2.605528	0.0046	-0.930165	0.1761
Panel PP test	-3.466041	0.0003	-1.567055	0.0586
Panel ADF test	-3.276523	0.0005	-1.44209	0.0746
Group rho test	-1.087161	0.1385	1.934315	0.9739
Group PP test	-1.979146	0.0239	1.103718	0.8651
Group ADF test	-2.307356	0.0105	0.879805	0.8105

Source: authors' calculations

The existence of cointegration in the variables raises the question of the extent to which the explanatory variables affect the money supply in the long term. For estimation, after the existence of cointegration, ordinary least squares (OLS), dynamic OLS (DOLS) and fully modified OLS (FMOLS) methods are used.

In our study, the long-term coefficients were determined by Pedroni (2000) proposed FMOLS and Pedroni (2001) proposed by DOLS.

DOLS (Pedroni, 2001) estimator will be expressed with the help of the following model:

$$Y_{it} = \gamma_i + x_{it}\beta_i + \sum_{i=P_t}^{P_t} \varphi_{ik}\Delta x_{it-k} + \varepsilon_{it} \quad (2)$$

Here, y and x shows (INF, IR, ER, X, M ve OP) matrix of the dependent and independent variables respectively. Δ is the first difference operator and pi is the lag length (Temur et al., 2017: 136).

FMOLS estimator is shown with the following model method:

$$Y_{it} = a_i + \beta x_{it} + \mu_{it} \quad (3)$$

$$x_{it} = x_{it-1} + e_{it} \quad (4)$$

Y_{it} expresses dependent variable and, x_{it} expresses the dependent, a_i expresses fixed effect. In addition FMOLS estimator shows that there is no dependency between the cross-sections forming the panel. The error term is fixed in equation 2 therefore if Y_{it} is integrated in the first degree, there is a long term co-integration relation between Y_{it} and x_{it}. β expresses the co-integration vector required to be estimated (Nazlıoğlu, 2010: 98).

The following table shows the results of the DOLS and FMOLS estimator.

Table 4 DOLS and FMOLS Estimator Results

DOLS Estimator Results			
Variable	Coefficient	t-statistic	Probability
Inflation	-1.072857*	29.36088	0.0000
Interest Rate	-1.474034*	-.5136446	0.0000
Exchange Rate	0.001996*	2.690573	0.0072
Export	0.833849*	7.668294	0.0000
Import	0.013209	0.101447	0.9192
Oil Prices	-0.226557*	-9.924642	0.0000
FMOLS Estimator Results			
Variable	Coefficient	t-statistic	Probability
Inflation	-1.073191*	32.58789	0.0000
Interest Rate	-1.046476*	-4.507005	0.0000
Exchange Rate	0.002105*	2.777406	0.0055
Export	0.634163*	7.473279	0.0000
Import	0.302491*	2.817882	0.0049
Oil Prices	-0.251743*	-11.96983	0.0000

Notes: *5% expresses significance at the level of significance. Money supply is dependent variable.

Source: authors' calculations

Table 4 shows the results of the DOLS and FMOLS estimator. According to the results of DOLS estimator, inflation, interest rate, exchange rate, export and oil prices have explanatory effects on money supply. According to DOLS estimator results; inflation, interest rate and oil prices have a negative and significant effect on money supply. The effect of exchange rate and exports on money supply was found to be positive and significant. According to the DOLS estimator, the effect of imports on money supply seems unimportant.

According to FMOLS estimator results, inflation, interest rate, exchange rate, export, import and oil prices explain the money supply. Inflation, interest rate and oil prices have a negative and significant effect on money supply. The effect of exchange rate, export and import on money supply was found to be positive and significant.

5. CONCLUSIONS

In our study, panel data were used in order to determine the explanatory effect of inflation, interest rate, exchange rate, import, export and oil prices on the money supply by using the monthly data for the period of 2010: M1-2018:M12 and the selected economies. Panel cointegration test results showed that inflation, interest rate, exchange rate, export, import and oil prices effected the money supply. According to DOLS estimator results; it is determined that the increases in inflation, interest rate and oil prices have a decreasing effect on money supply, while the increase in exchange rates and exports increase the money supply. Import item appears to be ineffective on money supply.

While FMOLS estimator results were generally consistent with DOLS estimator results, a difference was found on import data. The increase in imports by FMOLS estimator leads to an increase in money supply. The results show that the effects of inflation, interest rate, exchange rate, export, import and oil prices on money supply meet the expectations.

There is no doubt that the monetary policy cannot be fully attributed to the above-mentioned variables. For a healthier assessment a model with all elements of monetary policy is required. Future studies can be discussed with this perspective. In addition, the tests we have used are discussed with panel data methods only for developing countries. In the next study, it is planned to add a model for all fourteen developing countries in the model with Johansen cointegration test and Vector Error Correction Model. Describing descriptive statistics for each country.

The results obtained in this study have similar characteristics to Tüzün (2007). Tüzün (2007) has dealt with Turkish economy in the study has identified a negative relationship between the money supply and inflation. In our study, it was found negative relationship between inflation and money supply.

The results which we obtained in scope of this study, has the guiding capacity for determining monetary policy.

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